CHAPTER - I

Regulations for Post Graduate Degree Courses in Medical Sciences

1. Branches of Study :

Postgraduate Degree Courses The following courses of studies may be pursued.

Pre-Clinical

1. Anatomy
2. Physiology
3. Biochemistry

and such other subjects which may be introduced in future from time to time and recognized by National Medical Commission.

Para-Clinical

1. Pharmacology
2. Pathology
3. Microbiology
4. Forensic Medicine & Toxicology

and such other subject which may be introduced in future from time to time and recognized by National Medical Commission.

Goal :

The goal of post-graduate medical education shall be to produce competent specialist and medical teachers recognised by the fraternity as the graduating scholars, building upon their undergraduate education and skills who shall –

i. Recognise the health needs of the community and carry out professional obligations ethically keeping in view the objectives of the national health policy;

ii. Have mastered most of the competencies, pertaining to the respective speciality, that is required to be practised at the secondary and the tertiary levels of the health care delivery system;

iii. Be aware of the contemporary advancements and developments in the respective discipline concerned and shall progress accordingly

iv. Have acquired a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology;

v. Have acquired the basic skills in the teaching of medical and paramedical professionals;

vi. Acquire basic management skills in human resources, materials and resource management related to health care delivery, general hospital management, principal inventory skills and counselling; vii. Develop personal characteristics and attitudes required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals; viii. Become an exemplary citizen by observing the highest standards of professional ethics and working towards fulfilling social and professional obligations to respond to national aspirations.

General Objectives

At the end of the postgraduate 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 need of the community and the national priorities in the health sector.

ii) Practice the speciality concerned ethically and in step with 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 rehabilitative, preventive and promotive 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 advice measures for the prevention and rehabilitation of patients suffering from disease and disability related to the specialty.

vii) Demonstrate skills in documentation of individual case details as well as morbidity and mortality data relevant to the assigned situation.

viii) Demonstrate empathy and humane approach towards patients and their families and exhibit interpersonal behaviour in accordance with the social norms and expectations.

ix) Play the assigned role in the implementation of national health programmes, 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 educational needs and use appropriate learning resources.

xii) Demonstrate competence in basic concepts of research methodology and epidemiology, and be able to critically analyse 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.

Statement of the Competencies

Keeping in view the general objectives of postgraduate training, each discipline shall aim at development of specific competencies, which shall be defined and spelt

out in clear terms. Each department shall produce a statement and bring it to the notice of the trainees in the beginning of the programme so that he or she can direct the efforts towards the attainment of these competencies.

Components of the PG Curriculum The major components of the PG curriculum shall be:

- Theoretical knowledge
- Practical / clinical Skills
- Training in Thesis.
- Attitudes, including communication.
- Training in research methodology.

3. **Eligibility for Admission : ELIGIBILITY CRITERIA FOR SELECTION OF POSTGRADUATE STUDENTS**

A. Students for postgraduate medical courses shall be selected strictly on the basis of their academic merit.

B. For determining the academic merit, the university shall adopt the following procedures for degree courses:

C. – Eligibility to pursue a post-graduate broad-speciality course in Medicine shall be as per "NMC, National Exit Test Regulations, 2023".

Provided that until the first batch based on National Exit Test (NExT) becomes eligible for admission in broad-speciality courses, the existing system of admission through National Eligibility-cum-Entrance Test-Post graduate (NEET-PG) as per Post-Graduate Medical Education Regulation, 2000 (PGMER-2000) shall Continue

The candidate has to make an application to the KAHER with the following documents along with the prescribed fee :

1 MBBS pass / degree certificate issued by the KAHER. Recognized Universities approved by NMC.

2 Marks cards of all the examinations passed during MBBS course.

3 Attempt Certificate issued by the Principal.

4 Certificate regarding the recognition of the medical college by the National Medical Commission.

5 Completion of internship certificate.

6 In case internship was done in a non-teaching hospital, a certificate from the National Medical Commission that the hospital has been recognized for internship.

7 Registration by any State Medical Council.

Candidates should obtain the Eligibility Certificate before the last date for admission as notified by the KAHER.

A candidate who has been admitted to postgraduate course should register his / her name in the KAHER within a month of admission after paying the registration fees.

4. Intake of Students

The intake of students to each course shall be in accordance with the NMC approval.

5. Course of the Study

Duration :

a) M.D./M.S. Degree Courses

The course of study shall be for a period of 3 years

Training Programme:

(i) Post-graduate training shall consist of training of the students through lectures, seminars, journal clubs, group discussions, participation in laboratory and experimental work, involvement in research, clinical meetings, grand rounds, clinico-pathological conferences, practical training in the diagnosis and medical and surgical treatment, training in the basic medical sciences as well as in allied clinical specialties, etc. as per the requirement of Speciality training.

(ii) All post-graduate students will work as full-time resident doctors. They will work for reasonable working hours and will be provided reasonable time for rest in a day.

(iii) All broad-speciality will do thesis related research and will write thesis.

(iv) Every institution undertaking post-graduate training programme shall set up an Academic Cell, under the Chairmanship of a senior faculty member, who shall monitor the implementation of training programmes in each speciality and ensure its quality as mandated by the PGMEB.

(v) The training programmes shall be updated as and when required while keeping in mind the curriculum requirements and other relevant requirements prescribed by PGMEB from time to time. The structured training programme shall be written and strictly followed, to enable the examiners to determine the training undergone by the candidates.

(vi) Post-graduate students of broad and super Speciality degree courses shall maintain a dynamic e-log book which needs to be updated on a weekly basis about the work being carried out by them and the training programme undergone during the period of training. Provided that M.S. /M.Ch students shall mandatorily enter details of surgical procedures assisted or done independently.

(vii) It shall be the duty of the Post-graduate guide imparting the training to assess and authenticate monthly the record (e-Log) books.

(viii) The post-graduate students shall essentially be required to participate in the teaching and training programme of undergraduate students and interns.

(ix) During the training for award of Degree/Diploma, there shall be proper training in basic medical sciences related to the disciplines concerned. During the training programmes emphasis has to be laid on preventive and social aspects. All post-graduate medical college/institution shall have facilities for teaching the basic science subjects as per guidelines

(x) Course in Research Methodology –

a. All post-graduate students shall complete an online course NPTEL in Research Methodology.

b. The students shall have to register on the Swayam portal.

c. The students are expected to complete the course in the first year.

d. The online NPTEL certificate generated on successful completion of the course and examination thereafter, will be acceptable evidence of having completed this course.

e. The above certification shall be a mandatory requirement to be eligible to appear for the final examination of the respective post-graduate course.

f. This requirement shall be applicable for all post-graduate students.

(xi) Course in Ethics -

a. All post-graduate students shall complete course in ethics including Good Clinical Practices and Good Laboratory Practices, whichever is relevant to them, to be conducted by institutions/Universities.

b. The students are expected to complete the course in the first year.

c. No post-graduate student shall be permitted to appear in the examination without the above certification.

(xii) Course in Cardiac Life Support Skills -

a. All post-graduate students shall complete a course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills to be conducted by the institution.

b. The students are expected to complete the course in the first year.

c. No post-graduate student shall be permitted to appear in the examination without the above certification.

6. Attendance, Progress and Conduct

a) A candidate pursuing degree course should work in the concerned department of the institution for the full period as a full time student. No candidate is permitted to run a clinic/laboratory/nursing home while studying postgraduate course.

b) Each year shall be taken as a unit for the purpose of calculating attendance.

c) Every student shall attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, case presentation, clinics and lectures during each year as prescribed by the department and not be absent himself / herself from work without valid reasons.

d) Every candidate is required to attend a minimum of 80% of the training during each academic year of the post graduate course. Provided further, leave of any kind shall not be counted as part of academic term without prejudice to minimum 80% attendance of training period every year

e) Any student who fails to complete the course in the manner stated above shall not be permitted to appear for the KAHER Examinations.

7) Leave Rules for Post-graduate Students –

The following leave rules will be followed:

a. Every post-graduate student will be given minimum 20 days of paid leave (casual leave) per year, 5 days academic leave per year. Thus a student is entitled to 52 weekly offs and 20 paid casual leaves per year.

b. Subject to exigencies of work, post-graduate students will be allowed one weekly holiday.

c. Female post-graduate students shall be allowed maternity leave as per existing Government rules and regulations.

d. Male post-graduate students shall be allowed paternity leave as per existing Government rules and regulations.

e. In addition to 20 days' paid leave, the candidates will be allowed.

f. If candidate avails leave in excess of the permitted number of days, his/her term of course shall be extended by the same number of days to complete the training period. However, one shall be able to appear in the examination if one has 80% (eighty per cent) of the attendance.

A student shall require 80% attendance on working days i.e-751 days for appearing for exams.

8) Work diary / E- Log Book - Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc .E Log book will be maintained digitally .Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. The work diary shall be scrutinized and certified by the Head of the Department and Head of the Institution and presented in the university practical/clinical examination. The log book

is thus a record of various activities by the student like: Overall participation &performance, attendance, participation in sessions,record of completion of pre-determined activities, and acquisition of selected competencies.

a) Periodic tests: In case of degree courses of three years duration, the concerned departments should conduct three internal assessments, two of them be annual at the end of first and second year. The third internal assessment will be preliminary examination which will be held three months before the final examination conducted by the college similar to final University Examination. The tests may include written papers, practical's / clinicals (Direct Observation of Procedural skills)/ OSCE/ Case Based discussion/ Mini Cex and viva voce. Records and marks obtained in such tests will be maintained by the Department and sent to the concerned authority.

b) Records: Records and marks obtained in tests will be maintained by the head of the Department and will be made available to the University or NMC.

9. Dissertation

A) Every candidate pursuing MD/MS degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of a dissertation.

B) The dissertation is aimed to train a post graduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, comparison of results and drawing conclusions.

C) Every candidate shall submit to the Registrar (Academic) of the University in the prescribed proforma, a synopsis containing particulars of proposed dissertation work within six months from the date of commencement of the course on or before the dates notified by the KAHER. The synopsis shall be sent through the proper channel.

D) Synopsis will be reviewed and the dissertation topic will be registered by the KAHER. No change in the dissertation topic or guide shall be made without prior approval of the KAHER.

E) The dissertation should be written under the following headings:

i. Introduction
ii. Aims or Objectives of study
iii. Review of Literature
iv. Material and Methods
v. Results
vi. Discussion
vii. Conclusion
viii. Summary
ix. References
x. Tables
xi. Annexures

F) The written text of dissertation shall be not less than 50 pages and shall not exceed 150 pages excluding references, tables, questionnaires and other annexures. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. The dissertation shall be certified by the Guide, Head of the department and Head of the Institution.

G) Four copies of dissertation thus prepared shall be submitted to the Registrar (Evaluation), six months before final examination on or before the dates notified by the Institute.

H) The dissertation shall be valued by 2 EXTERNAL examiners appointed by the KAHER and assessed for 20 marks.

I) Guide: The academic qualification and teaching experience required for recognition by KAHER as a guide for dissertation work is as per Medical Council of India, Minimum Qualifications for Teachers in Medical Institutions Regulations, 2000. -Teachers in a medical college/institution having a total of eight years teaching experience out of which at least five years teaching experience as Lecturer or Assistant Professor gained after obtaining post graduate degree shall be recognized as post graduate teachers.

J) A Co-guide may be included provided the work requires substantial contribution from a sister department or from another medical institution recognized forteaching/training by KAHER /National Medical Commission of India. The co- guide shall be a recognized post graduate teacher of KAHER.

K) Change of guide: In the event of a registered guide leaving the college for any reason or in the event of death of guide, guide may be changed with prior permission from the KAHER.

9) DISTRICT RESIDENCY PROGRAMME (DRP) –

Preamble:

Doctors have to be trained in diverse settings including those which are close to the community. Hence, they should be trained in the District Health System / the District Hospitals. Provided that in respect of M.D./M.S. students admitted with effect from academic session 2021, the training imparted as part of the District Residency Programme, shall be considered as training imparted in a medical institution.

Objectives: The main objectives of the District Residency Programme (DRP) would be:

a. To expose the post-graduate student to the District Health System/ District Hospital and involve them in health care services being provided by District Health System /District Hospital for learning while serving;

b. To acquaint them with the planning, implementation, monitoring, and assessment of outcomes of the National Health programmes at the district level.

c. To orient them to promotive, preventive, curative and rehabilitative services being provided by various categories of healthcare professionals under the umbrella of the National Health Mission. In doing so, the post-graduate medical students would also be contributing towards strengthening of services of the District Health System as Speciality resident doctors working as members of the district teams.

d. District Residency Programme:

All post-graduate students pursuing M.D./M.S. in broad specialties in all medical colleges/institutions under the purview of the National Medical Commission shall undergo a compulsory residential rotation of three months in District Hospitals/ District Health System as a part of the course curriculum. Such rotation shall take place in the 3 rd or 4th or 5th semester of the post graduate programme. This rotation shall be termed as 'District Residency Programme' (DRP) and the post-graduate medical student undergoing training shall be termed as a 'District Resident'.

e) Training and Responsibilities of District Residents:

The District Resident will work under the overall directions and supervision of the District Residency Programme Coordinator (DRPC). During this rotation, the Resident doctor will be posted with the concerned/allied Speciality team/ unit/ sections/services at the District Health System/ District Hospital. The clinical responsibilities assigned to the Residents would include serving in outpatient, inpatient, casualty, and other areas pertaining to their Speciality and encompass night duties. Post-graduate students of specialities where direct patient care is not involved will be trained by District Health System/ District Hospital teams within the available avenues in coordination with the District Health Officer/Chief Medical Officer. They would be trained in and contribute to the diagnostic/laboratory services, pharmacy services, forensic services, general clinical duties, managerial roles, public health programmes etc., as applicable.

They may also be posted in research units / facilities, laboratories and field sites of the Indian Council of Medical Research and other national research organizations.

f) Stipend and Leave for District Residents:

The District Residents shall continue to draw full stipend from their respective medical colleges for the duration of the rotation subject to the attendance record submitted by the appropriate district authorities to the parent medical college/institution, based on methods and system as prescribed. Subject to exigencies of work, the District Resident will be allowed one weekly holiday by rotation. They shall also be entitled to leave benefits as per the rules/ guidelines of the parent college/university.

g) Training during DRP and Certification thereof:

a. Quality of training shall be monitored by log books, supportive supervision, and continuous assessment of performance. The attendance and performance of District Residents shall be tracked by the District Residency Programme Coordinator (DRPC) of the district concerned, as well as the parent Medical College through an appropriate electronic/ digital or mobile enabled system. Such monitoring systems shall also be accessible to the State/Union Territory Steering Committee and the National Coordination Cell.

b. The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution by phone and e-communication for guidance, learning, and for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.

c. Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective post-graduate course.

d. The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to be decided by the PGMEB to the concerned medical college and the Govt. of the State/UT.

11) Scheme of Examination-

M.D. / M.S. Degree shall consist of

Both Formative Assessment (examination) and Summative Assessment (examination) consisting of Theory, Clinical/Practical and Viva Voce.

Both Formative Assessment (examination) and Summative Assessment (examination). shall consist of Theory, Clinical/Practical and Viva Voce.

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 8 months between the two examinations.

Formative Assessment :

Formative assessment should be continual and should assess medical knowledge, procedural and academic skills, interpersonal skills, professionalism, self-directed and ability to practice in the system.

General Principles -

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

SUMMATIVE ASSESSMENT

Essential pre-requisites for appearing for examination include:

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS 2023. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

Methodology

Broad Specialties: Doctor of Medicine (M.D.)/Master of Surgery (M.S.): M.D./ M.S. examinations, in any subject shall consist of theory papers, and clinical/ practical and viva voce examinations and Dissertation..

a. Theory:

The theory examination (both formative and summative) may be of descriptive answer of a question type. Theory examination for summative examination shall be of four theory papers. The first and the fourth paper shall be on basic medical science and recent advances, respectively. The theory examination shall be held well in advance before the clinical and practical examination.

b. Practical and viva voce

i. Clinical examination for the subjects in clinical sciences shall be conducted to test the knowledge and competence of the candidates for undertaking independent work as a consultant/specialist/teacher, for which candidates shall be examined for one long case and two short cases.

ii. Practical examination for other subjects 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 his ability to perform such studies as are relevant to his subject.

iii. The viva voce 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.

iv. Practical examination shall include Objective Structured Practical Examination (OSPE)

c) Dissertation : Every candidate shall carry out work and submit a dissertation Acceptance of dissertation shall be a precondition for the candidate to appear for the final examination.

Examiners:

a. The examiner (both internal and external) for the post-graduate examination in Broad and Super Specialties shall have three years' experience as recognised Post-graduate Guide in the concerned subject.

b. The minimum number of examiners for post-graduate examination shall be four. Out of which, at least two shall be external examiners and least one of them shall be from different university outside the state.

c. An examiner shall not be appointed for more than two consecutive regular examinations for the same institution.

Valuation:

a. All the teachers of the other colleges of the concerned University or other Universities, who are eligible to be post-graduate examiners, can perform the valuation of the answer scripts.

b. All the answer scripts shall be subjected for two valuations by the concerned University. The average of the total marks awarded by the two valuators for the paper, which is rounded off to the nearest integer

(whole number), shall be considered for computation of the results. All the answer scripts, where the difference between two valuations is 15% and more of the total marks prescribed for the paper, shall be subjected to third valuation. The average of the best two total marks, awarded by the three evaluators for the paper, rounded off to the nearest integer (whole number), shall be considered for final computation of the results.

c. After the computation and declaration of the results, under no circumstances, revaluation is permitted.

d. All the Health Universities/Institutions imparting post-graduate courses shall implement digital valuation.

L) Revised Eligibility requirements for PG Students in Broad Speciality and Super Speciality for appearing in University examination:

- Have minimum one Poster presentation or Podium presentation at a National / Zonal / State Conference of his / her specialty.
- Have minimum one Research paper published in journal of his / her specialty as first author.
- Complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated on successful completion of the course and examination.
- Complete a certification course in ethics including Good Clinical Practices and Good Laboratory Practices, (whichever is relevant to them) in the first year of the course conducted by institutions.
- Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills in the first year of the course conducted by the institution.
- Thesis acceptance by all evaluators before the conduct of University Examination.

Written Examination (Theory): A written examination shall consist of four question papers, each of three hours duration. Each paper shall carry 100 marks. Out of the four papers, the 1st paper in clinical subjects will be on applied aspects of basic medical sciences. Recent advances shall be covered in 4th paper. In basic medical subjects and para-clinical subjects, questions on applied clinical aspects should also be asked.

Paper	No. of Questions	Marks for each Question	Total Marks
Paper-I	10	10	100
Paper-II	10	10	100
Paper-III	10	10	100
Paper-IV	10	10	100
		GRAND TOTAL	400

Practical/Clinical Examination :

a) In case of practical examination, it should be aimed at assessing competence and skills, Techniques of procedures as well as testing students ability to make relevant and valid observations, interpretations and inference of laboratory or experimental work relating to his/her-subject.

b) In case of clinical examination, it should aim at examining clinical skills and competence of candidates for undertaking independent work as a specialist. Each candidate should examine at least one long case and two short cases.

c) The total marks for practical/clinical examination shall be 300.

Viva Voce: Viva Voce Examination shall aim at assessing depth of knowledge, logical reasoning and oral communication skills. The total marks shall be 100 .

Criteria for declaring as pass in KAHER Examination: A candidate shall secure not less than 50% marks in each head of passing which shall include

(1) Theory,

(2) Practical including clinical and viva voce examination separately.

Pre/Para-Clinical:

Description	M.D/M.S.
THEORY	
• No. of Theory papers	04
• Marks for each Theory paper	100
Total marks for Theory papers	400
Passing minimum for Theory	200/400 (40% minimum in each paper)
PRACTICALS	300
• Dissertation	20
• OSPE	25 (5 stations x 5 marks)
• Subject specific assessment	255
VIVA	100
• Criteria for passing	A candidate in a subject has to score theory and practical + viva separately with a minimum of 50% marks.
• Criteria for passing	A candidate in a subject has to score theory and practical + viva separately with a minimum of 50% marks.

Passing criteria :

"Obtaining a minimum of 50% marks in theory as well as Practical separately shall be mandatory for passing the whole Examination. (Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the 4 papers shall be mandatory. Obtaining a minimum of 50% marks (clinical and Viva-voce together) in Practical is mandatory)".

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in any subsequent examination upon payment of fresh fee to the Controller of Examinations.

1. **Declaration of distinction :** A successful candidate passing the KAHER examination in first attempt will be declared to have passed the examination with distinction, if the grand total aggregate marks is 75 percent and above. Distinction will not be awarded for candidates passing the examination in more than one attempt.

2. **Number of Candidates per day :** The maximum number of candidates for practical/clinical and viva-voce examination for degree course shall be upto 8 per day.

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN ANATOMY

Preamble:

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

These guidelines would help to achieve a uniform level of training of MD Anatomy to post graduate students throughout the country. The student, after undergoing the training, should be able to deal effectively with the needs of the medical community and should be competent to handle all problems related to the specialty of Anatomy and recent advances in the subject. The post graduate student should also acquire skills in teaching anatomy to medical and para-medical students and be able to integrate teaching of Anatomy with other relevant subjects, while being aware of her/his limitations.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of "domains of learning" under the heading "competencies".

Goal :

The Goal of MD Anatomy is to train a doctor to become a competent teacher and researcher in Anatomy who:

1. Is aware of contemporary advances and developments in the field of Anatomy.
2. Has acquired the competencies pertaining to the subject of Anatomy that are required to be practiced at all levels of health system.
3. Is oriented to the principles of research methodology.
4. Has acquired skills in educating medical and paramedical professionals.
5. Has acquired skills in effectively communicating with the students and colleagues from various medical and paramedical fields.
6. Has acquired skills of integrating anatomy with other disciplines as and when needed.

7. Has acquired qualities of a good teacher capable of innovations in teaching methodology.

8. Has been able to demonstrate adequate management skills to function as an effective leader of the team engaged in teaching and research.

Competencies

After completing the three-year course in MD Anatomy, the student should have achieved Competence in the following:

1. Knowledge of Anatomy

1.1. Acquire competencies in gross and surface anatomy, neuroanatomy, embryology, genetics, Histology, radiological anatomy, applied aspects and recent advances of the above mentioned branches of anatomy to clinical practice.

2. Practical and Procedural skills

2.1 Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.

3. Training skill in Research Methodology

3.1 Acquire skills in teaching, research methodology, epidemiology & basic information technology.

3.2 Acquire knowledge in the basic aspects of Biostatistics and research methodology.

3.3 Has knowledge to plan the protocol of a thesis, carry out review of literature, execution of research project and preparation of report.

3.4 Has ability to use computer applications Microsoft office (Microsoft word, excel, power point), Internet, Searching scientific databases (e.g. PubMed, Medline, Cochrane reviews).

3.5 Acquire skills in paper & poster preparation, writing research papers and Thesis.

4. Professionalism, attitude and communication skills:

4.1 Develop honest work ethics and empathetic behavior with students and colleagues.

4.2 Acquire capacity of not letting his/her personal beliefs, prejudices, and limitations come in the way of duty.

4.3 Acquire attitude and communication skills to interact with colleagues, teachers, students, body donors and their families.

5. Teaching Anatomy

5.1 Practicing different methods of teaching-learning.

5.2 Making presentations of the subject topics and research outputs.

6. Problem Solving

6.1 Demonstrate the ability to identify applied implications of the knowledge of anatomy and discuss information relevant to the problem, using consultation, texts, archival literature and electronic media.

6.2 Demonstrate the ability to correlate the clinical conditions to the anatomical/ embryological/hereditary factors.

6.3 Demonstrate the ability to evaluate scientific/clinical information and critically analyze conflicting data and hypothesis.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the student should have acquired following competencies:

A. Cognitive domain

1. Describe gross anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain and spinal cord.

2. Explain the normal disposition of gross structure, and their interrelationship in the human body. She/He should be able to analyze the integrated functions of organs systems and locate the site of gross lesions according to deficits encountered.

3. Describe the process of gametogenesis, fertilization, implantation and placenta formation in early human embryonic development along with its variation and applied anatomy.

4. Describe the sequential development of organs and systems along with its clinical anatomy, recognize critical stages of development and effects of common teratogens, genetic mutations and environmental hazards. She/He should be able to explain developmental basis of variations and congenital anomalies.

5. Explain the principles of light, transmission and scanning, compound, electron, fluorescent and virtual microscopy.

6. Describe the microscopic structure of various tissues & organs and correlate structure with functions as a prerequisite for understanding the altered state in various disease processes.

7. Describe the structure of cell and its components, cell cycle, cellular differentiation and proliferation.

8. Describe structure, number, classification, abnormalities and syndromes related to human chromosomes.

9. Describe important procedures in cytogenetics and molecular genetics with its application.

10. Describe about single gene pattern inheritance, intermediate pattern and multiple alleles, mutations, non-mendelian inheritance, mitochondrial inheritance, genome imprinting and parental disomy.

11. Describe multifactorial pattern of inheritance, teratology, structure gene, molecular screening, cancer genetics and pharmacogenetics.

12. Describe about reproduction genetics, assisted reproduction, prenatal diagnosis, genetic counseling and ethics in genetics.

13. Explain principles of gene therapy and its applied knowledge.

14. Describe immune system and cell types involved in defense mechanisms of the body. Also explain gross features, cytoarchitecture, functions, development and histogenesis of various primary and secondary lymphoid organs in the body.

15. Describe about common techniques employed in cellular immunology and histocompatibility testing.

16. Describe structure & development of tissue-organ system to comprehend deviations from normal.

17. Demonstrate knowledge about recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.

18. Explain collection, maintenance and application of stem cells, cryo-banking and principles of organ donation from recently dead bodies.

19. Demonstrate knowledge about surface marking of all regions of the body.

20. Able to interpret various radiographs of the body, normal CT-Scan, ultrasound and MRI.

21. Describe the different anthropological traits and use of related instruments.

22. Describe the outline of comparative anatomy of whole body and basic human evolution

23. Demonstrate knowledge about identification of human bones, determination of sex, age, and height for medico legal application of anatomy

B. Affective domain

1. Demonstrate self-awareness and personal development in routine conduct. (Self-awareness)

2. Communicate effectively with peers, students and teachers in various teaching learning activities. (Communication)

3. Demonstrate

    a. Due respect in handling human body parts & cadavers during dissection. (Ethics & Professionalism)

    b. Humane touch while demonstrating living surface marking in subject/patient. (Ethics & Professionalism)

4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.

5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure. (Equity and social accountability)

6. Ability to communicate with the registered body donors and family of donors.

C. Psychomotor domain

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

1. Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy.

2. Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.

3. Locate and identify clinically relevant structures in dissected cadavers.

4. Locate and identify cells & tissues under the microscope.

5. Identify important structures visualized by imaging techniques, specifically radiographs, computerized tomography (CT) scans, MRI and ultrasonography.

6. Demonstrate various movements at the important joints and actions of various groups of muscles in the human body.

7. Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor.

8. Demonstrate different methods of teaching-learning and make presentations of the subject topics and research outputs.

Specific practice-based competencies:

Name/Description of practice-based competencies

1. Gross anatomy:

1.1 Procurement, Embalming and Preservation of human cadavers

1.2 Preparation of chemicals for preserving bodies in tanks.

1.3 Dissection of cadaver

1.4 Window dissection of important regions

1.5 Preparation of specimens for museum with display

a) soft parts

b) models

c) charts

1.6 Preparation and preservation of human bones / skeleton as assigned by the faculty

1.7 Gross anatomy file in which labelled diagrams of important structures of upper limb, lower limb, thorax, abdomen, head & neck and brain should be drawn.

2. Histology

2.1 Preparation of common fixatives like 10% formalin, Bouin's fluid etc

2.2 Making paraffin blocks and section cutting and mounting

2.3 Preparation of staining set for H and E staining and staining paraffin sections with the stain.

2.4 Making celloidin, araldite, gelatin blocks and their section cutting

2.5 Processing hard tissues, decalcification of bones, block making and sectioning,preparation of ground sections of calcified bones.

2.6 Frozen section cutting on freezing microtome and cryostat

2.7 Honing and Stropping of microtome knives, including sharpening by automatic knife sharpener

2.8 Histology record book in which Light Microscopic pictures of all the organs and tissues of the body should be drawn and a small description of salient features written

3. Histochemical Methods

3.1 Practical classes for staining of glycogen, mucopolysaccharides, alkaline phosphatase ,acid phosphatase, and calcium

4. Cytogenetics

4.1 Preparation of media, different solutions, stains etc.

4.2 Preparation of buccal smear for sex chromatin Human chromosome preparation from peripheral blood and karyotyping.

4.3 Banding techniques (G and C)

4.4 Making of Pedigree charts for study of patterns of inheritance.

4.5 Chromosomal Analysis.

5. Neuroanatomy:

5.1 Dissection of brain and spinal cord for teaching and learning purpose

5.2 Preparation of brain and spinal cord macroscopic and microscopic sections and identification of different parts in them.

5.3 Discussions on clinical problems related to neurological disorders and anatomical explanation for the same.

Syllabus:

A post graduate student, after three years of training in M.D. (Anatomy) should have acquired knowledge in the following aspects of anatomy:

A: Cognitive domain:

Section – I

Gross anatomy

Gross Anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain and spinal cord

Section – 2

Developmental anatomy/embryology

- General embryology: gametogenesis, fertilization, implantation and placenta, early human embryonic development.
- Systemic embryology: development of organ systems and associated common congenital abnormalities with teratogenesis.
- Anatomical basis of congenital anomalies.

Section – 3

Histology and histochemistry

Cell Biology:

- Cytoplasm - cytoplasmic matrix, cell membrane, cell organelles, cytoskeleton,cell inclusions, cilia and flagella.
- Nucleus - nuclear envelope, nuclear matrix, DNA and other components of chromatin, protein synthesis, nucleolus, nuclear changes indicating cell death.
- Cell cycle - mitosis, meiosis, cell renewal.
- Cellular differentiation and proliferation.

- **Microscopic structure of the body:**
- Principles of light, transmission and scanning, electron, fluorescent, confocal and virtual microscopy.

- The systems/organs of body - Cellular organization, light and electron microscopic features, structure - function correlations, and cellular organization.
- Various histo-techniques and museum preparation techniques.

Section – 4

Neuroanatomy:

- Brain and its environment, Development of the nervous system, Neuron and Neuroglia, Somatic sensory system, Olfactory and optic pathways, Cochleovestibular and gustatory pathways, Motor pathways, Central autonomic pathways, Hypothalamo-hypophyseal system, Limbic system, Basal ganglia, Reticular system, Ventricular system of Brain, Cross Sectional anatomy of brain and spinal cord & its applied anatomy.
- Detailed structure of the central nervous system and its applied aspect.

Section – 5

Genetics

- Human Chromosomes - Structure, number and classification, methods of chromosome preparation banding patterns. Chromosome abnormalities, Autosomal and Sex chromosomal abnormalities syndromes, Molecular and Cytogenetics.
- Single gene pattern inheritance: Autosomal and Sex chromosomal pattern of inheritance, Intermediate pattern and multiple alleles, Mutations, Non-Mendelian inheritance, Mitochondrial inheritance, Genome imprinting, parental disomy.
- Multifactorial pattern of inheritance: Criteria for multifactorial inheritance, Teratology, Structure gene, Molecular Screening, Cancer Genetics - Haematological malignancies, Pharmacogenetics.
- Reproduction Genetics - Male and Female Infertility, Abortuses, Assisted reproduction, Preimplantation genetics, Prenatal diagnosis, Genetic Counseling and Ethics of Genetics.
- Principles of Gene therapy and its applied knowledge.

Section – 6

Immunology

- Immune system and the cell types involved in defense mechanisms of the body. Gross features, cytoarchitecture, functions, development and histogenesis of various primary and secondary lymphoid organs in the body.
- Biological and clinical significance of the major histocompatibility complex of man including its role in transplantation, disease susceptibility/resistance and genetic control of the immune response.
- Common techniques employed in cellular immunology and histocompatibility testing.
- Molecular hybridization and PCR technology in immunology research particularly mechanism of antigen presentation, structural and functional relevance of the T cell receptor, genetic control of the immune response, Molecular basis of susceptibility to disease.

Section – 7

Applied anatomy and recent advances

- Clinical correlations of structure and functions of human body. Anatomical basis and explanations for clinical problems.
- Applications of knowledge of development, structural (microscopy), neuro anatomy to comprehend deviations from normal.
- Recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.
- Collection, maintenance and application of stem cells, cryobanking and principles of organ donation from recently dead bodies.

Section – 8

- Surface Marking and Radiology Surface marking of all regions of the body. Interpretation of normal radiographs of the body including special contrast procedures like barium studies, cholecystography, pyelography, salphingography. Normal CT Scan, MRI and Ultrasound.

Section – 9

Anthropology and Comparative Anatomy

- Different anthropological traits, Identification and use of Anthropological instruments.
- Outline of comparative anatomy of the whole body and basic human evolution.

Section – 10

- **Forensic Medicine :**

Identification of human bones from their remains and determination of sex, age, and height. for medico legal application of Anatomy.

B - PSYCHOMOTOR DOMAIN:

Demonstrate following predominant Psychomotor domain competencies		
Sr. No.	Competency	Perform under supervision / perform Independently/ Observation only
1.	Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy	Independently
2.	Acquire mastery in dissection skills including window dissection of important regions	Independently
3.	Acquire mastery in embalming the human body	Independently
4.	Prepare tanks for preserving bodies	Observation
5.	Tissue preparation for histology and staining techniques	Independently
6.	Honing and Stropping of microtome knives, including sharpening by automatic knife sharpener	Independently
7.	Preparation of common fixatives embalming fluid 10% formalin, Bouin's fluid etc.	Independently
8.	Demonstrate the mounting of specimen in the museum	Independently
9.	Locate and identify clinically relevant structures in dissected cadavers.	Independently

10.	Locate, identify and demonstrate cells & tissues under the microscope.	Independently
11.	Identify the anatomical structures visualized by imaging techniques, specifically radiographs, computerized tomography (CT) scans, MRI and ultrasonography in normal individuals	Independently
12.	Demonstrate various movements at the important joints and actions of various groups of muscles in the human body.	Independently
13.	Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor.	Under supervision
14.	Demonstrate different methods of teaching-learning and assessments. Independently	Independently
15.	Make presentations of the subject topics for teaching and research outputs. independently	Independently
16.	Prepare buccal smear for sex chromatin. independently	Independently
17.	Prepare Human chromosome from peripheral blood and karyotyping. Under supervision	Under supervision
18.	Demonstrate Banding techniques (G and C) and Chromosomal Analysis Under supervision	Under supervision
19.	Demonstrate use of different anthropological instruments	Under supervision

Departmental Resources:

It is mandatory for the Department of Anatomy to develop at least three of the following laboratories, in addition to the other facilities. The laboratory should be involved in active research in at least one well defined field.

1. Histology
2. Immunology
3. Electron microscopy / Fluorescence microscopy / confocal and other forms of microscopy laboratories
4. Developmental anatomy
5. Anthropometry

6. Neuroanatomy
7. Cytogenetics
8. Imaging technique for Radiological Anatomy

TEACHING AND LEARNING METHODS:

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a log book for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations of dissections, symposia, journal clubs, seminars, small group discussion, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject should also be used. The suggested examples of teaching-learning methods are given below but are not limited to these.

A. Lectures : Didactic lectures should be used sparingly. A minimum of 10 lectures per year is suggested. All postgraduate trainees will be required to attend these lectures. Some examples of topics which can be covered in lecture are:

1. Topics in gross, surface and cross sectional anatomy, microanatomy, embryology, neuroanatomy, histochemistry, and genetics.
2. Recent advances in microanatomy, embryology, neuroanatomy, histochemistry,and genetics.
3. Research methodology and biostatistics.
4. Salient features of Undergraduate/Postgraduate medical curriculum.
5. Teaching and assessment methodology.

Topic numbers 3, 4, 5 can be done during research methodology/biostatistics and medical education workshops in the institute.

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence- based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work: Minimum - once every 1-2 weeks.

Laboratory work/ Skills lab teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department should participate in moderating the teaching-learning sessions. Hands-on experience on various techniques and procedures in microanatomy, histochemistry, genetics, embalming & preparation of museum specimens should be acquired.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest.

G. a) Rotational clinical / community / institutional postings

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions.

The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/ departments and details to be included in the specialty-based Guidelines. The postings schedule with duration is given below:

- Surgery -1 weeks
- Radiology -1 weeks
- Pathology -2 weeks
- ENT -1 week
- Ophthalmology -1 week
- Obstetrics & Gynecology -1 week
- Pediatrics -1 week
- Medical Education Unit -1 week (Optional & can be done in common with other department PGs

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

G. b) Posting under "District Residency Programme" (DRP):

- Preamble: Doctors have to be trained in diverse settings including those which are close to the community. Hence, they should be trained in the District Health System / the District Hospitals.
- Provided that in respect of M.D./M.S. students admitted with effect from academic session 2021, the training imparted as part of the District Residency Programme, shall be considered as training imparted in a medical institution.
- Objectives: The main objectives of the District Residency Programme (DRP) would be:

To expose the post-graduate student to the District Health System/ District Hospital and involve them in health care services being provided by District Health System /District Hospital for learning while serving;

To acquaint them with the planning, implementation, monitoring, and assessment of outcomes of the National Health programmes at the district level.

To orient them to promotive, preventive, curative and rehabilitative services being provided by various categories of healthcare professionals under the umbrella of the National Health Mission.

In doing so, the post-graduate medical students would also be contributing towards strengthening of services of the District Health System as Speciality resident doctors working as members of the district teams.

- Definition of District Hospital: For the purpose of this programme, a District Hospital shall be a functional public sector/government-funded hospital of not less than 50 beds with facilities/staff for the designated specialties at that level/facility. Any post-graduate medical institution or a super-speciality hospital will not be considered as district hospital.
- Definition of District Health System: For the purpose of this programme, the District Health System shall include all public sector/government-funded hospitals and facilities (including community health centres, primary health centres, sub-health centres, urban health centres, etc.), as well as community outreach system in a district. This would also include district system engaged in running respective public health services including the implementation of national and state public health programmes.
- District Residency Programme: All post-graduate students pursuing M.D./ M.S. in broad specialties in all medical colleges/institutions under the purview of the National Medical Commission shall undergo a compulsory residential rotation of three months in District Hospitals/ District Health System as a part of the course curriculum. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduate programme. In the case of those students who have taken admission after completion of the Diploma in the relevant Speciality, the District Residency Programme shall take place in the third semester only. Similarly, the post-graduate diploma students shall undergo the District Residency Programme in the third semester. This rotation shall be termed as 'District Residency Programme' (DRP) and the post-graduate medical student undergoing training shall be termed as a 'District Resident'.

- Training and Responsibilities of District Residents: The District Resident will work under the overall directions and supervision of the District Residency Programme Coordinator (DRPC). During this rotation, the Resident doctor will be posted with the concerned/allied Speciality team/ unit/sections/services at the District Health System/ District Hospital. The clinical responsibilities assigned to the Residents would include serving in outpatient, inpatient, casualty, and other areas pertaining to their Speciality and encompass night duties. Post-graduate students of specialities where direct patient care is not involved will be trained by District Health System/ District Hospital teams within the available avenues in coordination with the District Health Officer/Chief Medical Officer. They would be trained in and contribute to the diagnostic/laboratory services, pharmacy services, forensic services, general clinical duties, managerial roles, public health programmes etc., as applicable. They may also be posted in research units / facilities, laboratories and field sites of the Indian Council of Medical Research and other national research organizations.

- Stipend and Leave for District Residents: The District Residents shall continue to draw full stipend from their respective medical colleges for the duration of the rotation subject to the attendance record submitted by the appropriate district authorities to the parent medical college/institution, based on methods and system as prescribed. Subject to exigencies of work, the District Resident will be allowed one weekly holiday by rotation. They shall also be entitled to leave benefits as per the rules/guidelines of the parent college/university.

- **Training during DRP and Certification thereof:**

  Quality of training shall be monitored by log books, supportive supervision, and continuous assessment of performance. The attendance and performance of District Residents shall be tracked by the District Residency Programme Coordinator (DRPC) of the district concerned, as well as the parent Medical College through an appropriate electronic/ digital or mobile enabled system. Such monitoring systems shall also be accessible to the State/Union Territory Steering Committee and the National Coordination Cell.

  The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution by phone and e-communication for guidance, learning, and

for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.

Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective post-graduate course.

The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to be decided by the PGMEB to the concerned medical college and the Govt. of the State/UT.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis (if so mandated) under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

Others

The students shall undergo training in other courses such a on Telemedicine, how to write a manuscript and make effective presentations, use of Pubmed and other resources etc. as required – The student shall attend a one-day Medical Education Technology (MET) training workshop conducted by the Institution.

J. E-Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in labs, dissection hall, skill labs and other areas of posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The log book is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the Log Book is to:

a) help maintain a record of the work done during training,

b) enable Faculty/Consultants to have direct information about the work done and intervene, if necessary,

c) provide feedback and assess the progress of learning with experience gained periodically.

The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination.

It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in log book particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the NMC Logbook Guidelines uploaded on the Website.

K. Course in Research Methodology:

- All postgraduate students shall complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated in successful completion of the course and examination.

- Complete a certificate course in ethics including Good Clinical Practices and Good Laboratory Practices, (whichever is relevant to them) in the first year of the course conducted by institutions.

Other aspects:

- The Postgraduate trainees must participate in the teaching and training program of undergraduate students attending in the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Have minimum one Poster presentation or Podium presentation at National / Zonal / State conference of his / her specialty.
- Have minimum one Research paper published in journal of his / her specialty as first author.
- Department shall encourage e-learning activities.
- Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills in the first year of the course conducted by the institutions.
- The Postgraduate trainees must undergo training in information technology and use of computers.

ASSESSMENT

Examination

Examination shall consist of dissertation, written paper (theory), practical and viva voce. The Examination shall be organized based on marking system to evaluate and to certify post graduate's students level knowledge, skill and competence at the end of the training.

Criteria for Passing

Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degrees' examination shall be mandatory. Obtaining if 50% marks in Practical Examination shall be mandatory of passing the practical examination. Hence a candidate shall secure not less than 50% marks in each head of examination which shall include Theory, Practical and Viva voce examination. No grace mark is permitted in Postgraduate Examination either for Theory or for Practical.

FORMATIVE ASSESSMENT

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

During the three-year training period,

- A record of all theoretical, practical and experimental work done by the post graduate student and its assessment will be kept and shall be available for examiners at the time of the final practical and viva voce examination.
- There will be periodical examinations during the course of training. The pre-final theory and practical examination will be conducted by the faculty of the concerned college.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

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

✧ **Quarterly assessment during the MD training should be based on:**

- Dissection presentation : once a week
- Laboratory performance : twice a week
- Journal club : once a week
- Seminar : once a fortnight
- Case discussions : once a fortnight/month
- Interdepartmental case or seminar : once a month

✧ Note: These sessions may be organized and recorded as an institutional activity for all postgraduates

✧ The PG student will have to take formative assessment exam both theory & practical at the end of every Academic year

The student to be assessed periodically as per categories listed in the preclinical postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT

Essential pre-requisites for appearing for examination include:

1. Log book of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted

2. Have minimum one Poster presentation or Podium presentation at National / Zonal / State conference of his / her specialty. One research paper should be published / accepted in an indexed journal. (It is suggested that the local or University Review committee assess the work sent for publication).

3. Have minimum one Research paper published in journal of his/ her specialty as first author.

4. Complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated on successful completion of the course and examination.

5. Complete a certification course in ethics including Good Clinical Practices and Good Laboratory practices (whichever is relevant to them) in the first year of the course conducted by institutions.

6. Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills in the first year of the course conducted by the institutions.

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS 2023. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

The postgraduate examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners. A post graduate student in broad specialty shall be allowed to appear for the Theory and Practical/

Clinical examination only after the Thesis acceptance by all evaluators before the conduct of University Examination.

2. Theory examination

The examinations shall be organized on the basis of 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS 2023. 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./ M.S shall be held at the end of 3rd academic year.

There shall be four theory papers (as per PG Regulations 2023).

Paper I: 100 Marks

Gross Anatomy, Embryology, Microscopic Anatomy, Radiological Anatomy of human body Above the diaphragm & Body Preservation

a) Gross Anatomy of human body above the diaphragm i.e. upper limb, thorax, head and neck.

b) Embryology & Microscopic anatomy of tissues and organs above the diaphragm.

c) Methods of preservation of human body and its parts, radiological anatomy, sectional anatomy

Paper II: 100 Marks

Gross Anatomy, Embryology, Microscopic Anatomy, Radiological Anatomy of human body Below the diaphragm , General Anatomy, General Embryology and General Histology

a) Gross Anatomy of human body below the diaphragm i.e. lower limb, abdomen, pelvis.

b) Embryology & Microscopic anatomy of tissues and organs below the diaphragm.

c) General Histology, General Embryology

d) Principles of light, transmission and scanning electron microscopy, confocal, virtual microscopy.

Paper III: 100 Marks

Neuroanatomy & Genetics

a) Neuroanatomy - gross and applied aspects.

b) General principles of genetics, cytogenetics as applicable to medicine and different genetic disorders, gene therapy.

Paper IV: 100 Marks

Recent advances and applied Anatomy in medical sciences

a) Comparative and evolutionary anatomy

b) Clinical and applied aspect of Anatomy

c) Recent advances in the application of knowledge of anatomy on human body

d) Basics of principles of Body donation and Organ donation from recently dead bodies / brain dead patients and ethics involved in them.

3. Practical/clinical and Oral / viva voce examination Practical examination

Practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor domain.

- **First Day Practical :** To submit the duly signed gross anatomy file, histology file & the log book and thesis

a) Gross Anatomy

Dissection and related viva voce, Major and minor dissections to be included.

b) Histology

Spotting (10 spots) and viva voce

Techniques of tissue processing, paraffin block making, section cutting and staining (H and E stain) with related viva

- **Second Day Practical:**

a) Microteaching of a short topic to assess teaching skills

b) A short synopsis of the thesis work should be presented by the post graduate student

c) Grand viva including Gross anatomy, cross sectional anatomy, radiological Anatomy, Surface Anatomy, Embryology.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

Practical Examination to be organized as per details given below:

- Dissection on cadaver
- Histology spotting
- Histological techniques
- Surface Marking
- Radiology
- Teaching ability
- Thesis presentation
-

Oral / Viva-voce Examination

Grand viva

On dissected parts of the whole human body including nervous system, and Embryology models, teratology, skeletal system including short bones, embalming techniques and genetics, radiographs, MRI, CT & ultrasonography.

Day 1	**GROSS ANATOMY**	
	1. 3 hours Window dissection of the allotted gross anatomy topic on human cadaver	60 Marks
	2. Display and discussion of the allotted dissection exercise on a human cadaver	50 Marks
	3. Surface anatomy **(Objective Structured Practical Examination- OSPE)**	10 marks (2 x 5 = 10)
	4 DISCUSSION ON DISSERTATION TOPIC submitted for the examination	20 Marks
	TOTAL	**140Marks**

	HISTOLOGY	
	1. Identification and discussion of 10 stained slides (general histology, systemic histology, neuroanatomy) including Human Genetics charts	100 Marks 10 marks per slide X 10 number]
	2. Tissue preparation and staining	
	I Preparation of a paraffin block	10 Marks
	ii. Taking serial sections from blocks provided	10 Marks
	iii. Staining of given section with H & E and discussion (OSPE)	15 Marks
	iv. Discussion on histological techniques	05 Marks
	TOTAL	**140 marks**
	PEDAGOGY: Demonstration of teaching skill / techniques	20 Marks

Day 2	**VIVA VOCE**	100 Marks
	All the components of the syllabus along with specimens,	
	Embryology models	
	Osteology	
	Radiographs, MRI, CT & ultrasonography	
	TOTAL	**100 Marks**

Commended reading:

Max marks for M.D Anatomy	Theory	Practical's	Viva-voce	Marks
	400	300	100	800

Scheme of Examination

SL.No	Description	MD Anatomy
1	**THEORY**	
	No of Theory Paper	4
	Marks for each Theory Paper	100
	Total marks for Theory Paper	400
	Passing Minimum for Theory	200/400 (40% minimum in each paper)

2	**PRACTICAL**	**300**
	● Dissertation	20 marks
	● OSPE	25
	● Subject specific assessment	255
3	**VIVA VOCE**	**100**
	Passing minimum for Practical including Viva voce	200/400

The candidate shall secure not less than 50% marks in each head of passing which shall include

(1) Theory – aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%)

(2) Practical/Clinical and Viva voce - aggregate 50%

(3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination.

(4) 5 per cent of mark of total marks of Clinical/Practical and Viva Voce marks (20 marks) will be of dissertation/thesis and it will be part of clinical/practical examination marks. External examiner outside the state will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce.

(5) No grace mark is permitted in post-graduate examination either for theory or for practical

- The University shall conduct not more than two examinations in a year for a subject, with an interval of not less than four and not more than eight months (8) between the examinations.

Books (latest Edition)

Gross Anatomy:

- Susan Strandring: Gray's Anatomy: The anatomical basis of clinical practice, Churchill Livingstone Elsevier.
- Keith and Moore Clinically Oriented Anatomy. Lippincot Williams and Wilkins.
- R.J. Last. Anatomy Regional and Applied. Churchill Livingston.
- Frank H. Netter. Atlas of Human Anatomy. Saunders Elsevier.

- ML Ajmani. Embalming: Principles and Legal Aspects. Jaypee Brothers.

Histology

- Young B. and Heath J. Wheater's Functional Histology. Churchill Livingstone.
- M.H. E Ross. Histology: A textbook and atlas. Williams and Wilkins.
- Harold A Davenport. Histological and Histochemical Techniques. W.B Saunders Company.

Genetics

- J.S Thompson and Thompson. Genetics in medicine. W.B. Saunders and Co. Philadelphia, London.

Embryology

- TW Sadler. Langman's Medical Embryology. Lippincotts, Williams and Wilkins
- Keith L Moore and T.V.N. Persaud. The Developing Human. Saunders.

Neuroanatomy

- Richard S. Snell. Clinical Neuroanatomy for Medical Students. Williams and Wilkins.

Statistics

- David E. Matthews and Vernon T. Farewell. Using and Understanding Medical Statistics. Karger.

Radiology

- J.B. Walter et.al. Basic Atlas of Sectional Anatomy with correlated imaging. Saunders Elsevier.

Surface anatomy

- SP John, Lumley editors. Surface Anatomy, The Anatomical basis of clinical examination. London: Churchill Livingstone.

Journals

03-05 international Journals and 02 national (all indexed) journals

Annexure 1

Student appraisal form for MD in Anatomy											
	Elements	Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	**Scholastic aptitude and learning**										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Posters, publications etc.)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work-based assessments										
1.6	Self-directed Learning										
2	**Work related to training**										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										

2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	**Professional attributes**										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	**Space for additional comments**										
5	**Disposition**										
	Has this assessment pattern been discussed with the trainee?	Yes	No								
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										

COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN PHYSIOLOGY

Preamble

The purpose of postgraduate medical education in Physiology is to produce experts with necessary knowledge, skills and attitude to function as competent physiologists who actively contribute towards growth of the subject through research and intellectual contribution, participate in the training of budding health professionals, participate meaningfully in-patient care and lifestyle disorders, stay abreast with the advancements in the field and serve the community at large. Physiology being the basis of entire practice of Medicine, a postgraduate in Physiology needs to acquire all necessary competencies that would enable him or her to function efficiently in domains of preclinical, para- clinical and clinical sciences.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes. The Expert group of the National Medical Commission has endeavored to render uniformity without compromise to purpose and content of this document. The revision within the document are mainly aimed to introduce competencies that ensure application of Physiology beyond preclinical boundaries and thereby improve health outcomes, embrace research and pedagogy as a vital part of training and reduce redundancy of contents. This document envisions a competent Physiologist who performs the roles of a Medical Teacher, Researcher, Member of Health Care Team (Clinical Physiologist), Administrator and Life Long learner with equal zeal and efficiency.

SUBJECT SPECIFIC LEARNING OBJECTIVE

Focus and Goal

The goal is to have uniform standards in the teaching of Physiology at the postgraduate level throughout the country. The guidelines will help in achieving such standards which will ensure availability of competent physiologists equipped with required skills for teaching, patient care (diagnostic, therapeutic and rehabilitative) and applied research.

The focus and goal of post-graduate medical education shall be to produce competent specialist and medical teachers recognized by the fraternity as the graduating scholars, building upon their undergraduate education and skills who shall –

i. Recognize the health needs of the community and carry out professional obligations ethically keeping in view the objectives of the national health policy;

ii. Have mastered most of the competencies, pertaining to the respective specialty, that is required to be practiced at the secondary and the tertiary levels of the health care delivery system;

iii. Be aware of the contemporary advancements and developments in the respective discipline concerned and shall progress accordingly;

iv. Have acquired a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology;

v. Have acquired the basic skills in the teaching of medical and paramedical professionals;

vi. Acquire basic management skills in human resources, materials and resource management related to health care delivery, general hospital management, principal inventory skills and counselling;

vii. Develop personal characteristics and attitudes required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals;

viii. Become an exemplary citizen by observing the highest standards of professional ethics and working towards fulfilling social and professional obligations to respond to national aspirations.

The institutions imparting post-graduate medical education shall continually work to synchronize the institutional goals with the national goals to produce the kind of trained manpower with high knowledge, appropriate skills and impeccable ethical standards required.

Learning Objectives

A postgraduate student having qualified for the MD (Physiology) examination should be able to:

1. Achieve comprehensive knowledge of general, systemic and applied Physiology.

2. Teach effectively the basic physiological mechanisms of human body in the context of pathophysiological basis of evolution, clinical presentation and

management of disease states to undergraduate and postgraduate medical, dental and paramedical courses.

3. Acquire in-depth knowledge of physiology while catering to the learning needs of specific courses such as sports physiology, speech pathology etc.

4. Understand general principles of medical education (use of appropriate teaching techniques and resources) and apply theoretical frameworks in pedagogy.

5. Interpret and evaluate research publications critically.

6. Conduct research in core physiology, applied physiology and Education which may have significant application towards improving health, patient care and student learning.

7. Generate credible evidence towards advancement of Physiology and its application in basic and applied significance.

8. Acquire skills in conducting collaborative research in the field of physiology with allied sciences, clinical sciences and biomedical engineering.

9. Explain how the knowledge of physiology can be effectively applied in diagnostic and therapeutic clinical settings.

10. Integrate physiology with Diagnostic, Therapeutic, Preventive and Rehabilitative Medicine.

11. Interact with the allied departments and render services in advanced laboratory investigations.

12. Interact effectively with other paraclinical, clinical and allied health sciences departments to develop integrated modules in basic sciences and teach competencies related to the same.

13. Acquire administrative skills to set up concerned department / laboratories and initiate purchase procedures and procure necessary items for running such laboratories.

14. Be an efficient Leader and member of academic, research and health care team.

15. Participate actively in various workshops/seminars/journal clubs of allied subjects to acquire various skills for collaborative research.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the postgraduate student should be able to learn:

A. Predominant in Cognitive Domain

1. Demonstrate in-depth understanding of basic physiological concepts, their clinical applications and physiological demands in special circumstances such as sports, environmental changes, yoga, meditation etc.

2. Demonstrate comprehensive knowledge of physiology of specific organ systems to cater to the learning needs of specialized courses such as speech pathology, kinesiology, aerospace physiology etc.

3. Impart knowledge about the basic physiological mechanisms of human body with reference to their implications in the pathophysiology of disease and the physiologic basis of their management to undergraduate medical and paramedical students.

4. Demonstrate knowledge of integrated study of basic sciences as per the needs of current CBME.

5. Demonstrate higher order thinking and problem-solving skills to exhibit interactive teaching techniques and facilitate contextual study of physiology in various teaching learning sessions.

6. Demonstrate knowledge and ability to participate in the present student centric TL strategies of CBME such as ECE, SDL, AETCOM and AITo (Aligned and Integrated Topic).

7. Demonstrate knowledge of the current assessment practices in undergraduate CBME such as DOAP.

8. Demonstrate knowledge of research methodologies and statistics.

9. Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.

10. Incubate ideas and contribute towards generation of patents and copyrights related to the subject.

11. Interact with other departments by rendering services in advanced laboratory investigations and relevant expert opinion.

12. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.

13. Contribute to society by imparting physiological understanding of health problems. Disseminate knowledge of human physiology, the clinical applications and research as per the needs or specific demands of the society at large.

14. Outline the components of a basic physiology curriculum, demonstrate ability to develop or implement the same in future academic career.

15. Serve as interface with society at large.

B Predominant in Affective Domain

At the end of the course, the postgraduate student should be able to:

1. Demonstrate responsibility, professionalism and ethical conduct in all professional undertakings.

2. Demonstrate ethical conduct in biomedical or animal research.

3. Follow ethical guidelines with regards to research and publications.

4. Demonstrate appropriate behavior of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.

5. Display principles of integrity and social accountability as a teacher.

6. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (Equity and social accountability).

7. Mentor/ counsel students to facilitate their holistic development.

8. Communicate effectively with peers, students and teachers in various curricular [teaching-learning, research] activities.

9. Function effectively as a member of the department, professional bodies and maintain professional conduct in interactions with students, peers, patient and staff.

10. Demonstrate the ability to give effective student feedback to undergraduate students.

11. Demonstrate the ability to receive feedback from teachers and peers.

12. Develop the capacity to reflect on own academic progress, develop self-directed learning skills and assess own learning needs.

C. Predominant in Psychomotor Domain

The postgraduate student should acquire practical competencies in the following tasks:

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

1. Demonstrate physiological concepts of various organ systems by performing amphibian experiments using simulated models
2. Demonstrate physiological concepts of specific organ systems by performing mammalian experiments using simulated models.
3. Perform and interpret a complete hematological profile
4. Perform clinical examination of various organ systems
5. Perform human experiments pertaining to specific organ systems and interpret results of the same
6. Perform human experiments related to physiological challenges such as exercise, yoga and meditation
7. Perform studies in stimulated environment - microgravity; high altitude; hot and cold environment.

Syllabus

Course contents:

A : Cognitive domain

Paper-I : General and Cellular Physiology including Genetic Basis and Historical perspectives:

1. Physiology of cell, various cellular mechanisms and genetic control mechanisms.
2. Various principles of Physics and Physical Chemistry involved in physiological phenomenon e.g. hemodynamics, bio-electrical potentials, body fluids, methods of measurements.
3. History of Physiology, Nobel laurates and discoveries.
4. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
5. Growth and Development including aging.

6. Excretion, pH, water and electrolyte balance.

7. Comparative Animal Physiology

Paper-II : Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology.

1. Blood and Immunity.
2. Cardiovascular System.
3. Respiratory System.
4. Gastro- Intestinal Tract (GIT) and dietary requirements.

Paper-III : Systemic Physiology (system concerned with procreation, regulation and neural control)

1. Nerve-Muscle Physiology including muscle mechanics
2. Endocrine Physiology
3. Nervous System (Central, peripheral and autonomic)
4. Special Senses
5. Reproduction & family planning/fetal & neonatal Physiology

Paper-IV : Applied Physiology including recent advances

1. Recent advances relevant to Physiology
2. Patho-physiology pertaining to systemic Physiology
3. Physiological basis of various clinical investigation tests
4. Interaction of human body in ambient environment- high altitude, space and deep sea
5. Exercise & Sports physiology
6. Transgender Physiology
7. Integrated Physiology
8. Yoga and Meditation
9. Social responsibilities of physiologists
10. Application of Artificial Intelligence in Physiology

B : Psychomotor domain:

A. The postgraduate student during the training period must PERFORM independently the following procedures:

i. Hematological profile

1. Estimation of hemoglobin
2. Determination of Total Erythrocyte (RBC) Count and RBC Indices (Blood Standards)
3. Determination of Total Leucocytes (WBC) Count: TLC
4. Preparation of a peripheral Blood Smear and Determination of Differential Leucocyte Count: DLC
5. Determination of Arneth Count
6. Determination of Bleeding Time (BT) and Clotting Time (CT)
7. Determination of Blood groups (A, B, O and Rh system)
8. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed cell volume (PCV)
9. Determination of Osmotic Fragility of Red Blood Cells
10. Determination of Platelet Count
11. Determination of Reticulocyte Count

ii. Human Physiology

a. Clinical Physiology

1. Detailed clinical examination of various systems.

b. Nerve muscle physiology

1. Ergography and hand-grip spring dynamography and study of human fatigue.
2. Recording of electromyography (EMG) and its application.
3. Recording of nerve conduction.

c. Cardiovascular system (CVS)

1. Clinical examination of CVS
2. Examination of arterial & venous pulses
3. Measurements of arterial blood pressure and effect of head-up/ head-down tilt
4. Recording of 12 lead Electrocardiography (ECG) and its interpretation
5. Measurement of blood flow
6. Heart rate variability
7. Ambulatory Blood pressure monitoring

d. Respiratory system

1. Clinical examination of respiratory system.
2. Stethography – study of respiratory movements and effect of various factors.
3. Assessment of respiratory functions (spirometry, vitalography, and gas analysis).
4. Measurement of BMR.
5. Cardio pulmonary resuscitation (CPR) and Artificial respiration.

e. Gastrointestinal system:

1. Clinical examination of abdomen.

f. Integrative Physiology / Excretory system

1. Recording of body temperature/effect of exposure to cold and hot environment

g. Reproductive system

1. Determination of ovulation time by basal body temperature chart and pregnancy diagnostic test - Immunological Tests.
2. Semen analysis: sperm count, motility and sperm morphology.

h. Nervous System including Special senses

1. Clinical examination of the nervous system and its physiological basis.
2. Examination of higher mental functions.
3. Examination of cranial nerves.
4. Examination of sensory system.
5. Examination of motor system including reflexes.
6. Clinical examination of special senses:
    (i) Smell and Taste
    (ii) Test for hearing to differentiate deafness
    (iii) Physiology of eye:
        (a) Clinical examination of the eye and pupillary reflex
        (b) Visual acuity
        (c) Perimetry – mapping out of visual field and blind spot
        (d) Accommodation
        (e) Fundoscopy
        (f) Colour vision and colour blindness
7. Reaction (visual and auditory) and reflex time.
8. Electroencephalography (EEG) and Polysomnography
9. Autonomic Nervous System (ANS) Testing.
10. Neuro-electrodiagnostic techniques: Nerve conduction study, Visual evoked potential (VEP), Brainstem auditory evoked potential (B.A.E.P), Somato-sensory evoked potential (SEP), Motor evoked potential (MEP).
11. Use of various test batteries for psychological evaluation of subject.

i. Sports Physiology

Tests for physical fitness : Cardio – respiratory responses to steady state exercise using:

(i) Body Composition

(ii) Conducting the Clinical Exercise Test

(iii) Harvard step test

(iv) Bicycle Ergometry

(v) Treadmill test for determination of VO2 max

j. Yoga and Meditation Physiology

i. Physical, Mental and Emotional well being

ii. Effect of yoga and pranayama on physiological parameters

iii. Mindfulness

iv. Concentration, anxiety and stress

v. Counseling in health and diseases

k. Others

1. Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients.

2. Basic Life Support and Cardiac Life Support

3. Effective Digital presentation, medical photography, Good Clinical Practice, Humanities and Bioethics.

iii. Amphibian (Frog) Experiments

All animal experiments must be compliant with Government of India Regulations, notified from time to time). Experiments in Amphibian/Dog/Cat should be conducted by computer assisted simulation models/ facilities. Other experiments should be performed as permissible by CPCSEA guidelines.

Effect of temperature on simple muscle twitch.

1. Effect of two successive stimuli (of same strength) on skeletal muscle.

2. Effect of increasing strength of stimuli on skeletal muscle.

3. Effect of increasing frequency of stimuli on skeletal muscle (genesis of tetanus).
4. Effect of free load and after load on skeletal muscle.
5. Effect of repeated stimuli on skeletal muscle (study of phenomenon of Fatigue).
6. Study of isometric contraction in skeletal muscle.
7. Determination of conduction velocity of sciatic nerve and effect of variables on it.
8. Properties of cardiac muscle – Refractory period, All-or-None Law, extra-systole and compensatory pause, beneficial effect.
9. Regulation of Heart, Vagus dissection and effect of Vagal and WCL stimulation.
10. Effect of physiological and pharmacological variables on intact frog's heart.
11. Perfusion of isolated frog's heart-role of sodium, potassium, calcium ions and drugs.

B. The postgraduate student during the training period must ASSIST in the following procedures:

Human Physiology

i. Cardiovascular system (CVS)

- Cardiac TMT Holter Monitoring
- Collection and Assessment of Arterial blood gas

ii. Nervous System including Special senses

- Intra operative neuro monitoring (IONM)

C. The postgraduate student during the training period must OBSERVE the following procedures:

i. Hematological profile

- Determination of Absolute Eosinophil Count
- Study of Haemopoietic Cells present in the Bone Marrow
- Other high-end hematological investigations (specify) : Flow cytometry, Platelet functions, D Dimers, coagulation profile etc.

ii. Human Physiology

- Cardiovascular system (CVS)
- Echocardiography
- Central venous line insertion, CVP monitoring
- Respiratory system
- Introduction to working of continuous positive airway pressure and Bilevel positive airway pressure (CPAP & BiPAP) Therapy

■ Ventilator setting

- Gastrointestinal system:
- GI Manometry
- Reproductive system
- Ovulation study by using ultrasonography
- Integrative Physiology / Excretory system
- Pressure and PH studies in esophagus, stomach, intestine and rectum
- Others
- Genetic testing and introduction to procedural skills for clinical genetics/ prenatal diagnosis/ adult genetics - birth defects, genetic hematology, dysmorphology, skeletal dysplasia, neurological and muscular disorders, primary immunodeficiency diseases, autoimmune and multi-factorial disorders, biology and genetics of cancer.
- Interaction of human body in ambient environment - high altitude, space and deep sea
- Exercise & Sports physiology
- Integrated Physiology
- Yoga and Meditation
- Social responsibilities of physiologists
- Application of Artificial Intelligence in Physiology

iii. Mammalian Experiments (Dog/Rabbit/Guinea pig/Rat/Mice)

- General management of mammalian experiments.
- Recording of heart rate, blood pressure and respiration and study the effects of various factors; drugs; asphyxia; occlusion of common carotid artery.
- Effect of stimulation of central and peripheral end of vagus on arterial blood pressure and respiration after vagotomy.
- Effect of stimulation and distension of carotid sinus on blood pressure and respiration.
- Effect of stimulation of splanchnic nerve.
- Effect of stimulation of peripheral somatic nerve (sciatic nerve).
- Study of hypovolemic shock and its reversal.
- Perfusion of isolated mammalian heart and study the effects of drugs and ions.
- Recording of Isolated Intestinal movement and tone and studying the effect of drugs and ions.
- Study of various stages of menstrual cycle, cervical smear and vaginal smear.

Departmental resources

1. Clinical Neurophysiology Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

(i) Electroencephalography

(ii) Evoked potential recording

(iii) Electromyography

(iv) Nerve conduction studies

(v) Autonomic nervous system (ANS) testing

(vi) Any other newer technology like Functional Near infrared spectroscopy (fNIRS), Intra operative neuro monitoring (IONM), polysomnography

(vii) Diabetic neuropathy assessment kit

(viii) Reaction time apparatus

(ix) Electroretinography

2. Cardio-Respiratory Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

(i) Electrocardiography

(ii) Blood-gas Analysis

(iii) Computerized multifunctional spirometry

(iv) Laboratory for measuring pulmonary diffusion capacity and functional residual capacity (FRC)

(v) Whole-body plethysmography

(vi) Laboratory for Blood flow measurements (Impedance plethysmograph / Laser flow meter/ Doppler flow meter)

(vii) Ankle brachial pressure index/ Vascular Doppler

3. Exercise Physiology Laboratory

The department should generate liaison with sports authorities and clinical departments to provide services for testing and grading exercise and physical efficiency for health monitoring and diagnostics (disease). This should be done by using the following techniques:

(i) Two step test exerciser

(ii) Bicycle Ergometry

(iii) Tread mill

(iv) Respiratory gas analysis and measurement of basal metabolic rate (BMR)

4. Metabolic/Endocrinology/Reproductive Bio-medicine laboratory

This laboratory should perform various tests pertaining to gastrointestinal, renal, metabolic, endocrinal and reproductive bio-medicine. The department should generate liaison with clinical departments and provide routine services for health monitoring and diagnostics (disease).

1. Body Fat Analysis
2. Spectrophotometer
3. pH meter
4. Elisa Reader/Washer
5. Luminometer
6. Semi-autoanalyzer
7. Artificial reproductive techniques/ semen laboratory/ infertility laboratory

Post graduate students should be posted in the above laboratories and extend the required services on routine basis.

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a log book for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used.

A. Lectures : Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per subject requirements All postgraduate trainees will be required to attend these lectures. Lectures can cover topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. Salient features of Undergraduate/Postgraduate medical curriculum
5. Teaching and assessment methodology.

(Topic numbers 3, 4, 5 can be done during research methodology/biostatistics and medical education workshops in the institute.)

B. Journal club : Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the e-logbook.

C. Student Seminar : Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in- depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium : Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work / Bedside clinics : Minimum - once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department should participate in moderating the teaching- learning sessions during clinical rounds.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest or clinical cases.

G. a. Rotational clinical / community / institutional postings

- Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions including Medical Education Unit (MEU) or Department of Medical Education (DOME). The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines.
- Clinical Postings: Compulsory clinical postings in following departments must be undertaken as per specified number of days in table 1 depicted below:

Table 1 : Plan of Clinical postings for MD Physiology

Prof Year	Department	Period of posting	Focus areas
1st year	Biochemistry	15 days	1. Auto & Semi auto Analyzer, Electrophoresis, Chromatography, RIA, Study of serum chemistry (proteins, Lipid, glucose, electrolytes, enzymes etc.) – 8 days
			2. Constituents of normal and abnormal urine, liver function tests, Renal function tests, Gastric function tests – 7 days
1st year	Pharmacology	20 days	1. Animal House (to learn technique of Animal Handling, Blood sampling, anesthesia, Euthanasia, effective Analgesia and infection control after surgery. Study of Animal behavior like eating, drinking, locomotion, sexual activity etc.)
			2. Experimental Pharmacology lab to study ongoing animal experimental procedures including dissection for rat phrenic nerve hemidiaphragm and others – 10 days
			3. Study various guidelines related to ethical use of animals in experiments. To study preparation of different animal models and various tests to study physiological parameters. – 15 days

1st year	Pathology	30 days	1. Blood bank - Cross matching, blood Storage, Immunohistochemistry, Immunological tests – 15 days
			2. Central Lab. - Tests for bleeding & clotting disorders, study of Haemopoietic Cells present in the Bone Marrow – 10 days
			3. Cemen analysis, determination of ovulation time by basal body temperature chart and pregnancy diagnostic tests – 5 days
1st year	Microbiology	10 days	1. Fluorescent microscopy, use of Elisa reader & Washer – 5 days
			2. Immuno-physiology and other facilities available in the dept. – 5 days
2nd year	Ophthalmology	15 days	1. Direct and indirect Ophthalmoscopy, Retinoscopy – 8 days
			2. Slit lamp microscopy, Tonometry, Pachymetry, Study of corneal topology, Optometry, Auto-refractometer – 7 days
2nd year	Tuberculosis & Chest Disease (Pulmonary Medicine)	15 days	1. Whole body plethysmography – 8 days
			2. Bronchoscopy & other facilities available in the dept. – 7 days
2nd year	ENT	15 days	1. Audiometry – 7 days
			2. Oto-rhino-laryngoscopy, direct and Indirect Laryngoscopy, BERA, BSAEP – 8 days
3rd year	General Medicine	20 days	1. TMT, Holter analysis, ABG, ECG – 10 days
			2. EMG, NCV – 10 days
3rd year	Psychiatry	10 days	1. EEG
			2. Biofeedback
3rd year	Casualty	15 Days	1. To know basics of how to handle emergency
			2. Minor procedures

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that

students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

G b. Posting under DISTRICT RESIDENCY PROGRAMME (DRP)

Preamble: Doctors have to be trained in diverse settings including those which are close to the community. Hence, they should be trained in the District Health System / the District Hospitals.

M.D./M.S. students admitted with effect from academic session 2021, the training imparted as part of the District Residency Programme, shall be considered as training imparted in a medical institution.

- **District Residency Programme:** All post-graduate students pursuing M.D./ M.S. in broad specialties in all medical colleges/institutions under the purview of the National Medical Commission shall undergo a compulsory residential rotation of three months in District Hospitals/ District Health System as a part of the course curriculum. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduate programme.

  This rotation shall be termed as 'District Residency Programme' (DRP) and the post-graduate medical student undergoing training shall be termed as a 'District Resident'.

- **Training during DRP and Certification thereof:**

a. Quality of training shall be monitored by log books, supportive supervision, and continuous assessment of performance. The attendance and performance of District Residents shall be tracked by the District Residency Programme Coordinator (DRPC) of the district concerned, as well as the parent Medical College through an appropriate electronic/digital or mobile enabled system. Such monitoring systems shall also be accessible to the State/Union Territory Steering Committee and the National Coordination Cell.

b. The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution by phone and e-communication for guidance, learning, and for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.

c. Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective post-graduate course.

d. The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to be decided by the PGMEB to the concerned medical college and the Govt. of the State/UT.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

J. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in the department and other areas of posting (as specified in table 1). This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The log book is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and acquisition of selected competencies.

The purpose of the Log Book is to:

a) Help maintain a record of the work done during training,

b) Enable Faculty/Consultants to have direct information about the work done and intervene, if necessary,

c) Provide feedback and assess the progress of learning with experience gained periodically.

d) The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in log book particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the MCI e-logbook Guidelines uploaded on the Website.

K. Course in Research Methodology

a. All post-graduate students shall complete an NPTEL course in Research Methodology.

b. The students shall have to register on the portal of the designated training institutions.

c. The students are expected to complete the course in the first year.

d. The online certificate generated on successful completion of the course and examination thereafter, will be acceptable evidence of having completed this course.

e. The above certification shall be a mandatory requirement to be eligible to appear for the final examination of the respective post-graduate course.

f. This requirement shall be applicable for all post-graduate students.

L. Course in Ethics

a. All post-graduate students shall complete course in ethics including Good Clinical Practices and Good Laboratory Practices, whichever is relevant to them, to be conducted by institutions/Universities.

b. The students are expected to complete the course in the first year.

c. No post-graduate student shall be permitted to appear in the examination without the above certification.

M. Course in Cardiac Life Support Skills

a. All post-graduate students shall complete a course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills to be conducted by the institution.

b. The students are expected to complete the course in the first year.

c. No post-graduate student shall be permitted to appear in the examination without the above certification.

N. A post-graduate student of a degree course in broad specialty/super specialty will do at least one in each following categories to make him/her eligible to appear in his/her final examination:

a. Minimum one Poster presentation at a National/Zonal/State conference of his/her speciality;

b. At least one Podium presentation at a National/Zonal/State conference of his/her speciality;

c. At least one research paper published/accepted for publication in journal of his/her speciality as first author

O. Other aspects

Institutions may arrange training in any other courses like awareness in medical audit, medical law, exposure to human behaviour studies, finance, accounts, etc, which are beneficial to the postgraduate students.

ASSESSMENT

Examinations: The medical college/institution will conduct the Formative Assessment (examination) and the University will conduct the Summative Assessment (examination).

Both Formative Assessment (examination) and Summative Assessment (examination). shall consist of Theory, Clinical/Practical and Viva Voce. 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 8 months between the two examinations.

FORMATIVE ASSESSMENT:

Formative assessment should be continual and should assess medical knowledge, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal Assessment should cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment should be conducted in theory and practical/clinical examination, should cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

There shall be Three Internal Examinations both Theory and Practical as per the format of summative examination as follows:

1. I Internal Examination at the end of 1st year,
2. II Internal Examination at the end of 2nd year and
3. Preliminary examination at the end of 3rd year.

SUMMATIVE ASSESSMENT:

Eligibility Criteria for Post Graduate student for appearing in University Examination –

Candidates will be permitted to appear for examination only if attendance (Minimum 80% in each calendar year) and internal assessment are satisfactory and dissertation is accepted.

1. Have minimum one Poster Presentation or Podium presentation at a National/Zonal/State conference of his/her specialty
2. Have minimum one Research paper published in journal of his/her specialty as first author.

3. Complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated on successful completion of the course and examination.

4. Complete a certification course in ethics including Good Clinical Practices and Good Laboratory Practices, (whichever is relevant to them) in the first year of the course conducted by institutions.

5. Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills in the first year of the course conducted by the institution.

6. Thesis acceptance by all evaluators before the conduct of University Examination.

The summative examination would be carried out as per the Rules given in the latest PGMER December 2023. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

The postgraduate examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of two examiners. A postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory examination

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify postgraduate student's level of knowledge, skill and competence at the end of the training, as given in the latest PGMER December 2023. 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. shall be held at the end of 3rd academic year.

3. Practical/clinical and Oral/viva voce examination Practical examination

Practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor domain.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

Scheme of Examination

SL No	Description	MD Physiology
1	**THEORY**	
	No of Theory Paper	4
	Marks for each Theory Paper	100
	Total marks for Theory Paper	400
	Passing Minimum for Theory	200/400 (40% minimum in each paper and aggregate of 50% in theory to declared pass in theory)
2	**PRACTICAL**	**300**
	• Dissertation	20 marks
	• OSPE	25 (5 stations x 5 marks)
	• Subject specific assessment	255
3	**VIVA VOCE**	**100**
	Passing minimum for Practical including Viva voce	200/400

The candidate shall secure not less than 50% marks in each head of passing which shall include

(1) Theory – aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%)

(2) Practical/Clinical and Viva voce - aggregate 50%

(3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination.

(4) 5 per cent of mark of total marks of Clinical/Practical and Viva Voce marks (20 marks) will be of dissertation/thesis and it will be part of clinical/practical examination marks. External examiner outside the state will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce.

(5) No grace mark is permitted in post-graduate examination either for theory or for practical

- **Dissertation**

  Postgraduate student shall present his or her dissertation work for 10 minutes which will be evaluated and followed by discussion by all examiners.

- **OSPE -** Five stations including procedure and question stations will be kept and observed and evaluated by examiners.

- **Pedagogy –** Student will be given a topic to present to assess his/her teaching skills.

  There shall be 4 theory papers each of three hours duration and each paper shall have TEN short essay questions of 10 marks (10x10 = 100).

Preferably case-based questions.

Paper	Syllabus
Paper I	Basic sciences as applied to the subject (General and Cellular Physiology including Genetic basis and historical perspectives)
Paper II	Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology
Paper III	Systemic Physiology (system concerned with regulation, neural control and procreation)
Paper IV	Recent advances in the subject (including applied Physiology)

Note: The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

Questions on recent advances may be asked in any or all papers.

Note: The distribution of chapters / topics shown on the papers are suggestive only and may overlap or change.

3. Practical and oral/viva voce examination:

Practical examination: 300 marks

The practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor domain. One day should be for conducting practical examination including table viva that will focus on the nuances of laboratory techniques and quality assurance.

The practical examination should include:

B. Practical Examination: 300 Marks

i)	Clinical Physiology Clinical examination of a given subject Discussion on investigations Interpretation of laboratory findings Physiological principles in diagnosis	75 Marks
ii)	Human experiment	50 Marks
iii)	Hematology	40 Marks
iv)	Amphibian & Mammalian	30 Marks
v)	Neuro-electrodiagnostic/ANS/Sports Physiology -Tests	40 Marks
vi)	OSPE	25 Marks
vii)	Dissertation	20 Marks
viii)	Pedagogy 20 Marks	

C. Viva-voce Examination: 100 Marks

Recommended Reading:

Books (latest edition)

1. A.C. Guyton – Text book of Medical Physiology
2. W.F. Ganong – Review of Medical Physiology
3. William's Textbook of Endocrinology
4. J.E. Cotes- Respiratory Physiology
5. D.T. Harris – Experimental Physiology
6. Wintrobe's – Clinical Hematology

7. Principles of medical physiology by Sircar
8. Brown B.L. – Cell signaling, Biology and medicine of signal transudation
9. Berne and Levy- Medical Physiology
10. Textbook of Medicine by Harrison
11. Principles of Neural sciences edited by E. R. Kandel, J. H. schwartz and T. M. Jessell
12. Williams Hematology edi. by M.A. Lichtman, E. Beutter, K. Kaushansxy, T.J. Kipps, U. Seligsohn, J. Prachal
13. Medical Physiology: by W. F. Boron and E. L. Boulpep
14. Medicat Physiology: by A. Rhodes and G. A. Tanner
15. Neuroscience : by Dale Purves

Practical Books:

1. Hutchison's Clinical Methods: An Integrated Approach to Ctinical Practice.
2. Macleod's clinical Examination
3. Textbook of Practical Physiology: by Dr. G. K. Pal and Dr. Pravati Pal
4. Textbook of Practical Physiology: by Dr. C. L. Ghai
5. Textbook of Practical Physiology: by Dr. Ranade
6. Textbook of Practical Physiology: by Dr. A. K. Jain

Journals :

03-05 International Journals and 02 National (all indexed) journals

Annexure 1

Student appraisal form for MD in Physiology

Elements		Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	Scholastic aptitude and learning										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Posters, publications etc.)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work-based assessments										
1.6	Self-directed Learning										
2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										

Elements		Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee?	Yes	No								
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										

COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN BIOCHEMISTRY

M.D. BIOCHEMISTRY

Preamble

A competency is the capability to apply or use a set of related knowledge, skills, and abilities required to successfully perform "critical work functions" or tasks in a defined work setting. Competency-based training is a learning model in which the required level of knowledge and skill (competency) on a task must be demonstrated. The purpose of the competency- based postgraduate education in Biochemistry is to create specialists, with the required knowledge, skills, and attitude, who would provide high-quality healthcare complying with the principles of personal integrity and professional ethics and would advance the cause of science through teaching, research & training along with constant updating of his/her knowledge and skills as a lifelong self-directed learner.

The student, after undergoing training in MD Biochemistry, should be able to demonstrate his/her knowledge of the basic concepts and recent advances in the subject, and a defined set of skills including expertise in various laboratory techniques applicable to metabolic and molecular aspects of medicine, planning and executing research projects, writing research papers/ articles demonstrating the acquired training in research methodology. The postgraduate training course should equip the student with skills to become a competent teacher who is also able to demonstrate his/her competence in planning teaching programs and apply those to facilitate the learning of the students in medical and allied health science courses in compliance with the curriculum while advancing the same with needful and feasible innovations. He/she should demonstrate competence in integrating teaching-learning of Biochemistry with other relevant subjects/disciplines to facilitate the holistic application of the subject of Biochemistry in patient care. He/she should be able to demonstrate his/her training in good laboratory practices with the ability to set up/manage a quality-controlled and quality-assured diagnostic laboratory, generate, evaluate, interpret and report the diagnostic laboratory data, with a good understanding of the sources of errors, corrective and preventive actions, hospital and laboratory information system network, and interact with clinicians as may be needed for effective patient care.

This document aims to provide teachers and learners with comprehensive guidelines to achieve a defined set of outcomes through learning and assessment and apply those in a given setup. This document has been framed by the Expert Group of the National Medical Commission with an aim to render a uniform PG medical curriculum to be implemented by all the medical colleges in the country. The curriculum so designed has been named the competency-based PG medical

education curriculum in conformity with the purpose and content of PG medical education.

Goal:

The postgraduate course M. D. (Biochemistry) should enable a student to acquire in depth knowledge in basic concepts of biochemistry, recent advances in the subject and skills and expertise in various laboratory techniques applicable to metabolic and molecular aspects of medicine and in research methodology

SUBJECT-SPECIFIC LEARNING OBJECTIVES

The goal of the training program in MD Biochemistry is to enable a student to become a competent teacher/facilitator of teaching-learning processes, researcher, problem solver, and healthcare provider. He/ she should be able to acquire a defined set of cognition and skills as detailed below and demonstrate his ability to apply the same in a given healthcare setup.

A. Acquisition of Knowledge

The student should be able to explain the molecular, physical, and physiological logic of the processes involved in the maintenance of normal health and their deviation in a disease state. He/should be able to integrate his/her acquired knowledge in principles and concepts of classical biochemistry, biophysics, and molecular biology, comprehend and apply his/her cognition and skills in a professional patient care setup.

B. Acquisition of Skills

The student should be able to facilitate the UG and PG learning of biochemical concepts and principles and should be able to render hands-on training in the Biochemical laboratory investigations and experimentations relevant to the strengthening of biochemical concepts, scientific and clinical problem-solving, and biomedical research. He/she should be able to analyze, interpret and evaluate the data, and rationalize their application in clinical management and experimental research.

C. Teaching and training

As a competent healthcare personnel, the student should develop his/her learning skills by applying the fundamental principles of medical education, through teaching and assessing the undergraduate students in medicine and allied health science courses and, by contributing to the training of postgraduate students.

D. Diagnostic laboratory skills

The student should be competent in setting up/supervising/managing a diagnostic laboratory in Biochemistry in a hospital or in any other setup (diagnostic units in remote places or independent of a hospital setting) ensuring quality control along with quality assurance and providing reliable healthcare support services. The student should be able to provide consultation to clinicians and also contribute to community healthcare by conducting screening tests.

E. Professionalism, Ethics, Communication skills

The student should be able to develop and sustain work ethics and empathetic behavior with students and colleagues. He/she should be able to demonstrate professional integrity, honesty, and higher ethical standards and be able to display appropriate attitude and communication skills to interact with colleagues, teachers, students, laboratory personnel, and other healthcare professionals. While dealing with the patients and their relatives, he/she should exhibit compassion, care, and concern

F. Research

The student should be able to demonstrate his/her competence in carrying out research work and related activities from the planning phase to writing (dissertation/thesis, research report/research paper) by applying the principles of research methodology.

LEARNING OBJECTIVES

At the end of three years of training in the MD Biochemistry course, a postgraduate student should be able to:

- Demonstrate his/her knowledge of Biochemistry, Cell Biology, Molecular Biology, Molecular diagnostics, Biophysics, and applied aspects of all the mentioned branches to contribute to the teaching-learning processes and healthcare management.
- Identify learning needs and set the learning objectives for his/her self-directed learning and acquire and apply the needful learning in subjects like Genetics, Nutrition & Dietetics, Immunochemistry, and Laboratory Medicine in a relevant context.
- Apply the Medical Education principles to effectively contribute to Teaching-Learning processes, Assessment & Integrated learning.

- Demonstrate his/her knowledge about various aspects of the Competency-based UG medical education implemented w.e.f academic year 2019-20.
- Explain, comprehend and analyze the basics of Cellular and Molecular Biochemistry, functional mechanisms of the biomolecules and their logistics in the human body in normal health and their deviations in the disease conditions. He/she should be able to integrate his/her cognition and skills to facilitate medical education for undergraduate, postgraduate, and allied health sciences students and for patient management.
- Demonstrate administrative, decision-making, group activity, teamwork, and leadership skills in (a) setting up a department in the medical institution and (b) diagnostic services in the hospital and managing them as a part of the healthcare team.
- Analyze, interpret and evaluate laboratory data and provide consultancy to the clinician for judicious use of lab tests, with appropriate interpretation whenever needed, to facilitate the diagnosis, treatment, follow-up, and overall management of patients.
- Conduct research and related activities in the field of Biochemistry, Clinical Biochemistry, Molecular diagnostics, and Medical Education.
- Analyze, interpret, evaluate, appraise and present research-related data and publications to identify the best clinical evidence for research and demonstrate his/her competence in scientific /clinical work presentation.
- Describe the principles of evidence-based medicine, evidence-based practice, good laboratory practice, and good clinical practice.
- Communicate effectively to fellow colleagues, teachers, patients & their relatives and other healthcare members for providing services to the community.
- Actively participate in all the teaching-learning-related activities like CMEs/ workshops/ conferences/hands-on-training/Interdepartmental meets/clinical meetings and acquire interpersonal skills.

SUBJECT/DOMAIN-SPECIFIC COMPETENCIES

At the end of three years training course, the postgraduate student should be able to demonstrate the competencies under the following three domains:

A. Cognitive domain (Knowledge domain)

1. Describe the biochemical principles and mechanisms to define and explain a healthy, and a diseased state, and execute the application of the biochemical mechanisms in the perception, diagnosis, and treatment of a disease.

2. Describe the biomolecules and their importance in sustaining life processes.

3. Explain the concept of intermediary metabolism, energy transactions, and metabolic and molecular homeostasis in the sustenance of life.

4. Explain the characteristics, components, and functional significance of different metabolic pathways, their specific intermediates, their inter-conversions, pathway- specific, organ-specific, and interrelated regulation of metabolic pathways, and apply that in explaining the biochemical logic in the functioning of the body in health and disease.

5. Describe and apply the concept of nutrition in health and disease, and critically evaluate the role of essential micro- and macro-nutrients, and their interlinks with cellular metabolism.

6. Apply the integrated knowledge and understanding of biochemical principles and mechanisms in clinical problem-solving.

7. Demonstrate knowledge of genetic engineering in various fields of medicine.

8. Apply the principles of biostatistics in research, clinical laboratory practices, community-based health data collection, and epidemiological surveys.

9. Demonstrate knowledge of the establishment of a diagnostic laboratory and its accreditation process.

10. Analyze, interpret and evaluate biochemical laboratory findings in integration with the relevant clinical data to evaluate, analyze and monitor a disease state.

11. Apply the knowledge acquired in the basic principles of research methodology to develop a research protocol.
12. Make use of the latest available statistical tools for analyzing the research data, and interpreting and disseminating the results.
13. Demonstrate familiarity with the advances in artificial intelligence and computer-based modeling as and when required.
14. Describe and implement various components of the Competency-based UG Medical Education.
15. Apply the principles of teaching-learning technology while taking interactive classroom lectures, prepare modules for case-based learning (CBL) and problem-based learning (PBL), organize and conduct CBLs/PBLs, case discussions, small group discussions, seminars, journal clubs, and research presentations.
16. Explain the principles of instrumentation and their automation in the Biochemistry laboratory and demonstrate knowledge about the latest advances in technology.
17. Exhibit knowledge of professional ethics and integrity in his/her day-to-day conduct and services rendered.
18. Apply the updated knowledge to suggest and implement judicious use of clinical laboratory investigations.
19. Demonstrate knowledge on the use of laboratory gadgets and instruments taking necessary precautions.
20. Demonstrate knowledge on the preparation of solutions and reagents with necessary precautions as may be required for the estimations in experimental and diagnostic laboratories.
21. Display knowledge about recent advances and trends in the core subject area, research, and laboratory practice along with point-of-care testing (POCT) in the field of biochemistry.

B. Affective domain (Attitudes including Communication and Professionalism)

1. Communicate appropriately with peers, teachers, healthcare professionals, and patients coming from a variety of backgrounds to explain the molecular and metabolic basis of health and disease in integration with lifestyle management.

2. Demonstrate care, concern, respect, empathy, and compassion while dealing with patients and their relatives at any point of interaction.

3. Demonstrate progressive improvement in AETCOM in routine endeavors through self- assessment, feedback from the peers, stakeholders and adapting to relevant learning.

4. Explain effectively to the patients/their relatives the precautions and preparations needed for them to comply with for specific biochemical analysis/laboratory tests that they will be subjected to.

5. Ensure that the related technical staff is apprised of the above and is duly trained while dealing with the patients.

6. Apply ethical principles and display proper etiquette in dealing with patients, relatives, and other health personnel.

7. Demonstrate appropriate attitude and ethical behavior in exchanging feedback with peers, teachers, clinicians, patients, and their relatives.

8. Display ethical behavior, and personal and professional integrity in his/her conduct and services.

9. Demonstrate the ability to maintain confidentiality in declaring the laboratory results to the concerned personnel wherever applicable.

10. Display awareness and respect for the rights of the patients.

11. Demonstrate counseling skills, especially in the context of nutritional and genetic counseling.

12. Demonstrate competency in judicious decision-making free from personal beliefs/thoughts, pride, and prejudice and, that, no such limitations impact his/her professional performance.

C. Psychomotor domain

13. Demonstrate the principles and facts of cellular and molecular biochemistry by performing relevant laboratory exercises and analytical tests on body fluids, and other biologically important substances, along with documentation of the test procedures, results, and interpretation of findings.

14. Develop a differential diagnosis, wherever applicable, based on the results obtained after performing the requisite tests.

15. Plan & conduct lectures, practical demonstrations, tutorial classes, and case-based or problem-based small group discussions for undergraduate students of medical and allied disciplines.
16. Identify, select and perform various biochemical tests in the clinical laboratory which are useful in the diagnosis, treatment, follow-up, and overall management of diseases and be able to interpret the results of such tests.
17. Perform relevant biochemical, immunological, and molecular biology techniques, wherever applicable.
18. Demonstrate compliance with the standard operating procedures of various methods and techniques used in a clinical biochemistry laboratory.
19. Perform enzymatic assays and conduct experiments to study enzyme kinetics affirming the ability to discuss, interpret and document the related data.
20. Perform routine investigations in hematology and microbiology, as and when required.
21. Demonstrate presentation skills at academic meetings and scientific paper writing skills.
22. Prepare research protocols and conduct relevant experimental studies.
23. Analyze and solve clinical and experimental problems.

By the end of the course, the postgraduate student should be able to demonstrate his competency in performing the following procedures independently:

- Demonstrate the use of all the routine glassware/equipment used in UG teaching- learning in Biochemistry (as per MSR) and advanced instruments used in the clinical laboratory attached to the respective hospital for patient care.
- Preparation of buffers, normal laboratory solutions like molar/molal/normal and reagents with validation.
- Perform all the undergraduate practicals as per the new competency-based medical education prescribed by NMV
- Perform experiments to study selected reactions of carbohydrates, amino acids and proteins, and lipids.

- Perform experiments to demonstrate constituents of milk.
- Perform experiments to demonstrate normal and abnormal constituents of urine.
- Perform Paper chromatography for separation of amino acids.
- Determination of enzyme activity and study of enzyme kinetics, using any two suitable enzymes (e.g., alkaline phosphatase from any liver tissue or acid phosphatase from potatoes).
- Plot standard curve for different estimations.
- Estimate (including calibration) and interpret clinical analytes as detailed below:
    - Blood glucose, glycated hemoglobin, the performance of glucose tolerance test and glucose challenge test,
    - Total protein, albumin, and A:G ratio,
    - Electrolytes, arterial blood gas analysis,
    - Cholesterol, triglycerides, free fatty acids, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), phospholipids, Lp(a), and calculated parameters under lipid profile,
    - Amylase, lipase,
    - Urea, creatinine, uric acid, urinary microalbumin,
    - Parameters of liver function tests (bilirubin, hepato-biliary enzymes such as AST, ALT, ALP, GGT, serum proteins/albumin and prothrombin time, CRP),
    - Calcium, magnesium, phosphorus, copper (and ceruloplasmin), serum iron, TIBC, and ferritin,
    - Markers of myocardial damage (CK, CK-MB, troponins, LDH),
    - Vitamin D, B12, and folate,
    - o Point-of-care testing (POCT).
- Electrophoresis of serum proteins, lipoproteins,
- Separation and molecular weight determination of proteins by SDS-PAGE,

- Electrophoretic separation of LDH isozymes or any other isoenzymes,
- Hb electrophoresis,
- Renal clearance tests,
- CSF and other body fluid analysis,
- Stone analysis,
- Thyroid function tests, Tumor markers, and relevant hormone assays by ELISA/ RIA/Chemiluminescence.

Clinical Laboratory

- Demonstrate familiarity with the essentials of a clinical laboratory setup, the working of autoanalyzer, data transfer, statistical considerations, authorizing and reporting results in an advanced clinical laboratory with an ability to enlist the possible sources of errors (pre-analytical, analytical and post-analytical), perform root cause analysis, and undertake corrective actions, and preventive actions (CAPA).
- Perform and demonstrate activities under total quality management (TQM) of the Laboratory:
    a. Specimen collection, handling, processing, and storage of the sample.
    b. Methods of standardization & calibration.
    c. Methods of quality control, quality assurance, CAPA & assessment.
- Demonstrate ability to prepare and interpret a Levy-Jennings chart and plot inter- assay and intra-assay variation for any analyte estimated in the laboratory.
- Implementation and interpretation of Westgard rules followed by their CAPA, as required.
- Determination of reference values for any one parameter for the clinical laboratory.
- Perform inter-instrumental comparison for at least four parameters.
- Perform in-house calibration of pipettes, centrifuge, hot-air oven, thermometer, and thermo-hygrometer.
- Student should undergo internal auditor training as per ISO 15189:2012, NABL (optional).

- Able to prepare a lab quality manual and frame relevant Standard Operating Procedure (SOP) and Work Desk Instructions (WDI), for every procedure followed in a clinical lab.

Molecular laboratory techniques

The student should be able to perform the following:

- Isolation of genomic DNA from blood,
- Isolation of RNA, synthesis of cDNA by reverse transcription,
- PCR and Reverse transcriptase PCR (both conventional and real-time),
- Primer designing,
- Blotting techniques,
- Basic techniques and principles of protein/enzyme purification and determining homogeneity.

By the end of the course, the postgraduate student should be able to perform under supervision or, demonstrate familiarity with, as the case may be, the following procedures (at least any five):

1. Separation of peripheral blood leukocytes using relevant isolation technique,
2. Subcellular fractionation/marker enzymes for organelles to demonstrate fractionation and purity of the fraction,
3. Ultracentrifugation,
4. Isolation of plasmids,
5. Basic techniques and essentials in cell culture and establishing different cell culture facilities,
6. High-performance liquid chromatography (HPLC)/GC-MS/LC-MS,
7. Restriction fragment length polymorphism (RFLP),
8. Fluorescent in-situ hybridization (FISH),
9. DNA fingerprinting,
10. Immunodiffusion techniques,
11. Immuno-electrophoresis,
12. Therapeutic drug monitoring,
13. Flow cytometry,
14. Nephelometry,
15. HLA typing.

SYLLABUS

The course contents are outlined below:

A. Cognitive Domain

Biomolecules, Principles of Biophysics and its biomedical importance, Cell biology, Fluid, electrolyte and acid-base balance, Analytical techniques and instrumentation, Biostatistics and research methodology, Basics of medical education in teaching and assessment of Biochemistry.

BIOMOLECULES

Ionization of water, the concept of acid and base, weak acids and bases, pH, pK, Henderson- Hasselbalch equation, buffer and buffering capacity.

Proteins:

- Classification, structure, properties and functions of amino acids and peptides, biologically important peptides,
- Classification, biological significance and structural organization of proteins,
- Structure-function relationship of proteins (haemoglobin, myoglobin, collagen and immunoglobulins),
- Fractionation, purification, structural analysis and characterization of proteins,
- Protein folding and its associated disorders,
- Protein denaturation,
- Protein degradation – lysosomal and proteosomal,
- Plasma proteins.

Carbohydrates:

- Classification, biomedical importance, functions, properties and reactions of carbohydrates,
- Structural aspects of monosaccharides, disaccharides and polysaccharides,
- Mucopolysaccharides/glycosaminoglycans, glycoproteins and glycolipids,
- Glycation, glycosylation and role of carbohydrates in blood group substances.

Lipids:

- Types, properties and biomedical importance of lipids,
- Fatty acids - nomenclature, classification, properties, reactions including essential fatty acids, polyunsaturated fatty acids and trans fatty acids,
- Mono, di- and triacylglycerols,
- Trans fats,
- Cholesterol - structure, properties and biomedical importance,
- Phospholipids – classification, properties, composition, and biomedical importance of various phospholipids,
- Glycolipids – classification, properties, composition, and biomedical importance,
- Lipoproteins – classification, properties, composition, and functions of various lipoproteins including the role of apoproteins, their importance in health and disease,
- Role of lipids in the structure and function of biological membranes,
- Structure, properties, and biomedical applications of micelles and liposomes.

Nucleotides and nucleic acids:

- Purine and pyrimidine bases in DNA and RNA,
- Nucleosides and nucleotides,
- Biologically important nucleotides (including synthetic analogs of purine/ pyrimidine bases and nucleosides used as therapeutic agents),
- Structure, functions, properties, and types of DNA and RNA.

PRINCIPLES OF BIOPHYSICS AND ITS BIOMEDICAL IMPORTANCE

- Diffusion, osmosis, dialysis, surface tension, viscosity, colloids, crystalloids, and suspensions.

CELL BIOLOGY

- Structural organization and functions of a biological cell and different subcellular organelles along with their marker enzymes,

- Molecular organization, functions, and structure-function relationship of a cell membrane,
- Solute transport across biological membranes with related disorders,
- Cell fractionation and separation of organelles,
- Disorders related to cell membrane and subcellular organelles,
- Intracellular traffic and sorting of proteins,
- Intracellular signaling pathways, membrane receptors and second messenger,
- Intercellular junctions, cellular adhesion molecules, intercellular signaling and communication,
- Extracellular matrix: composition, and biomedical importance,
- Components of the cytoskeleton, and their role in muscle contraction and cell motility,
- Cell cycle, its regulation, and mechanism of cell death,
- Structure and functions of specialized cells.

FLUID, ELECTROLYTE, AND ACID-BASE BALANCE

- Fluid, electrolyte, and acid-base balance, mechanism of regulation and associated disorders.

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

- Colorimetry
- Spectrophotometry
- Atomic absorption spectrophotometry
- Flame photometry
- Fluorometry
- Turbidimetry and nephelometry
- Gravimetry
- Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes, enzyme electrodes)

- Chemical sensors (biosensors)
- Osmometry
- Chemiluminescence
- Water quality testing (TDS, pH, fluoride) for autoanalyzer
- Electrophoresis (principle, types, applications; isoelectric focusing, capillary electrophoresis; 2-D electrophoresis)
- Chromatography [principle, types (including high-performance liquid chromatography and gas chromatography)]
- Mass spectrometry
- Immunochemical techniques
- Techniques in molecular biology
- Nanotechnology and microfabrication
- Techniques to study in vivo metabolism (NMR, SPECT, PET scan, etc.)
- Radioisotope-based-techniques and their applications (permissions, precautions, management of radioactive waste)
- Automation
- Point-of-care testing

BIOSTATISTICS AND RESEARCH METHODOLOGY

- Basic concepts of biostatistics as applied to health science,
- Statistical tests: t-test, analysis of variance, chi-square test, non-parametric tests, correlation and regression,
- Statistical methods of validation of diagnostic tests,
- Types of study designs and sampling methodologies,
- Meta-analysis and systematic reviews,
- Planning and management of research,
- Electronic search of the literature,

- Ethical aspects related to research and publication,
- Brief introduction of software for data analysis,
- Essentials of intellectual property rights, patents and copyrights.

BASICS OF MEDICAL EDUCATION IN TEACHING-LEARNING AND ASSESSMENT OF BIOCHEMISTRY

- Group dynamics,
- Principles of adult learning, the taxonomy of learning,
- Curriculum planning,
- Educational objectives,
- Developing a lesson plan (appropriate to the objective and teaching learning method),
- Interactive and innovative teaching methods for large and small groups,
- Use of appropriate media (for a learning session),
- Principles of self-directed learning and giving feedback,
- Framing appropriate essay questions, short answer questions and multiple-choice questions,
- Item analysis and preparation of question bank,
- Principles and types of assessment,
- Methods of assessing cognitive skills, psychomotor skills, communication skills, and professionalism (including viva voice and OSPE),
- Developing a plan for internal assessment and formative assessment,
- Preparation of blueprint and setting of question paper,
- Microteaching,
- Reflection writing.

Enzymes, Bioenergetics, Biological oxidation, Intermediary metabolism and inborn errors of metabolism, Nutrition, Vitamins and Minerals, Detoxification and metabolism of xenobiotics, Free radicals and anti-oxidant defense systems

ENZYMES

- Properties, classification, mechanism of action, coenzymes and cofactors, proenzymes, ribozymes, nanozymes, catalytic antibodies,
- Factors affecting the rate of enzyme-catalyzed reaction,
- Kinetics of enzyme activity, regulation of enzyme activity,
- Isoenzymes and isoforms, role in metabolic regulation,
- Enzyme inhibition,
- Principles of enzyme assays,
- Applications of enzymes: diagnostic, therapeutic and commercial uses of enzymes,
- Enzymes as targets for drug development.

BIOENERGETICS

- Basic concepts of thermodynamics and its laws, as applicable to living systems,
- Exergonic and endergonic reactions and coupled reactions, redox potential,
- High energy compounds,
- Enzymes of biological oxidation,
- Cytochromes.

BIOLOGICAL OXIDATION

- Components, complexes and functioning of the respiratory chain including inhibitors,
- Process and regulation of oxidative phosphorylation including uncouplers,
- Mechanisms of ATP synthesis and regulation,
- Mitochondrial transport systems and shuttles,
- Mitochondrial diseases

INTERMEDIARY METABOLISM AND INBORN ERROR OF METABOLISM

Metabolism of carbohydrates:

- Digestion and absorption including associated disorders
- Glycolysis and TCA (Kreb's cycle), including regulation

- Glycogen metabolism and its regulation
- Cori cycle, gluconeogenesis and its regulation
- Metabolism of fructose and galactose and their clinical significance
- Pentose phosphate /HMP shunt pathway and uronic acid pathways and their clinical significance
- Polyol/sorbitol pathway
- Regulation of blood glucose, hyperglycemia, hypoglycemia and their clinical significance
- Glucose tolerance test and its interpretation
- Diabetes mellitus – classification, pathogenesis, metabolic derangements and complications, diagnostic criteria and laboratory investigations, principles of treatment (including diet and lifestyle modification)
- Inborn errors and disorders of carbohydrate metabolism.

Metabolism of Lipids:

- Digestion and absorption and associated disorders
- Metabolism of fatty acids, regulation and related disorders
- Metabolism of eicosanoids and their clinical significance
- Metabolism of triacylglycerol, storage and mobilization of fats
- Metabolism of adipose tissue and its regulation
- Metabolism of cholesterol including its transport and hypercholesterolemia
- Metabolism of lipoproteins, atherosclerosis, fatty liver and lipid profile
- Metabolism of methanol and ethanol
- Role of liver in lipid metabolism
- Metabolism of phospholipids and associated disorders
- Metabolism of glycolipids and associated disorders
- Inborn errors of lipid metabolism

Metabolism of amino acids and proteins:

- Digestion, absorption and associated disorders
- Deamination, transamination, disposal of the amino group, catabolism of the carbon skeleton of amino acids
- Formation and disposal of ammonia (including urea cycle) and related disorders and ammonia toxicity
- Metabolism of individual amino acids and associated disorders
- One carbon metabolism
- Biogenic amines
- Inborn errors of amino acid metabolism

Metabolism of nucleotides:

- Metabolism of purines and pyrimidines and their associated disorders.

Metabolism of haem:

- Metabolism of haem and associated disorders.

Inter organ and intra organ interrelationships and integration of metabolic pathways:

- Metabolic adaptation in starvation, diabetes mellitus, obesity, and during exercise.

NUTRITION

- Calorific value, Basal Metabolic Rate (BMR), Specific dynamic action (SDA) of food.
- Nutritional importance of proximate principles of food including sources and RDA.
- Glycemic index.
- Biological value of proteins and nitrogen balance.
- Thermogenic effect of food.
- General nutritional requirements.
- Balanced diet, diet formulations in health and disease, mixed diet.
- Calculation of energy requirements and prescribing diet.

- Nutritional supplements and parenteral nutrition.
- Food toxins and additives.
- Disorders of nutrition, obesity, protein energy malnutrition, under-nutrition and laboratory diagnosis of nutritional disorders.
- National Nutrition Programme.

VITAMINS AND MINERALS

- Structure, functions, sources, RDA, and metabolism of vitamins and minerals and their associated disorders.

DETOXIFICATION AND METABOLISM OF XENOBIOTICS FREE RADICALS AND ANTI-OXIDANT DEFENSE SYSTEMS

- Detoxification: Phase –I reactions and Phase-II reactions: Oxidation, Hydroxylation, reduction, hydrolysis, Acetylation, Methylation, and Conjugation reactions - Glucuronic acid, Glutathione, Glycine.
- Xenobiotics and disease caused.
- Biotransformation
- Cytochrome P450 system
- Free radicals and anti-oxidant defense systems in the body.
- Associations of free radicals with disease processes.
- Oxygen toxicity.
- Oxidative stress markers in blood, urine, and other biological fluids.

Molecular biology, Molecular and genetic aspects of cancer, Immunology, and Environmental Biochemistry

MOLECULAR BIOLOGY

Structure and organization of chromosomes and chromatin re-modeling DNA replication:

- DNA replication in prokaryotes and eukaryotes (including important differences between the two).
- End replication problem: Telomere, telomerase and their role in health and disease.

- DNA repair mechanisms and their associated disorders.
- Inhibitors of DNA replication and their clinical significance.
- DNA recombination.
- DNA protein interaction.

Transcription:

- Structure of a gene - exons and introns, promoter, enhancers/repressors and response elements.
- Process of transcription in prokaryotes and eukaryotes.
- Post-transcriptional modifications.
- Inhibitors of transcription.
- RNA editing and stability.

Genetic code, gene polymorphism, and mutation:

- Characteristics of the genetic code.
- Molecular basis of the degeneracy of the genetic code (Wobble hypothesis).
- Mutation and gene polymorphism.
- Mutagens- examples of physical, chemical, and biological mutagens.
- Types of mutations.
- Mutation in health and disease.

Translation:

- Basic structure of prokaryotic and eukaryotic ribosomes.
- Process of protein synthesis (translation) in prokaryotes and eukaryotes.
- Post-translational modifications.
- Protein sorting, protein targeting, protein folding and related disorders.
- Inhibitors of translation in prokaryotes and eukaryotes, and their clinical significance.

Regulation of gene expression in prokaryotes and eukaryotes Recombinant DNA technology and its applications in modern medicine Overview of human genome project

Basics of bioinformatics

Principles of human genetics:

- Alleles, genotypes and phenotypes.
- Patterns of inheritance: monogenic and polygenic inheritance.
- Population genetics.
- Genetic factors in causation of diseases.
- Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders.
- Screening for genetic diseases and prenatal testing.
- Ethical and legal issues related to medical genetics.

Stem cells and regenerative medicine:

- Basic concepts regarding stem cells
- Types of stem cells: embryonic and induced pluripotent stem cells (IPSC)
- Application in regenerative medicine and disease therapeutics
- Ethical and legal issues related to use of stem cells in medicine.

MOLECULAR AND GENETIC ASPECTS OF CANCER

- Biochemical characteristics of a cancer cell
- Biochemistry of carcinogenesis
- Carcinogens
- Role of oncogenes and tumor suppressor genes
- Genetic alterations and adaptations in cancer
- Tumor markers, cancer risk assessment, and community screening
- Biochemical basis of cancer chemotherapy and drug resistance
- Anti-cancer therapy.

IMMUNOLOGY

- Organization and components of the immune system
- Innate and adaptive immunity- components and functions
- Antigens, immunogens, epitopes and haptens, carriers, adjuvants

- Immunoglobulin: structure, types, and functions
- Mechanism of antibody diversity: organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching
- Humoral and cell-mediated immunity, regulation of immune responses, immune response to infections
- Major histocompatibility complex, antigen processing, and presentation
- Antigen-antibody interaction, immune effector mechanisms
- Complement system
- Hypersensitivity reactions
- Tolerance, autoimmunity
- Immunodeficiency, immune unresponsiveness, and their clinical implications
- Vaccines
- Immunology of chronic diseases
- Transplantation immunology
- Immunodiagnostics and immunotherapy.

ENVIRONMENTAL BIOCHEMISTRY

Health and pollution

Effects of environmental pollutants on the body

Basic principles and practice of clinical biochemistry, Biochemical analytes, Assessment of organ system functions, and Recent advances in biochemistry

BASIC PRINCIPLES AND PRACTICE OF CLINICAL BIOCHEMISTRY

- Units of measurement, reagents, clinical laboratory supplies, basic separation techniques, laboratory calculations, specimen collection, transport and processing, safety in the laboratory
- Essentials of clinical investigations in Biochemistry, the clinical utility of laboratory tests (including accuracy, precision, sensitivity, specificity, ROC curves, etc), analysis in the laboratory, and selection and evaluation of methods (including statistical techniques)

- Evidence-based laboratory medicine, establishment and use of reference values, pre- analytical, analytical, and post-analytical variables and biological variations, total quality management (TQM), clinical laboratory and hospital informatics, concepts and reporting of critical values.

BIOCHEMICAL ANALYTES

Biochemical analyses and their clinical significance:

- Amino acids, peptides and proteins; non-protein nitrogenous compounds
- Enzymes
- Carbohydrates
- Lipids, lipoproteins and apolipoproteins and other cardiovascular risk markers
- Electrolytes
- Blood gases and pH
- Hormones
- Catecholamines, serotonin, and other neurotransmitters
- Vitamins, minerals, trace and toxic elements
- Hemoglobin, and bilirubin
- Porphyrins
- Bone markers
- Tumour markers.

Body fluid analysis

Stone analysis

Therapeutic drug monitoring

Clinical toxicology

Pharmacogenomics

Pediatric and geriatric biochemical investigations

Biochemistry of aging

ASSESSMENT OF ORGAN SYSTEM FUNCTIONS

Hematopoietic disorders:

- Hemostasis and thrombosis-biochemical mechanism, related laboratory tests, antiplatelet therapy anticoagulant therapy, and fibrinolytic therapy
- Anemia- classification, etiology, laboratory investigations, and management
- Hemoglobinopathies - sickle cell anemia, methemoglobinemia, thalassemia syndromes
- RBC membrane, metabolism, inherited defects in RBC membrane, and enzymes
- ABO blood group system – the biochemical basis of incompatibility and transfusion biology
- Plasma cell disorders
- Other disorders of hematopoietic cells and their progenitors.

Endocrine system:

- Classification and general mechanism of action of hormones
- Biosynthesis, secretion, regulation, transport, and mode of action of hypothalamic peptides, adenohypophyseal and neurohypophyseal hormones, thyroid and parathyroid hormones, calcitonin, pancreatic hormones, adrenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, parahormones
- Neuro-modulators and their mechanism of action and physiological significance
- Biochemical aspects of diagnosis and treatment of endocrinal disorders
- Endocrinology of conception, reproduction, and contraception
- Antenatal testing, newborn screening, and inborn errors of metabolism.

Cardiovascular system:

- Atherosclerosis - pathogenesis, risk factors, prevention and treatment
- Biochemistry of cardiac failure, acute coronary syndrome, cardiomyopathies, and cardiac arrhythmias
- Cardiac biomarkers.

Respiratory system:

- Pulmonary gaseous exchanges in health and disease
- Biochemistry of respiratory disorders.

Renal system:

- Biochemistry of kidney functions
- Pathophysiology, biochemistry, laboratory findings and management in acute and chronic kidney diseases
- Nephrolithiasis, biochemical aspects of renal stones
- Biochemistry of renal transplant.

Gastrointestinal system:

- Biochemistry of gastric functions
- Regulatory peptides in the gut
- Digestion and absorption of nutrients, evaluation of malabsorption
- Biochemical aspects of- Peptic ulcer diseases, Zollinger-Ellison syndrome, Celiac disease, Inflammatory bowel disease, Protein losing enteropathy and Neuroendocrine tumors.

Hepato-biliary and pancreatic system:

- Biochemistry of hepato-biliary and pancreatic functions
- Formation, composition and functions of bile
- Pathophysiology, biochemistry, laboratory findings and management in acute and chronic hepato- biliary and pancreatic disorders.

Skeletal system:

- Bone structure, metabolism, associated disorders and markers
- Bone mineral homeostasis.

Nervous system:

- Neurotransmitters and their receptors
- Ion channels and channelopathies

- Neurotrophic factors
- Infective and inflammatory diseases of nervous system (meningitis, encephalitis etc.)
- Protein aggregation, neurodegeneration and related disorders (Alzheimer's disease, Parkinson's disease, Huntington's disease, and others)
- Prions and prion diseases
- Ischemic and hemorrhagic neuro disorders
- Neuro-immune disorders (Guillain-Barre syndrome, Myasthenia gravis, multiple sclerosis and others)
- Pathophysiology and biochemistry of psychiatric disorders
- Recent advances in Biochemistry.

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skill oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real-time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used. **The suggested examples of teaching-learning methods are given below but are not limited to these. The frequency of various below-mentioned teaching-learning methods can vary based on the subject's requirements, competencies, workload, and overall working schedule in the concerned subject.**

A. Lectures : Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per subject requirements.

All postgraduate trainees will be required to attend these lectures. Lectures can cover topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. Salient features of Undergraduate/Postgraduate medical curriculum
5. Teaching and assessment methodology.

Topic numbers 3,4,5 can be done during research methodology/biostatistics and medical education workshops in the institute.

B. Journal club : Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar : Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium : Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence- based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work / Bedside clinics : Minimum-once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department should participate in moderating the teaching-learning sessions during laboratory work.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main department and other department/s on topics of current/common interest or clinical cases.

G. a. Rotational clinical / community / institutional postings

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in-depth knowledge as applicable to

the concerned specialty. Postings would be rotated between various units/ departments and details to be included in the specialty-based Guidelines.

Suggested departments and duration of rotational postings:

- General Medicine - 1 month (includes Endocrinology, Pediatrics, and ICU posting)
  - Endocrinology [Focus: Clinical correlation and important investigations related to diabetes mellitus and other diseases, dietary advice, point-of-care testing]
  - ICU/ICCU [Focus: ABG analysis and correlation, electrolyte imbalances, cardiac biomarkers and correlation, markers of septicemia and its management, basics of ventilation]
  - Pediatrics [Focus: Inborn errors of metabolism and other common diseases, nutritional disorders, and dietary advice]
- Hematology - 15 days
- Immunohematology and blood transfusion (Transfusion Medicine)/Blood bank - 15 days
- Microbiology- 15 days
- Medical Education Unit (MEU) or Department of Medical Education (DOME)- one week/ shall attend a specific workshop or a training course [Focus: Principles of teaching-learning-assessment and other important aspects of Medical Education].

G. b. Posting under "District Residency Programme" (DRP):

- **Preamble :** Doctors have to be trained in diverse settings including those which are close to the community. Hence, they should be trained in the District Health System / the District Hospitals.

  Provided that in respect of M.D./M.S. students admitted with effect from academic session 2021, the training imparted as part of the District Residency Programme, shall be considered as training imparted in a medical institution.

- **Objectives :** The main objectives of the District Residency Programme (DRP) would be:

  To expose the post-graduate student to the District Health System/ District Hospital and involve them in health care services being provided by District Health System /District Hospital for learning while serving;

To acquaint them with the planning, implementation, monitoring, and assessment of outcomes of the National Health programmes at the district level.

To orient them to promotive, preventive, curative and rehabilitative services being provided by various categories of healthcare professionals under the umbrella of the National Health Mission.

In doing so, the post-graduate medical students would also be contributing towards strengthening of services of the District Health System as Speciality resident doctors working as members of the district teams.

- **Definition of District Hospital :** For the purpose of this programme, a District Hospital shall be a functional public sector/government-funded hospital of not less than 50 beds with facilities/staff for the designated specialties at that level/ facility. Any post-graduate medical institution or a super-speciality hospital will not be considered as district hospital.

- **Definition of District Health System :** For the purpose of this programme, the District Health System shall include all public sector/government-funded hospitals and facilities (including community health centres, primary health centres, sub-health centres, urban health centres, etc.), as well as community outreach system in a district. This would also include district system engaged in running respective public health services including the implementation of national and state public health programmes.

- **District Residency Programme :** All post-graduate students pursuing M.D./ M.S. in broad specialties in all medical colleges/institutions under the purview of the National Medical Commission shall undergo a compulsory residential rotation of three months in District Hospitals/ District Health System as a part of the course curriculum. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduate programme. In the case of those students who have taken admission after completion of the Diploma in the relevant Speciality, the District Residency Programme shall take place in the third semester only. Similarly, the post-graduate diploma students shall undergo the District Residency Programme in the third semester. This rotation shall be termed as 'District Residency Programme' (DRP) and the post-graduate medical student undergoing training shall be termed as a 'District Resident'.

- **Training and Responsibilities of District Residents :** The District Resident will work under the overall directions and supervision of the District Residency Programme Coordinator (DRPC). During this rotation, the Resident doctor

will be posted with the concerned/allied Speciality team/unit/sections/services at the District Health System/ District Hospital. The clinical responsibilities assigned to the Residents would include serving in outpatient, inpatient, casualty, and other areas pertaining to their Speciality and encompass night duties. Post-graduate students of specialities where direct patient care is not involved will be trained by District Health System/ District Hospital teams within the available avenues in coordination with the District Health Officer/ Chief Medical Officer. They would be trained in and contribute to the diagnostic/laboratory services, pharmacy services, forensic services, general clinical duties, managerial roles, public health programmes etc., as applicable. They may also be posted in research units / facilities, laboratories and field sites of the Indian Council of Medical Research and other national research organizations.

- **Stipend and Leave for District Residents :** The District Residents shall continue to draw full stipend from their respective medical colleges for the duration of the rotation subject to the attendance record submitted by the appropriate district authorities to the parent medical college/institution, based on methods and system as prescribed. Subject to exigencies of work, the District Resident will be allowed one weekly holiday by rotation. They shall also be entitled to leave benefits as per the rules/guidelines of the parent college/university.

- **Training during DRP and Certification thereof :**

  Quality of training shall be monitored by log books, supportive supervision, and continuous assessment of performance. The attendance and performance of District Residents shall be tracked by the District Residency Programme Coordinator (DRPC) of the district concerned, as well as the parent Medical College through an appropriate electronic/digital or mobile enabled system. Such monitoring systems shall also be accessible to the State/Union Territory Steering Committee and the National Coordination Cell.

  The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution by phone and e-communication for guidance, learning, and for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.

  Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective post-graduate course.

The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to be decided by the PGMEB to the concerned medical college and the Govt. of the State/UT.

H. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

I. Log book

During the training period, the postgraduate student should maintain a logbook indicating the duration of the postings/work done in wards, OPDs, casualty, and other areas of the posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The logbook entries must be done in real-time. The logbook is thus a record of various activities by the student like (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the logbook is to:

a) Help maintain a record of the work done during training,

b) Enable faculty/consultants to have direct information about the work done and intervene, if necessary,

c) Provide feedback and assess the progress of learning with experience gained periodically.

The logbook should be used in the internal assessment of the student, and should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce a completed log book in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in the logbook particularly of the critical incidents. Components of good teaching

practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the NMC (Erstwhile MCI) Logbook Guidelines uploaded on the website.

A dynamic e-log book which needs to be updated on a weekly basis about the work being carried out by them and the training programme undergone during the period of training.

It shall be the duty of the post graduate guide imparting the training to assess and authenticate monthly the record (e-Log) books.

J. Course in Research Methodology:

All postgraduate students shall complete an online course in Research Methodology within one year of the commencement of the batch and generate the online certificate on successful completion of the course.

- No post-graduate student shall be permitted to appear in the examination without the above certification.

K. Course in Ethics

- All post-graduate students shall complete course in ethics including Good Laboratory Practices, whichever is relevant to them, to be conducted by institutions/Universities.
- The students are expected to complete the course in the first year.
- No post-graduate student shall be permitted to appear in the examination without the above certification.

L. Course in Cardiac Life Support Skills

- All post-graduate students shall complete a course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills to be conducted by the institution.
- The students are expected to complete the course in the first year.
- No post-graduate student shall be permitted to appear in the examination without the above certification.

Other aspects

- The postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.

- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The postgraduate trainees must undergo training in information technology and use of computers.
- Institutions may arrange training in any other courses like awareness in medical audit, medical law, exposure to human behaviour studies, finance, accounts, etc, which are beneficial to the postgraduate students.

  During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learned initially on the models, and later to be performed under supervision followed by independent performance. For this purpose, the provision of skills laboratories in medical colleges is mandatory.

ASSESSMENT

The assessment for postgraduate student in Biochemistry will be of two types; Formative and Summative

FORMATIVE ASSESSMENT

Formative assessment is the assessment conducted during the training with the primary purpose of providing feedback for improving learning. It should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning, and ability to practice in the system. The formative assessment will be used to determine the existing knowledge base and future needs, and identify priority areas.

General Principles

The Internal Assessment will include both theory and practical examination. At the end of first and second year, internal assessment I and II will be conducted respectively and at the end of third year before final examination, a preliminary internal assessment will be conducted which will be conducted like university examination. Internal assessment shall cover all domains of learning, and should be used to provide feedback to improve learning; it should also cover professionalism and communication skills.

Formative assessment during the MD training should be based on:

- Case presentation/case work up: once a week
  - The student will present a case from ward/lab along with investigations done in the clinical laboratory
- Laboratory performance: once a week
  - The student will analyze an unknown sample on an autoanalyzer, starting with calibration, quality control of the machine, and then loading the sample. He/she will do the reporting and interpret the results and will be evaluated the next day.
  - He/she will be evaluated separately for practicals listed in the undergraduate syllabus.
  - He/she will be evaluated at the end of each postgraduate practical session as listed under the psychomotor domain.
- Journal club: once a quarter
  - The student will present and critically evaluate an original research article. The article should be preferably from outside his/her area of work so that he/she can learn newer techniques. The focus should be on understanding the research question and evaluating whether appropriate study design, methodology, and statistical tools were used to find answers to the same.
- Seminar: once a fortnight
  - The student will present a topic from the syllabus and will try to research and include recent advances on that topic. He/she will also present recent advances (not included in the syllabus) periodically.
- Micro-teaching: Once a week
  - The teaching skills of the student will be evaluated. Special topics can be given, and the student will teach that topic to the evaluators or he/she may be evaluated during pre-practical briefing of undergraduate students.
- Interdepartmental case or seminar: once in 3 months
  - This should be organized at the institute level and appropriate vertical and horizontal integration should be ensured.

Note : These sessions may be organized and recorded as an institutional activity for all postgraduates.

- AETCOM : Once in every six months
    - The postgraduate student can be evaluated during the AETCOM sessions of the undergraduates.
    - Case scenarios should be provided and the postgraduate will be asked to demonstrate how he/she will respond to the situation.
- Attendance at Scientific meetings, CME programme (at least 02 each during the course)

The student is to be assessed periodically as per categories listed in the appropriate (non- clinical/clinical) postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT

Assessment at the end of training to evaluate whether the student has acquired sufficient knowledge and skills to be awarded MD degree.

Essential pre-requisites for appearing for examination include:

Eligibility Criteria for Post Graduate student for appearing in University Examination –

1. Logbook of work done during the training period including rotational postings, departmental presentations, and reports of the internal assessment conducted during the training period should be submitted.
2. Candidates will be permitted to appear for examination only if attendance (Minimum 80% in each calendar year) and internal assessment are satisfactory and dissertation is accepted.
3. Have minimum one Poster Presentation or Podium presentation at a National/ Zonal/State conference of his/her specialty
4. Have minimum one Research paper published in journal of his/her specialty as first author.
5. Complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated on successful completion of the course and examination.
6. Complete a certification course in ethics including Good Clinical Practices and Good Laboratory Practices, (whichever is relevant to them) in the first year of the course conducted by institutions.

7. Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills in the first year of the course conducted by the institution.

8. Thesis acceptance by all evaluators before the conduct of University Examination.

The summative examination would be carried out as per the Rules given in the latest PGMER December 2023. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/ Practical and Oral examination.

The summative examination would be carried out as per the rules given in the latest Postgraduate Medical Education Regulations 2023. The theory examination shall be held in advance before the clinical and practical examination so that the answer books can be assessed and evaluated before the commencement of the clinical/practical and oral examination.

CRITERIA FOR EVALUATION OF M D Biochemistry

SL No	Description	MD Biochemistry
1	**THEORY**	
	No of Theory Paper	4
	Marks for each Theory Paper	100
	Total marks for Theory Paper	400
	Passing Minimum for Theory	200/400 (40% minimum in each paper and aggregate of 50% in theory to declared pass in theory)
2	**PRACTICAL**	**300**
	• Dissertation	20 marks
	• OSPE	25 (5 stations x 5 marks)
	• Subject specific assessment	255
3	**VIVA VOCE**	**100**
	Passing minimum for Practical including Viva voce	200/400

The candidate shall secure not less than 50% marks in each head of passing which shall include

(1) Theory – aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%)

(2) Practical/Clinical and Viva voce - aggregate 50%

(3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination.

(4) 5 per cent of mark of total marks of Clinical/Practical and Viva Voce marks (20 marks) will be of dissertation/thesis and it will be part of clinical/practical examination marks. External examiner outside the state will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce.

(5) No grace mark is permitted in post-graduate examination either for theory or for practical

The postgraduate examination shall be in three parts.

1. Dissertation

Dissertation shall be submitted at least six months before the Theory and Clinical / Practical examination. A postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis, by all evaluators before the conduct of university examination.

2. Theory examination:

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and certify post-graduate student's level of knowledge, skill, and competence at the end of the training, as given in the latest Postgraduate Medical Education Regulations 2023.

Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing the examination as a whole. The examination for M.D./ M.S shall be held at the end of the 3rd academic year.

There shall be 4 theory papers each of three hours duration and each paper shall have TEN short essay questions of 10 marks (10x10 = 100).

Preferably case-based questions.

Paper	Syllabus
Paper I	Biomolecules, Principles of Biophysics and its biomedical importance, Cell biology, Fluid, electrolyte and acid-base balance, Analytical techniques, and instrumentation, Biostatistics and research methodology, Basics of medical education in teaching and assessment of Biochemistry.
Paper II	Enzymes, Bioenergetics, Biological oxidation, Intermediary metabolism and inborn errors of metabolism, Nutrition, Vitamins and Minerals, Detoxification and metabolism of xenobiotics, Free radicals, and anti-oxidant defense systems
Paper III	Molecular biology, Molecular and genetic aspects of cancer, Immunology, and Environmental Biochemistry
Paper IV	Basic principles and practice of clinical biochemistry, Biochemical analytes, Assessment of organ system functions, and Recent advances in biochemistry

Questions on recent advances may be asked in any or all papers.

Note: The distribution of chapters / topics shown on the papers are suggestive only and may overlap or change.

3. Practical and oral/viva voce examination:

Practical examination: 300 marks

The practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor domain. One day should be for conducting practical examination including table viva that will focus on the nuances of laboratory techniques and quality assurance.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

The practical examination should include(300 marks):

- **Dissertation presentation: 20 marks**

  The postgraduate student will present his dissertation to all the four examiners. Which will be evaluate by a pedagogy by all the four examiners. The ability of the student to justify the methodology, and findings with interpretation, should be evaluated.

- **One Clinical / Paper case: 75 marks**

  A sample of case assigned will be analyzed by the student, and he/she will have to prepare the report along with the interpretation of the same. It should include both serum and urine analysis.

- One practical exercise on any molecular biology technique.50 marks
- One practical exercise on immunology technique. 50 marks
- OSPE: 25 marks

  It shall include 5 questions of 5 marks each. It shall be conducted on various topics which have not been covered in the above-mentioned practical, there will be skill and interpretation stations kept for OSPE and should include, if possible, evaluation of AETCOM (Attitude, Ethics, and Communication) skills of the students.

- Evaluation of laboratory management skills. 50 marks
- Pedagogy Exercise: 30 marks (20 minutes duration plus 10 minutes for questions)

Micro-teaching: The essentials of classroom teaching skills should be evaluated. A topic would be 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 20 minutes

Viva-voce Examination 100 Marks:

Grand Viva Voce: 100 marks

Viva voce on defined areas should be conducted by each examiner separately. The oral examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject focusing on the and affective domains

VI. RECOMMENDED BOOKS (LATEST EDITIONS):

Sl. No	Name of the Textbook	Authors	Publishers
1.	Harrison's principles of internal medicine	Fauci, braunwald, kaper, haurer, longo, jameson, lascalgo	Mc Graw hill Companies
2.	Oxford Textbook of medicine	David A Warrell, Timothy Cox, John Firth	Oxford university press
3.	Harper's Review of Biochemistry	Murray.K.	Appleton & Lange
4.	Lehniger's Principles's of Biochemistry.	David L Nelson	CBS
5.	Biochemistry	Lubert Stryer	WH Freeman
6.	Text Book of Biochemistry with clinical correlations	Devlin TM	Wiley Liss
7.	Biochemistry	Voet D & Voet J	John Wiley & Sons
8.	Biochemistry A Functional approach	McGilvery RW	WB Saunders
9.	Medical Biochemistry	N V Bhagawan	Jones & Bartlett
10.	Biochemistry A case oriented Approach	Montgomery	C V Mosby
11.	Duncan's Diseases of Metabolism	Bondy	Academic press
12.	Molecular cell Biology	Harvey Lodish	W.H.Freeman & Company
13.	Clinical Biochemistry.	Latner	WB Saunders
14.	Practical Clinical Biochemistry	Varley	Heinemann Medical Books
15.	Teitz Text Book of Clinical Biochemistry	Burtis	WB Saunders
16.	Clinical Chemistry, Theory, Analysis & Correlation.	Kaplan	Academic Press
17.	Clinical Chemistry	Marshall	Churchill Livingstone
18.	Molecular Biology of THE CELL	Bruce Alberts	Garland Science, New York
19.	Text Book of Biochemistry	West & Todd	Oxford & IBH

20.	Metabolic basis of inherited diseases.	Stab Bury	Churchill Livingstone
21.	Biochemistry.	APPS	WB Saunders
22.	Principles of Biochemistry.	Abrham White	Mac Graw Hill Inc.
23.	Clinical Chemistry	Henry	Churchill Livingstone
24.	Krauses Food, Nutrition & Diet Therapy.	L. Kathleen Mahan	WB Saunders
25.	Clinical Physiology of acid-base and electrolyte disorders.	Rose BD	MeGraw Hill
26.	Clinical chemistry. Principles, Procedures & Correlations	M. L. Bishop	Lippincott
27.	The Principles & Practice of Diagnostic Enzymology	Henry Wilkinson	Arnold Publishers Ltd
28.	Text Book of Immunology. An Introduction to immunochemistry & immunobiology.	James T. Barrett	C.V.Mosby. Company

VII. RECOMMENDED JOURNALS:

Sl.No	Name of the Journal
1	Annual Review of Biochemistry.
2	Clinical Chemistry (J).
3	Trends in Biochemical Sciences.
4	Clinical Chemistry Reviews.
5	Medical Biochemistry (J).
6	Recent Advances in Endocrinology and Metabolism.
7	Recent Advances in Clinical Chemistry.
8	Essays in Biochemistry, Biochemical Society, UK.
9	Indian Journal of Clinical Biochemistry (J).
10	Indian Journal of Medical Research (J).

ANNEXURE 1

Student appraisal form for MD in Biochemistry

Elements		Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	Scholastic aptitude and learning										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self-directed Learning										
2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and Accountability										

3.2	Contribution to growth of learning of the Team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee?	Yes	No								
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										

GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME FOR MD IN PATHOLOGY

Preamble

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training. This programme is meant to standardize Pathology teaching at post graduate level throughout the country so that it will benefit in achieving uniformity in teaching and resultantly creating suitable manpower with appropriate expertise. The post graduate student should be trained in handling and processing histopathology, clinical pathology, microbiology, biochemistry and transfusion medicine samples with a knowledge of general principles and methodology.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board cum Expert group of NMC has attempted to render uniformity without compromise to the purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of "domains of learning" under the heading "competencies".

Goal

The goal of postgraduate medical education shall be to produce a competent pathologist, diagnostician, research fellow and / or a medical teacher.

PATHOLOGY SPECIFIC LEARNING OBJECTIVES:

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The objectives may be considered under the subheadings.

A. Knowledge

1. Acquire competencies relevant to all aspects of pathology such as to diagnose hematology, cytopathology, histopatology, bone marrow, blood transfusion, clinical pathology specimens and other laboratory tests and interpret these including clinical biochemistry.

2. Interpret clinical and laboratory data with reasonable accuracy to prepare a compendious report as per universal reporting protocol including synoptic reporting, and to advise newer molecular tests in problematic cases.

3. Correlate clinical and laboratory findings with pathology findings at autopsy, identify miscorrelations and the causes of death due to diseases.

4. Maintain quality control of all tests by being part of Internal Quality Control Monitoring program, to make and record observations systematically and maintain accurate records of tests and their results for reasonable periods of time, identify problems in the laboratory, offer solutions thereof and maintain a high order of quality control.

5. Have knowledge of safe and effective disposal of laboratory waste, to manage and ensure minimal risk of exposure to infections and accidents to laboratory personnel.

B. Skill

1. Able to collect specimens by routinely performing non-invasive out-patient procedures such as venepuncture, finger-prick, fine needle aspiration of superficial lumps and bone-marrow aspirates, and provide appropriate help to colleagues performing an invasive procedure such as a biopsy or an imaging guided biopsy.

2. Able to perform routine tests in a Pathology Laboratory including autopsy and museum techniques, grossing of specimens, processing, cutting of paraffin and frozen sections, making smears and staining, and should be familiar with the function, handling and routine care of equipments in the laboratory.

C. Teaching

The student should be able to effectively teach and assess undergraduate medical students (MBBS) and allied health science courses (Dentistry, Nursing, Physiotherapy, Medical Laboratory technology) including laboratory personnel, so that they become competent healthcare professionals.

D. Research

Post graduate student should acquire skills to be able to plan, execute, analyse, present and publish research work independently or as a part of team and become a more experienced teacher & mentor in all the above areas and to eventually be able to guide postgraduates in their thesis, research work and all other academic activities.

E. Professionalism, Ethics and Communication skills The student should be able to learn and apply principles of professionalism, ethics and effective communication in conduct of research, pathology-based services, educational activities and day to day work

Pathology Specific Competencies:

A. Cognitive domain

A post graduate student upon successfully qualifying in the MD (Pathology) examination should have acquired the following broad theoretical competencies and should be:

1. Capable of offering a high quality diagnostic opinion in a given clinical situation with an appropriate and relevant sample of tissue, blood, body fluid, etc. for the purpose of diagnosis and overall wellbeing of the ill.

2. Conversant with the standard operating procedures of various laboratories including histopathology, cytopathology, hematology and laboratory medicine

3. Able to teach and share his knowledge and competence with others. The student should be imparted training in teaching methods in the subject which may enable the student to take up teaching assignments in Medical Colleges/Institutes.

4. Capable of pursuing clinical and laboratory based research. He/she should be introduced to basic research methodology so that he/she can conduct fundamental and applied research.

B. Affective domain

1. The student will show integrity, accountability, respect, compassion and dedicated patient care. The student will demonstrate a commitment to excellence and continuous professional development.

2. The student should demonstrate a commitment to ethical principles relating to providing patient care, confidentiality of patient information and informed consent.

3. The student should show sensitivity and responsiveness to patients' culture, age, gender and disabilities.

4. The student should demonstrate a commitment to ethical principles relating to research conduct and research publication.

C. Psychomotor domain

1. Able to perform grossing of biopsy and surgical specimens including gross diagnosis and taking appropriate sections/ samples necessary for diagnosis, comprehensive staging, and ancillary testing.

2. Conversant in histopathology tissue processing techniques and troubleshooting, cutting of paraffin and frozen sections, making imprint smears, and staining, and immunohistochemistry.

3. Able to collect specimens by routinely performing non-invasive out-patient procedures such as venipuncture, finger-prick, fine needle aspiration of superficial lumps and bone-marrow aspirates, making smears and staining, and provide appropriate guidance to colleagues performing procedure such as a biopsy or an imaging guided biopsy including on-site microscopic assessment of specimen adequacy.

4. Perform an autopsy, dissect various organ complexes and display the gross findings.

5. Conversant with the function, handling, and routine care of equipment in the laboratory and quality assurance.

6. Able to teach and share his knowledge and competence with others. The student should be imparted training in teaching methods in the subject which may enable the student to take up teaching assignments in Medical Colleges/Institutes.

7. Able to pursue clinical and laboratory-based research. He/she should be introduced to basic research methodology so that he/she can independently conduct fundamental and applied research.

Syllabus

Course content:

It is difficult to give a precise outline of the Course Contents for post graduate training. A postgraduate is supposed to acquire not only the professional competence of a well-trained specialist but also academic maturity, a capacity to reason and critically analyse scientific data as well as to keep himself abreast of the latest developments in the field of Pathology and related sciences. The study of Anatomic Pathology includes all aspects of Pathology as encompassed in the branches of General and Systemic Pathology. Only the broad outlines are provided.

A. COGNITIVE DOMAIN

A) General Pathology:

Normal cell and tissue structure and function:

- The changes in cellular structure and function in diseases.
- Causes of disease, its pathogenesis, reaction of cells, tissues, organ systems, and the body to various sub lethal and lethal injuries.
- Cellular adaptation, cell injury, and cell death.
- Mechanism, morphology and examples of cell injury, necrosis, apoptosis, autophagy, and newer forms of cell death including necroptosis and pyroptosis.
- Sub cellular and cellular responses and adaptation to injury.
- Intracellular and intercellular accumulations, pathological calcification, and cell aging.

Acute and chronic inflammation:

- Vascular and cellular events in acute inflammation, chemical mediators, outcome, and morphological patterns of acute inflammation.
- Chronic inflammation with special reference to granulomatous inflammation.
- Systemic effects and effects of deranged inflammation.
- Tissue renewal and repair: Regeneration healing and fibrosis.
- Control of normal cell proliferation and tissue growth, mechanism of tissue regeneration, repair by healing and fibrosis.
- Extracellular matrix and cell matrix interactions.

Hemodynamic disorders, thromboembolic disease, and shock:

- Edema, hyperemia, congestion, and hemorrhage.
- Normal Hemostasis, thrombosis, DIC, embolism, infarction, and shock.

Genetic Disorders

- Principles of genetics, normal karyotyping.
- Mutations, Mendelian disorders, disorders with multifactorial inheritance cytogenetic disorders involving autosomes and sex chromosomes.
- Single gene disorders with nonclassic inheritance.
- Diagnosis of genetic disorders involving molecular and genetic techniques.

Neoplasia

- Definition, nomenclature, and biology of tumor growth
- Molecular basis of cancer with special reference to carcinogenic agents and molecular basis of multistep carcinogenesis.
- Epidemiology and clinical features of tumors.
- Grading, staging and laboratory diagnosis of cancer.

Infectious Diseases

- Pathology and general principles of microbial pathogenesis, special techniques for diagnosing bacterial, fungal, parasitic, and viral infections.

Environmental and nutritional pathology

- Common environmental and occupational exposures leading on to diseases.
- Nutritional deficiencies and obesity related disorders.

Disease of Infancy and Childhood

- Congenital anomalies, birth injuries, diseases of neonates, inborn errors of metabolism, tumor, and tumor like lesions of infancy and childhood.

Immunopathology

- Innate immunity- Role of phagocytic cells, complement, mast cells & humoral mechanisms.

- Specific Acquired Immunity- Details about antibody production & action, Brief principles about memory, Ag specificity & vaccination.
- Cell involved in Immune response- T- Lymphocytes, B-lymphocytes, macrophages, dendritic cells, and natural-killer cells.
- Cytokines with details about their properties and functions.
- Structure and function of histocompatibility molecules and disease association.
- Disorders of the immune system.
- All hypersensitivity reactions.
- Autoimmune disorders with special reference to SLE, Rheumatoid arthritis, Sjogren's syndrome, systemic sclerosis, polyarteritis nodosa and other vasculitides, Mixed connective tissue disorders and inflammatory disorders.
- Immunodeficiency syndrome – Acquired with emphasis on AIDS.
- Amyloidosis including pathogenesis, special stains & clinical correlation.
- Transplant rejection in detail.
- Graft vs Host Disease.

B) Systemic Pathology:

The study of normal structure and function of various organ systems and the etiopathogenesis, gross and microscopic alterations of structure of these organ systems in disease and functional correlation with clinical features.

Blood vessels, lymphatic and veins

- Normal morphology, congenital anomalies, atherosclerosis, hypertensive vascular disease.
- Inflammatory and neoplastic diseases of all the vessels.

Heart

- Normal morphology, its blood supply and effect of aging on heart.
- Ischemic, Hypertensive, valvular, congenital heart diseases.
- Cardiomyopathies
- Myocardial disorders
- Pericardial diseases.
- Tumors of the heart.

Lungs and Mediastinum

- Congenital anomalies
- Obstructive and restrictive pulmonary diseases
- Diseases of vascular origin
- Infections of Lung
- Infections of Mediastinum
- Tumors of lung
- Lung transplantation
- Diseases of pleura
- Thymus – Developmental, autoimmune, and inflammatory disorder and tumors.

Head and Neck

- Oral cavity: - inflammatory disease, Preneoplastic lesions and tumors.
- Diseases of teeth and supporting structures.
- Upper airways and ear – congenital anomalies, infections, and tumors.
- Salivary glands – Infections autoimmune disorders and tumors.

Gastrointestinal Tract

- Congenital anomalies, infections, inflammatory and vascular disorders and tumors of esophagus, stomach, small and large intestines, appendix, and anal canal.
- Diseases of the peritoneum, Omentum and Mesentery Retroperitoneum.
- Inflammatory and neoplastic lesions.

Liver

- Normal morphology with general features of hepatic disease including LFTs.
- Infectious, autoimmune drug induced metabolic and circulatory disorders of liver.
- Hepatic diseases associated with pregnancy, neonates, organ and bone marrow transplantation.

- Liver transplantation pathology.
- Cysts, Nodules, and tumors of liver.

Biliary tract

- Congenital anomalies, injuries, Infection, inflammation, of Gallstones and tumors of gall bladder and extra hepatic bile ducts. Pancreas.
- Congenital anomalies, pancreatitis, and neoplasms of pancreas.

Kidney

- Clinical manifestations of renal diseases
- Congenital anomalies
- Diseases affecting glomeruli, tubules, interstitium and blood vessels.
- Cystic diseases of kidney
- Nephrolithiasis
- Tumors of kidney
- Kidney Transplant pathology

Lower urinary tract and male genital system

- Congenital anomalies, inflammation and tumors of bladder, ureter, urethra, penis, testis, epididymis, and Scrotum.
- Inflammation, enlargement, and tumors of prostate.

Female genital tract

- Physiology, cytology and histology of female genital tract, menstrual disorders, and hormonal abnormalities.
- Congenital anomalies, inflammation, preneoplastic and neoplastic lesions of vulva, vagina, cervix, uterus, fallopian tubes, ovaries and mesonephron.
- Gestational and placental disorders.

Breast

- Inflammations, benign epithelial lesions, and tumors of the breast.
- Diseases of male breast.

Endocrine System

- Normal hormonal levels and functions of all the endocrine glands.
- Hypo and hyperactivity of glands of endocrine system i.e., pituitary, thyroid, parathyroid, pancreas, adrenals, and pineal gland.
- Autoimmune diseases, inflammations and tumors affecting these glands,
- Neuroendocrine tumors,

Skin and Subcutaneous tissue

- Disorders of pigmentation and melanocytes,
- Inflammatory, vesiculobullous, and infectious disease,
- Proliferative lesions and Tumors of the epidermis, dermis, and skin appendage.

Musculoskeletal system

- Bone Modelling, growth, and development, genetic and acquired abnormalities in bone cells, matrix and structure, factures, necrosis and infections of bones, tumors and tumorlike lesions,
- Joints: Arthritis, tumor, and tumor-like lesions.
- Soft tissue: Tumors and tumor = like lesions.

Peripheral nerves and skeletal muscles

- General reactions of motor units.
- Inflammatory, infectious, hereditary, metabolic, and traumatic neuropathies.
- Atrophy, dystrophy, myopathies of the skeletal muscles.
- Diseases of neuromuscular junction.
- Tumors of peripheral nerves and skeletal muscles.

Skull and Central Nervous System

- Degenerative, metabolic, toxic, demyelinating, infectious, cerebrovascular malformations, and traumatic injuries.
- Tumors.

Eye and Orbit

- Infections, inflammatory, congenital diseases and neoplasms of orbit, eyelid, conjunctiva sclera, uvea, cornea, retina, and optic nerves.

C) Hematology and Transfusion medicine

The study of Hematology includes all aspects of the diseases of the blood and bone marrow.

This would involve the study of the normal, and the causes of diseases and the changes thereof.

Biology of stem cell and Hematopoiesis

- Overview of stem cell biology and cellular biology of hematopoiesis.
- Transcription factors and humoral regulation in normal and malignant hematopoiesis.
- Interaction between hematopoietic stem cells, progenitor cell and stromal compartment of bone marrow.
- Stem cell homing & mobilization.

Erythroid maturation, differentiation, and abnormality

- Pathobiology of human erythrocyte & Hemoglobin Anemia.
- Approach to anemia in adults and children in: Clinical correlation & diagnostic modalities.
- Classification of anemias (Morphological, pathophysiological, and based on erythropoiesis i.e., proliferative vs non-proliferative).
- Iron deficiency anemia including iron metabolism and differential diagnosis from other microcytic hypochromic anemias.
- Disorder of iron metabolism including iron overload.
- Anemia of chronic disorders with special reference to infections, collagen vascular disorders, inflammation etc.
- Megaloblastic anemia and other causes of megaloblastosis.
- Definition, approach, and classification of hemolytic anemia.
- Lab diagnosis of Hemoglobin disorders and hereditary anemia like Thalassemia and related hemoglobinopathies, sickle cell anemia.

- Hemoglobin associated with altered Oxygen affinity.
- Red blood cell enzymopathy, membrane disorder, autoimmune hemolytic anemia, nonimmune hemolytic anemia, paroxysmal nocturnal hemoglobinuria.
- Approach to Pancytopenia/ Cytopenia.
- Bone marrow failure syndrome.
- Porphyria.

WBC disorders, complement and immunoglobin biology

- Normal granulopoiesis.
- Acquired and congenital disorders of phagocytosis (neutrophil, monocyte, eosinophil, and macrophages.
- Disorder of leukocyte number, function, and morphology.

Storage disorder

Hematological responses to Infections

- Viral disorders - Infectious mononucleosis, Hepatitis, and dengue.
- Parasitic infections - Malaria, Kala azar.

Hematological malignancies

- Conventional & molecular cytogenetic and immunohistochemical basis of hematological malignancies.
- Classification (WHO, ICC).
- Their basis and diagnostic approach to various hematological malignancies.
- Pathophysiology, prognostic factors, cytochemistry, cytogenetics of various leukemias.
- Pathophysiology and classification of MDS, MPN/MDS, myeloproliferative disorders.
- Pathophysiology of Non-Hodgkin's lymphoma, Clinical staging of Hodgkin's lymphoma.
- Role of molecular cytogenetics and immunohistochemistry in Hodgkin's and NonHodgkin's lymphoma and lymphoproliferative disorders.

- AIDS related and Transplant related lymphomas.
- Plasma cell dyscrasias and gammopathies.
- Mastocytosis.
- Role of chemotherapy and antineoplastic agents based on molecular mechanism of hematological malignancies, clinical use of hematopoietic growth factors.

Hematopoietic stem cell transplantation

- Role and indications of HST, immunodeficiency state, hematological Malignancies and Non-hematological disorders.
- Practical aspect of umbilical cord stem cells transplantation.
- Peripheral stem cell collection.
- Role of stem cell in tissue repair.
- Complications of Hematopoietic stem cell transplant.
- Gene therapy and genetic engineering.

Prenatal diagnosis of genetic hematological diseases

Hemostasis & Thrombosis

- Megakaryocyte and platelet structure.
- Molecular basis of platelet function, activation.
- Role of blood vessel, coagulation system and fibrinolytic system in hemostasis.
- Clinical and lab evaluation of bleeding and coagulation disorders.
- Clinical & diagnostic aspects of factor deficiencies including hemophilia, von Willebrand disease, DIC, Vitamin K deficiency.
- Thrombotic and non-thrombotic purpura.
- Hereditary and acquired platelet disorders and its management.
- Thrombophilia (Inherited & acquired).
- Lab evaluation and management of hypercoagulable states.

Human blood group antigen and antibody and Immuno-hematology

- Selection of donor and screening..
- Principle, indication and storage of red blood cells, WBC, platelet, and plasma transfusion.
- Various methods of component separation and plasma derivatives with special reference to Fresh frozen plasma, cryo-precipitates, platelet concentrate, single donor plasma, albumin, and Immunoglobulin.
- Graft Rejection, GVH diseases, Transfusion Reactions, Blood grouping & cross matching.
- Blood bank audit.
- Apheresis

Hematological manifestations of systemic diseases

- Liver disorders, renal disorders, infections, cancers, parasitic diseases, AIDS, pregnancy, and surgical patients.

Spleen and its disorders

D) Laboratory Medicine (Clinical Pathology including Parasitology)

- Principles of testing, indications, values with ranges in normal and diseased states in relation to:
    - o Liver function tests
    - o Renal function tests
    - o Endocrine function tests
    - o Body fluid analysis including stool, urine, semen, CSF, etc.
- Principles of laboratory automation, trouble shooting, and quality assurance.

D) Special techniques

The student is expected to acquire a general acquaintance of techniques and principles and to interpret data in the following fields:

- Immunopathology,
- Electron microscopy,
- Histochemistry,

- Immunohistochemistry,
- Cytogenetics and in-situ hybridization,
- Molecular Biology,
- Digital Pathology and image analysis,
- Maintenance of records,
- Information retrieval, use of Computer and Internet in medicine.

E) Instrumentation and automation

- Principles, indications, working, maintenance, and troubleshooting of equipment used in various laboratories:
    - Histopathology laboratory – Histopathology tissue processor, microtome, water batch, embedding station, Stainer, IHC Stainer, ultramicrotome, etc.
    - Microscopes – Immunofluorescence, FISH, Confocal, Electron, etc.
    - Cytopathology Laboratory – Centrifuge, Cytocentrifuge, Cytospin apparatus, liquid-based cytology, etc.
    - Hematology Laboratory – automated cell counter, flow cytometer, coagulometer, HPLC, Electrophoresis apparatus, immunoblot, etc.
    - Clinical Pathology –Photoelectric colorimeter, Spectrophotometer, pH meter, Centrifuge, Electrophoresis apparatus, ELISA Reader, chemiluminescence, etc.
    - Digital pathology – Whole slide scanners
    - Molecular pathology – PCR, Sanger sequencer, NGS sequencers, etc.
- Automation in Pathology.
- Good lab practices and safety, record maintenance of capital equipment and consumables, purchase specifications, approximate costs of reagents and equipment, maintenance of store logbooks, etc.

F) Quality assurance program

- Internal and external quality assurance methods.
- Intra assay variations, batch variations, validation of chemicals and instruments.

G) Establishment Act and Rules and regulations formed by Govt. or regulatory bodies

H) Biomedical Waste management

- Disposal methods for each specimen, reagents, instruments, autoclaving techniques, recycling of products and e-waste.

I) Biostatistics, Research Methodology and Clinical Epidemiology

J) Ethics and Medico legal aspects relevant to Pathology

K) Current topics and recent advances in pathology

B. PSYCHOMOTOR DOMAIN

At the end of the course, the student should have acquired skills and be able to demonstrate following predominant Psychomotor domain competencies		
Sr. No.	Competency	Perform under supervision / perform independently / Observation only
I.	HISTOPATHOLOGY (SURGICAL PATHOLOGY)	
1.	Given the clinical and operative data, identify and systematically and accurately describe the chief gross anatomic alterations in the surgically removed specimens and be able to correctly diagnose common lesions received on an average day from the surgical service of an average teaching hospital	Independently
2.	Perform a systematic gross examination of the tissues including the taking of appropriate tissue sections and in special cases as in intestinal mucosal biopsies, muscle biopsies and nerve biopsies, demonstrate the orientation of tissues in paraffin blocks.	Independently
3.	Identify and systematically and accurately describe the chief histo- morphological alterations in the tissue received in the surgical pathology service. He/she should also correctly interpret and correlate with the clinical data to diagnose routine surgical material received on an average day.	Independently
4.	Identify common problems in histopathology processing techniques (poor fixation, delayed fixation, poor staining, etc.,) including automated tissue processing machine troubleshooting and rectify common problems	Independently

5.	Operate and maintain common equipment in the histopathology laboratory such as microtome, water bath, cryostat, tissue processor, auto Stainer, etc.	Perform under supervision
6.	Process a tissue, make a paraffin block and cut sections of good quality on a rotary microtome	Perform under supervision
7.	Stain paraffin sections with hematoxylin and eosin stain and common special stains needed for diagnosis (Stains for collagen, elastic fibres and reticulin, Iron stain, PAS stain, Acid fast stains, Any other stains needed for diagnosis)	Independently
8.	Cut a frozen section, stain and interpret the slide in correlation with the clinical data provided	Independently
9.	Standardize and validate new antibodies for immunohistochemistry with understanding of controls, clones, and dilutions	Independently
10.	Perform immunohistochemistry on paraffin sections using manual method	Independently
11.	Identify common problems in immunohistochemistry procedure (artifacts, inadequate retrieval, section floating, IHC failure, etc.,) and rectify such problems	Independently
12.	Decide on the appropriate immunohistochemical panels for diagnosis, prognosis and predictive purposes in common disease conditions based on standard recommendations and interpret their results	Independently
13.	Write histopathology reports, including synoptic reports, wherever needed, following protocols and international standards. The reports should be succinct and lucid, with clinical notes and advice, as necessary.	Independently

II	CYTOPATHOLOGY	
1.	Perform fine needle aspiration of superficial lumps and make good quality smears including collection of material for cell block preparation and decide on the type of fixative and stain in a given case	Independently
2.	Prepare and stain good quality smears for cytopathological Examination	Independently
3.	Provide appropriate guidance to colleagues performing procedure such as a biopsy or an imaging guided biopsy including on-site microscopic assessment of specimen adequacy.	Independently

4.	Decide on the technique of collection, preservation, transport and concentration of various exfoliative cytology specimens (such as filters, centrifuge, liquid-based cytology, cytospin, etc.)	Independently
5.	Perform on-site adequacy assessment in image guided sampling procedures and decide on sample triage for routine diagnosis (type of preparation, stain, etc.) and ancillary tests including microbiological and molecular tests	Independently
6.	Diagnose common cases received in a routine cytopathology laboratory and categorize them into negative, inconclusive and positive, using the correct technique of screening and dotting the slides for suspicious cells, correctly identify the type of tumor, if present, and the presence of organisms, fungi and parasites, if present	Independently
7.	Perform preparations (cytospin smears, liquid-based cytology, cell blocks, etc.) of common cytological samples using equipment such as centrifuge, cytocentrifuge and liquid based cytology apparatus	Observation only

III	HEMATOLOGY	
1.	Perform venipuncture for peripheral blood collection and decide on appropriate collection tubes, storage, and anticoagulant based on indication	Independently
2.	Prepare good quality peripheral blood smears, stain and report peripheral blood counts and other findings including reticulocyte and platelet counts on cell counter and manually, identify commonly occurring hemoparasites	Independently
3.	Perform bone marrow aspirates and biopsy, prepare good quality smears and imprints	Perform under supervision
4.	Perform bone marrow aspirate staining including stain for iron	Independently
5.	Perform cytochemical characterization of leukemia with special stains on bone marrow aspirates	Perform under supervision

6.	Perform and interpret coagulation profile including PT, APTT and FDP	Independently
7.	Perform and interpret sickling test and osmotic fragility test	Independently
8.	Describe accurately the morphologic findings in the peripheral and bone marrow smears, identifying and quantitating the morphologic abnormalities in disease states and arriving at a correct diagnosis in at least common cases referred to the Hematology clinic, given the relevant clinical data	Independently
9.	Given the clinical data, interpret the results of i. Red cell indices ii. Plasma hemoglobin iii. Hemosiderin in urine iv. Hemolytic anemia profile including HPLC, Hb electrophoresis etc. v. Hemoglobin and serum protein electrophoresis vi. Clotting time and other point of care tests for bleeding vii. G6PD enzyme estimation viii. Platelet function tests including platelet aggregation and adhesion and PF3 release ix. Russell's viper venom time (RVVT) x. Coagulation Factor assays xi. Serum Fibrinogen xii. Screening for coagulation factor inhibitor, Bethesda Assay, xiii. Fibrin Degradation Products (FDP), D-Dimers xiv. Monitoring of anti-coagulant therapy xv. Thrombophilia profile (Lupus anticoagulant (LAC), Anticardiolipin Antibody (ACA), Activated Protein C Resistance (APCR), Protein C (Pr C), Protein S (Pr S) and Antithrombin III (AT III)) xvi. Serum ferritin, Serum iron and total iron binding capacity	Independently
10.	Interpret flow cytometry findings in the immunophenotyping of leukemia, CD34 enumeration, CD 3/CD 19 enumeration, PNH work up, etc.	Independently

11.	Interpret results of cytogenetics and molecular diagnostics in the work up of hematological diseases	Independently
12.	Prepare samples as appropriate for the indication, and operate equipment such as automated cell counter, flow cytometry, coagulometers, HPLC and electrophoresis apparatus	Observation only

IV	LABORATORY MEDICINE	
1.	Plan a strategy of laboratory investigation of a given case, given the relevant clinical history and physical findings in a logical sequence, with a rational explanation of each step; be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.	Independently
2.	Perform urine analysis including physical, chemical and microscopic, examination of the sediment as well as by Dipstick methods.	Independently
3.	Perform macroscopic and microscopic examination of feces and identify the ova and cysts of common parasites.	Independently
4.	Perform a complete examination: physical, chemical and cell content of Cerebrospinal Fluid (C.S.F), pleural and peritoneal fluid	Independently
5.	Perform semen analysis and interpret results in the context of clinical and hormone findings	Independently
6.	Perform quantitative estimation of blood/serum by automated techniques for common biochemical tests such as blood urea, blood sugar, serum protein, serum bilirubins etc.	Independently
7.	Prepare standard solutions and reagents relevant to common biochemical tests including the preparation of normal solution, molar solution and buffers	Independently
8.	Interpret and report common laboratory biochemical tests (LFT, KFT, endocrine function tests) with understanding of clinical implications	Independently

9.	Explain principles of instrumentation, use and application of instruments, operate, maintain and troubleshoot common equipment used such as photoelectric colorimeter, Spectrophotometer, pH meter, Centrifuge, Electrophoresis apparatus, ELISA Reader, PCR, chemiluminescence, etc.	Perform under supervision

V	TRANSFUSION MEDICINE	
1.	Perform selection and bleeding of donors, ABO and Rh grouping and cross match, antibody screening and titer, selection of blood for exchange transfusion	Independently
2.	Resolve ABO grouping problems and outline measures for investigation of transfusion medicine	Independently
3.	Perform and interpret anti-globulin test in antenatal and neonatal work Up	Independently
4.	Prepare blood components such as cryoprecipitates, platelet concentrates, fresh frozen plasma, single donor plasma, red blood cell concentrates, etc. and test blood for presence of pathogens including HBV, HCV, HIV, VDRL, Malaria, etc.	Observation only

VI	AUTOPSY	
1.	Perform an autopsy, dissect various organ complexes, and display the gross findings (Note: An improvised autopsy may also be arranged in places where full autopsy is not possible. Relevant organs from wet specimens in the museum with appropriate clinical history may be arranged for a detailed description and diagnosis. At least ten such improvised autopsies may be discussed by each candidate during the entire duration of the course)	Independently (see Note)
2.	Provide Provisional and Final Anatomic Diagnosis report, major findings correctly and systematically at autopsy, and the Autopsy Protocol as per prescribed instructions.	Independently

VII	MOLECULAR BIOLOGY	
1.	Interpret results of Polymerase Chain Reaction (PCR), real time PCR, Sanger Sequencing in a given clinical context.	Independently
2.	Interpret results of in-situ hybridization (fluorescent and chromogenic) in a given clinical context	Independently
3.	Prepare sample by appropriate methods and perform Polymerase Chain Reaction (PCR), real time PCR, Sanger Sequencing, and in-situ hybridization including troubleshooting	Observation only

VIII	IMMUNOPATHOLOGY	
1.	Interpret direct/ indirect immunofluorescence results in the context of common diseases of the skin, medical renal diseases and autoimmune diseases	Independently
2.	Prepare sample by appropriate methods and perform indirect immunofluorescence on a frozen section from skin/ renal biopsy	Perform under supervision

IX	ELECTRON MICROSCOPY	
1.	Interpret transmission electron microscopy results in common non- neoplastic and neoplastic diseases	Independently
2.	Prepare specimen by appropriate methods and process tissue for electron microscopy, interpret semi-thin sections and view ultra-thin sections under electron microscope	Observation only

X.	DIGITAL PATHOLOGY	
1.	Navigate and annotate whole slide scanned images	Independently
2.	Select and scan slides for digitalization and perform basic image analysis functions such as length measurements, enumeration, etc.	Observation only

XI.	TEACHING	
1.	Demonstrate different methods of teaching-learning and assessments	Independently
2.	Engage and teach undergraduates and paramedical staff in the form of small group teaching and demonstrations	Independently
3.	Engage in peer teaching in the form of presenting seminars and journal clubs and be able to use different modes of teaching including PowerPoint projections and charts	Independently

XII.	RESEARCH	
1.	Write the thesis (and/or a scientific paper) in accordance with the prescribed instructions, as expected of international standards	Independently

TEACHING AND LEARNING METHODS

General principles

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents/demonstrators during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time. Maintenance of e-records of such procedures is encouraged.

The three-year training programme for the MD degree shall be arranged in the form of postings to different assignments/laboratories for specified periods as outlined below. The period of such assignments/postings is recommended for 36 months with breaks only for examinations and mandatory postings. Posting schedules shall be modified depending on needs, feasibility and exigencies. For facilities not available in our institution as well as for additional knowledge and skill, extramural postings shall be undertaken.

Posting schedule is given below:

Sl. No.	Section/Subject	Duration in months
1.	Surgical Pathology and IHC Techniques	13
2.	Haematology and Laboratory Medicine	08
3.	Cytopathology	06
4.	District Rotation Posting	03
5.	Transfusion Medicine/Blood Bank	02
6.	Autopsy and Museum techniques and record management	02
7.	Basic Sciences including Immunopathology, Electron microscopy, Molecular Biology, Research Techniques and cytogenetics, BSRC (15 days), KIDNAR (15 days), NIMHANS, Bangalore (15 days), Neuberg Anand Diagnostics, Bangalore (15 days) etc	02
	Total	36

Teaching-Learning methods

Theory:

A) **Lectures :** A minimum of 10 lectures per year on certain selected topics shall be taken as lectures on subject related important topics including Recent advances

B) **Journal Club :** Journal club shall be conducted once in 2 weeks. Topics shall include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C) **Student Seminar :** Student Seminar shall be conducted once every 1-2 weeks. Important topics should be selected as per subject requirements and allotted for in depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D) **Student Symposium :** Student Symposium shall be conducted once in 2 months. A broad topic of significance should be selected, and each part shall

be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E) **Laboratory work / Interactive slide and gross sessions :** This shall be conducted once every 1-2 weeks. Laboratory work, slide and gross specimen teaching sessions shall be coordinated and guided by faculty from the department. Various methods like case-based discussions, oral or written quiz, etc. are to be used. Faculty from the department should participate in moderating the teaching-learning sessions. Group discussions: This include Autopsy, clinical case discussion, biopsy review, Transparency review and grossing techniques.

F. **Interdepartmental colloquium :** Faculty and students must attend meetings between the pathology Department and other department/s on topics of current/common interest or clinical cases. This includes institutional activities such as clinic-pathological correlation conferences (CPC), and departmental activities like autopsy conferences.

G. **a.** **Rotational clinical / community / institutional postings :** Depending on local institutional policy and the subject specialty needs, postgraduate trainees shall be posted in relevant departments such as microbiology, biochemistry. The aim is to acquire more in-depth knowledge as applicable to the pathology specialty.

b. **Posting under "District Residency Programme" (DRP):**

All postgraduate students pursuing MD/MS/MS in broad specialties in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th, or 5th semester of the Postgraduate programme and the rotation shall be termed as "District Residency Programme" and the PG medical student undergoing training shall be termed as "District Resident".

Objectives : The main objectives of the District Residency Programme (DRP) would be:

1. To expose the post-graduate student to the District Health System/ District Hospital and involve them in health care services being provided by District Health System /District Hospital for learning while serving.

2. To acquaint them with the planning, implementation, monitoring, and assessment of outcomes of the National Health programmes at the district level.

3. To orient them to promotive, preventive, curative and rehabilitative services being provided by various categories of healthcare professionals under the umbrella of the National Health Mission.

In doing so, the post-graduate medical students would also be contributing towards strengthening of services of the District Health System as Speciality resident doctors working as members of the district teams.

Training and Responsibilities of District Residents:

The District Resident will work under the overall directions and supervision of the District Residency Programme Coordinator (DRPC). During this rotation, the Resident doctor will be posted with the concerned/allied Speciality team/ unit/ sections/services at the District Health System/ District Hospital. The clinical responsibilities assigned to the Residents would include serving in outpatient, inpatient, casualty, and other areas pertaining to their Speciality and encompass night duties.

Post-graduate students of specialities where direct patient care is not involved will be trained by District Health System/ District Hospital teams within the available avenues in coordination with the District Health Officer/Chief Medical Officer. They would be trained in and contribute to the diagnostic/ laboratory services, pharmacy services, forensic services, general clinical duties, managerial roles, public health programmes etc., as applicable. They may also be posted in research units / facilities, laboratories and field sites of the Indian Council of Medical Research and other national research organizations.

Stipend and Leave for District Residents:

The District Residents shall continue to draw full stipend from their respective medical colleges for the duration of the rotation subject to the attendance record submitted by the appropriate district authorities to the parent medical college/institution, based on methods and system as prescribed. Subject to exigencies of work, the District Resident will be allowed one weekly holiday by rotation. They shall also be entitled to leave benefits as per the rules/ guidelines of the parent college/university.

The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution

by phone and e-communication for guidance, learning, and for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.

c) PG students shall attend additional sessions in the form of workshops on basic sciences, biostatistics, research methodology, teaching methodology & assessment and salient features of Undergraduate/Postgraduate medical curriculum with relevant entries in the log book.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/ laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in Teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student. The postgraduate students should regularly do the ward rounds of various clinical departments and learn cases of interest for discussion with the clinical faculty.

J. e- Logbook : During the training period, the postgraduate student should maintain a e-Logbook indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The logbook entries must be done in real time. The e-logbook is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the e-Logbook is to:

a) help maintain a record of the work done during training,

b) enable Faculty/Consultants to have direct information about the work done and intervene, if necessary,

c) provide feedback and assess the progress of learning with experience gained periodically.

The e- Logbook should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed logbook in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination. The PG students shall be trained to reflect and record their reflections in logbook particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program.

K. Course in Research Methodology: -

All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Other aspects:-

- he Postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The Postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS), and complete the certificate courses, GLP.
- The Postgraduate trainees must undergo training in information technology and use of computers.

Leave Rules for Post-graduate Students ;-

The following leave rules will be followed:

Every post-graduate student will be given minimum 20 days of paid leave (casual leave) per year.

Subject to exigencies of work, post-graduate students will be allowed one weekly holiday.

Female post-graduate students shall be allowed maternity leave as per existing Government rules and regulations.

Male post-graduate students shall be allowed paternity leave as per existing Government rules and regulations. In addition to 20 days' paid leave, the candidates will be allowed academic paid leave of 5 days per year. If candidate avails leave in excess of the permitted number of days, his/her term of course shall be extended by the same number of days to complete the training period. However, one shall be able to appear in the examination if one has 80% (eighty per cent) of the attendance.

ASSESSMENT

FORMATIVE ASSESSMENT: is performed continuously during the training to assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system by means of work place based assessment.

General Principles

Internal Assessment is frequently conducted to cover all domains of learning and used to provide feedback to improve learning; it also covers professionalism and communication skills. The Internal Assessment will be conducted in theory and practical / Clinical examination at the end of every year.

Quarterly assessment during the MD training should be based on:

- Case presentation, case work up, case handling/management : once a week
- Laboratory performance : twice a week
- Journal club : once a fortnight
- Seminar : once a fortnight

- Case discussions : once a fortnight/month
- Interdepartmental case or seminar : once a month

Note : These sessions may be organized and recorded as an institutional activity for all postgraduates.

- Attendance at Scientific meetings, CME programmes (at least 02 each)

The student shall be assessed periodically as per categories listed in appropriate pathology postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT (AS PER THE RULES GIVEN IN POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2023)

Essential pre-requisites for appearing for examination include:

(Revised University Eligibility requirements for Post graduate students)

1. E-Log Book - Logbook of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.
2. Have minimum one Poster presentation or Podium presentation at a National/ Zonal/State conference of his/her specialty.
3. Have minimum one Research paper published in journal of his/her specialty as first author.
4. Complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated on successful completion of the course and examination.
5. Complete a certification course in ethics including Good Clinical Practices and Good Laboratory Practices, (whichever is relevant to them) in the first year of the course conducted by institutions.
6. Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills in the first year of the course conducted by the institution.
7. Thesis acceptance by all evaluators before the conduct of University Examination.

Attendance : A student will require minimum of 80% attendance of working days (i.e. 751 days of 939 days) for appearing in the examination. However, period of

training will be extended by the same number of days for which maternity/paternity leave and total excess casual leaves have been availed in three years.

Allowed leaves for Post-graduate students : Weekly one-day off (subject to exigencies of work). In addition, they are eligible for twenty days Paid Casual Leave. Five days Academic Leave per year, if availed by a student will be counted as duty. Thus, a student is entitled to 52 weekly offs and 20 Paid Casual Leave per year. Female post-graduate students shall be allowed maternity leave as per existing government rules and regulations. Male post-graduate students shall be allowed paternity leave as per existing government rules and regulations. However, period of training will be extended by the same number of days for which maternity/paternity leave have been availed.

Post Graduate Examination

The summative examination would be carried out as per the Rules given in **POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2023.**

The Post Graduate examination will be in three parts:-

1. Thesis:

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis 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 shall be submitted at least six months before the Theory and Clinical / Practical examination. 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 examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory:

The examinations shall be organised on the basis of 'Grading'or 'Marking system' 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 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 Pathology, Pathophysiology, Immunopathology, molecular biology, Autopsy and Techniques- surgical pathology

Paper II : Systemic Pathology – surgical and cytopathology, Applications of techniques in surgical and cytopathology

Paper III : Haematology, Transfusion Medicine (Blood Banking), Laboratory Medicine including instrumentation and quality control

Paper IV : Recent advances and applied aspects

Each theory paper will be of 100 marks & 3 hours duration. There will be 10 questions of 10 mark each.

Note : The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

3. Practicals /Clinical and Oral/viva voce Examination:

Practical examination should be spread at least over two days for each student and include various major components of the syllabus focusing mainly on the psychomotor domain. Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

I. Clinical Pathology:

- Discussion of a clinical case history.
- Plan relevant investigations of the above case and interpret the biochemistry findings.
- Two investigations should be performed including at least one biochemistry exercise/clinical pathology exercise like CSF, pleural tap etc. analysis and complete urinalysis.

II. Haematology:

- Discuss haematology cases given the relevant history. Plan relevant investigations

- Perform complete hemogram and at least two tests preferably including one coagulation exercise
- Identify electrophoresis strips, osmotic fragility charts etc. Interpretation of data from auto analysers, HPLC and flow cytometry. Examine, report and discuss around ten cases given the history and relevant blood smears and/ or bone marrow aspirate smears and bone marrow biopsy interpretation.

III. Transfusion Medicine:

- Perform blood grouping
- Perform the necessary exercise like cross matching.
- Coomb's test, gel cards interpretation.

IV. Histopathology:

- Examine, report and discuss 12-15 cases histopathology and 5-8 cytopathology cases, given the relevant history and slides.
- Perform a Haematoxylin and Eosin stain and any special stain on a paraffin section. Should be conversant with histopathology techniques including cryostat.

V. Autopsy:

- Given a case history and relevant organs (with or without slides), give a list of anatomical diagnosis in a autopsy case.

VI. Gross Pathology

- Describe findings of gross specimens, give diagnosis and identify the sections to be processed. The post graduate student shall perform grossing in front of the examiners for evaluation.

VII. Basic Sciences:

- 10-15 spots based on basic sciences be included
- Identify electron micrographs
- dentify gels, results of PCR, immunological tests including interpretation of immuno-fluorescence pictures.
- Identify histochemical and immuno-histochemistry stains

VIII. Teaching exercise 10 min

All practical exercises shall be evaluated jointly by all the examiners.

An oral question-answer session shall be conducted at the end of each exercise.

(a) Viva on dissertation and research methodology

(b) General Viva-Voce

Theory Examination : 400 Marks

Duration : 3 hours

Paper 1	General Pathology, Pathophysiology, Immunopathology, Molecular Biology, Autopsy and Techniques- surgical pathology	10 Questions of 10 marks each	100 marks
Paper 2	Systemic Pathology- Surgical and Cytopathology, Applications of techniques in surgical and cytopathology	10 Questions of 10 marks each	100 marks
Paper 3	Haematology, Transfusion Medicine (Blood Banking) Laboratory Medicine including instrumentation and quality control	10 Questions of 10 marks each	100 marks
Paper 4	Recent advances and applied aspects	10 Questions of 10 marks each	100 marks

Practical Examination : 400 Marks
Practicals : 280 marks
Thesis : 20 marks

Viva voce : 100 marks
Duration - 2 days

PRACTICALS 280 MARKS

DAY 1		
a)	Autopsy / Reconstructed autopsy (organ systems)	20 Marks
b)	Haematology & Cytology slides : 8 + 5 slides	50 marks (30 + 20)
c)	Gross Specimens (4 Specimens)	20 marks

d)	Histopathological Techniques : 1. Frozen section & Block cutting - 10 marks 2. Staining – Special stain and H & E stain - 20 marks 3. Cytology stain - 10 marks	40 marks
e)	Haematology and clinical pathology (i) Clinical case/History/ clinical data discussion (ii) Haematology exercise including Blood Banking	25 Marks
DAY 2		
a)	Histopathology slides - 15 slides	60 Marks
b)	Histopathology case discussion with complete workup including IHC	20 marks
c)	OSPE, Basic sciences: 25 (5 Stations x 5 marks) Performance stations - 3 1. PT / APTT 2. Blood grouping 3. Cross matching Question & Interpretation Station - 2 - Flow cytometry, Immunofluorescence, Electron Micrographs, Histochemical stains, IHC, Coomb's test, Gel card tests, PCR etc	25 marks
d)	Pedagogy	20 marks
	DISSERTATION VIVA	**20 marks**
	VIVA VOCE	**100 marks**

Criteria for evaluation of MD Pathology Course:

The candidate shall secure not less than 50% marks in each head of passing which shall include

(1) Theory - aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%)

(2) Practical/Clinical and Viva voce - aggregate 50%

(3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination.

(4) Five per cent of mark of total marks of Clinical/Practical and Viva Voce marks (20 marks) will be of dissertation/thesis and it will be part of clinical/ practical examination marks. External examiner outside the state will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce.

(5) No grace mark is permitted in post-graduate examination either for theory or for practical.

(6) The University shall conduct not more than two examinations in a year for any subject, with an interval not less than 4 months & not more than 8 months between the two examinations.

Recommended Reading: Books (latest edition)

1. Histology for Pathologists. Stephen S. Sternberg (Ed), Raven Press, New York.
2. Robbin's Pathologic Basis of Disease Ramzi S.Cotran, Vinay Kumar, Stanley L Robbins WB Saunders Co., Philadelphia.
3. Ackerman's Surgical Pathology. Juan Rosai Mosby. St. Louis.
4. Diagnostic Surgical Pathology. Stephen S Sternberg. Lippincott, William Wilkins. Philadelphia.
5. Diagnostic Histopathology of Tumours. Christopher DM Fletcher (Ed). Churchill Livingstone. Edinburgh.
6. Manual & Atlas of Fine Needle Aspiration Cytology. Svante R Orell, et al London.
7. Theory and Practice of Histological Techniques, Bancroft JD, Stevens A, Turner DR, Churchill Livingstone, Edinburgh.
8. Diagnostic Cytology and its Histopathologic Basis, Koss LG, J.B. Lippincott, Philadelphia.
9. Comprehensive Cytopathology, Bibbo M, W.B. Saunders Co., Philadelphia.
10. Wintrobe's Clinical Hematology, Lee GR, Foerster J, Lupeus J, Paraskevas F, Gveer JP, Rodgers GN, Williams & Wilkins, Baltimore.
11. Atlas and Text of Hematology 4th edition. Singh T. Avichal Publishing Company.
12. Dacie and Lewis Practical Hematology, Bain BJ, Bates I, Laffan MA. Elsevier.
13. Bone Marrow Pathology, Bain BJ, Clark DM, Lampert IA, Blackwell Science, Oxford.
14. Henry's clinical diagnosis and management by laboratory methods.
15. WHO classification of tumors. IARC Lyon.

Journals

1. Acta Cytologica
2. Journal of Pathology
3. Histopathology
4. British Journal of Haematology
5. Blood
6. Journal of Clinical Pathology
7. Diagnostic Cytopathology
8. Human Pathology
9. New England Journal of Medicine
10. Indian Journal of Pathology and M
11. Lancet
12. American Journal of Surgical Pathology
13. Cancers
14. Modern Pathology

Annexure I

Student appraisal form for broad specialty non-clinical disciplines											
Elements		Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	**Scholastic aptitude and learning**										
1.1	Has knowledge appropriate for level of training										

1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self-directed Learning										
2	**Work related to training**										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	**Professional attributes**										
3.1	Responsibility and accountability										

3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	**Space for additional comments**										
5	**Disposition**										
	Has this assessment pattern been discussed with the trainee? Yes / No										
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										

Annexure 2

Criteria for evaluation of dissertation (Tick whichever is appropriate)

S. No.	Criterion	Adequate	Inadequate
1	Title of the study		
2	Research Background & Objectives		
3	Research Methodology utilized in accordance with the objectives		
4	Depiction of results		
5	Discussion		
6	Conclusion		
7	References		

GUIDELINES FOR COMPETENCY-BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN PHARMACOLOGY

Revised PG Curriculum

Preamble

The purpose of the postgraduate (PG) education is to create specialists who would provide high quality education, health care and advance the cause of science through research and training. Pharmacology consists of both experimental and clinical sciences. The experimental component is essential in understanding the drug action in diseases as well as for the research in drug discovery and development. Clinical application of pharmacology concepts is essential for rational prescribing practices, rational therapeutics, clinical trials, rational use of drugs including antimicrobials, pharmacovigilance and pharmacology consults.

The job prospects for a medical pharmacologist have evolved over time along with a congruent rise in the demand for trained pharmacologists in India, both in academics as well in other areas such as pharmacovigilance centres, regulatory bodies, national research institutes, pharmaceutical industry and as scientific writers or science managers. Hence, a PG student in Pharmacology should be competent to meet the growing challenges in job requirements at all levels in various fields and organizations. Considering the emerging trends in pharmacology & therapeutics, clinical applications of the subject, its role in national programs, evolving integrated course schedules while broadening the subject scope and number of students seeking to join the PG degree in pharmacology, there is huge demand to standardize and update PG curricular components including competencies, teaching learning methods and assessment methods in the MD pharmacology course in India. This requires integration of pharmacology with other sciences including basic, para-clinical and clinical disciplines.

A pragmatic approach to postgraduate pharmacology teaching in India is a key step towards addressing the aforesaid challenges and facilitating a fresh curriculum design. The purpose of this document is to provide teachers and learners comprehensive guidelines to achieve the defined competencies through various teaching-learning and assessment strategies. This document was prepared by various subject and education experts of the national Medical Commission. The subject Expert Group has attempted to render uniformity without compromising the purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

PHARMACOLOGY SPECIFIC LEARNING OBJECTIVES (GOALS)

At the end of the MD training programme in Pharmacology, the student should meet the following goals:

1. Acquisition of knowledge

The student should be able to clearly explain concepts and principles of pharmacology and therapeutics, drug development processes, the drugs and cosmetics act, rational use of drugs, antimicrobial resistance, pharmacovigilance, pharmacy, health economics, clinical trial processes and relevant national programs.

2. Acquisition of Skills

The student should be able to develop and apply skills in pharmacology-based services (e.g. rational prescribing), in self-directed learning for evolving educational needs and scientific information, in conduct of research and in managerial assignments in the department/institution.

3. Teaching and training

The student should be able to effectively teach and assess undergraduate medical students (MBBS) and allied health science courses (Dentistry, Nursing, Physiotherapy) so that they become competent healthcare professionals and are able to contribute to training of undergraduates (UG) and postgraduates.

4. Research

The student should be able to conduct a research project (in both basic and clinical pharmacology) from the planning to the publication stage and be able to pursue academic interests and continue life-long learning to become a more experienced teacher & mentor in all the above areas and to eventually be able to guide postgraduates in their thesis, research work and all other academic activities.

5. Professionalism, Ethics and Communication skills

The student should be able to learn and apply principles of professionalism, ethics and effective communication in conduct of research, pharmacology-based services, educational activities and day to day work.

PHARMACOLOGY SPECIFIC COMPETENCIES

The competencies will have a judicious mix of all domains of learning and usually are predominant in one domain. The postgraduate student during the training program should acquire the following competencies to achieve the defined five goals:

A. Predominant in Cognitive domain

The MD Pharmacology student after training in the course should be able to:

General Pharmacology:

1. Demonstrate an understanding of the basic principles of Pharmacology including molecular pharmacology.
2. Demonstrate an awareness of the historical journey and contributions of scientists in the drug development process.
3. Describe the process of new drug development including preclinical and clinical phases.
4. Describe principles of pharmacokinetics of drugs and apply these to prescribe medicines for individualization of pharmacological therapy, including use of medicines in special categories (Pediatrics, Geriatrics, Pregnancy and Pathological states).
5. Explain the principles of pharmacodynamics and apply these in different therapeutic situations.
6. Describe mechanisms of drug-drug interactions and their clinical importance.
7. Describe the principles of pharmacogenomics and its clinical significance.
8. Describe pharmacological principles underlying the effects of drugs used in diagnosis, prevention and treatment of common systemic diseases in man.
9. Demonstrate an understanding of the factors that modify drug action.
10. Define Therapeutic Drug Monitoring (TDM), describe the methods of TDM and importance in therapeutic decision making.
11. Describe the principles and importance of Pharmacoeconomics in healthcare delivery. Describe the methods in pharmacoeconomic studies and the economic considerations in the use of medicines in individuals and in the community.

12. Describe the principles, methods and importance of pharmacoepidemiology, including drug utilization studies.

13. Define pharmacovigilance. Describe the importance of pharmacovigilance in ensuring patient safety and the various methods/procedures in pharmacovigilance.

14. Describe the role of Essential Medicines in rational therapeutics. Describe principles for selecting Essential Medicines for a defined healthcare delivery system.

15. Demonstrate an understanding of principles of rational prescribing.

16. Demonstrate an understanding of prescription analysis and be able to conduct prescription analysis in a healthcare facility.

17. Demonstrate an understanding of antimicrobial resistance, antibiogram, antimicrobial stewardship program and strategies for containment of antimicrobial resistance.

Systemic Pharmacology:

1. Apply and integrate knowledge of pathophysiology of diseases and pharmacological principles underlying the effects of drugs, for the purpose of diagnosis, prevention and treatment of common systemic diseases in man including disorders of:

    a. Synaptic & neuroeffector junctional sites of the autonomic nervous system
    b. Neuromuscular junction
    c. Central nervous system
    d. Cardiovascular system
    e. Endocrine system
    f. Gastrointestinal system
    g. Respiratory system
    h. Renovascular system
    i. Hematological system
    j. Immunological system
    k. Autacoids

2. Describe the mechanism of action, pharmacological effects and therapeutic status of drugs used for prevention and management of microbial and parasitic infections/infestations and neoplastic disorders.

3. Describe the pathophysiological basis and management of common poisonings.

4. Demonstrate an awareness about the recent advances in pharmacology and therapeutics.

5. Demonstrate an understanding of the special considerations in pharmacokinetics, mechanism of action, pharmacological effects and therapeutic status of drugs used for dermatological and ocular disorders.

Research :

1. Demonstrate an understanding of the importance and ethical considerations of biomedical research in animals and man.

2. Describe the principles and methods of biomedical research in animals and man.

3. Describe the current principles of Good Clinical Practice (GCP) and Good Laboratory Practice (GLP) guidelines, as applicable.

4. Demonstrate an understanding of the different tools and methods for literature search.

5. Describe and apply the principles of biostatistics in the evaluation and interpretation of efficacy and safety studies of drugs in man. Apply and interpret the various statistical tools in biomedical research.

6. Demonstrate an understanding of the principles of Good Publication practices as applicable to publication of research studies.

7. Describe different methods of drug assays - biological, chemical, immune-assay including knowledge of analytical techniques like HPLC, TLC etc. and their applications in therapeutics.

    - Describe the methods for screening/evaluation of various pharmacological agents like analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensives, hypocholesterolemic agents, antiarrhythmic drugs, antidiabetics, local anaesthetics, antifertility agents, diuretics, adrenergic blocking drugs, drugs used in peptic ulcer diseases and drugs affecting learning and memory etc. in animals and man.

8. Describe the regulatory and ethical issues involved in drug development and research.

Teaching and Assessment:

1. Demonstrate an awareness about the salient features of Undergraduate Medical Education Curriculum in India.
2. Demonstrate an awareness about Postgraduate Medical Education Curriculum and Guidelines in India.
3. Describe the principles of teaching-learning technology and apply these to conduct classroom lectures, self-directed learning (SDL) sessions, Case-Based Learning (CBL), case discussions, integrated teaching, small group discussions, seminars, journal club and research presentations.
4. Describe the principles of assessment of learning and be able to use the different methods for assessment of undergraduate students in pharmacology.
5. Demonstrate knowledge about the utility of computer assisted learning and be able to use them efficiently to promote learning of pharmacology.

Note : A postgraduate student is expected to be knowledgeable about all aspects of the subject and be updated about the contemporary advances and research in the subject.

B. Predominant in Affective Domain

The students after training in the MD (Pharmacology) course should be able to:

1. Effectively explain to patients, the effects, appropriate use and adverse effects of drugs, including drug interactions and the need for medication adherence.
2. Communicate effectively with students, peers, staff, faculty and other members of the health care team about rational use of medicines and improving spontaneous reporting of adverse drug reactions, with pharmacological reasoning
3. Demonstrate respect in interactions with peers, patients and other healthcare professionals.
4. Demonstrate professionalism, ethical behavior and integrity in one's work.
5. Demonstrate ability to generate awareness about the use of generic drugs in various conditions.

6. Acquire skills for self-directed learning to keep up with advances in the subject and to improve the skills and expertise towards continuous professional development.

C. Predominant in Psychomotor Domain

a. Mandatory

i. The students after training in the MD (Pharmacology) course should be able to perform the following procedures independently or as a part of a team and/or interpret the results:

1. Predict, report, monitor and participate in the management and causality assessment of adverse drug reactions associated with use of drugs, as per national program.
2. Demonstrate skills for writing rational prescriptions and prescription analysis.
3. Demonstrate proper use of equipment following the SOPs e.g. organ bath, analgesiometer, physiograph, convulsiometer, plethysmograph, equipment for testing/measuring learning and memory, affective disorders, muscle relaxants, blood pressure, ECG, respiration and pain.
4. Prepare drug solutions of appropriate strength and volume.
5. Determine EC50, ED50, pD2 and pA2 values of drugs.
6. Demonstrate presentation skills in a classroom setting as well as in academic meetings at local and national levels.
7. Provide critical appraisal of a research paper.
8. Perform experiments to demonstrate and interpret the dose response curve and effect of agonists (in the presence or absence of an antagonist) on simulations.
9. Perform the following:
    - Design protocol for evaluation of a given drug for various phases of clinical trials.
    - Prepare Informed Consent Form and Participant Information Sheet for clinical trials/research.
    - Administer Informed Consent Form

- Evaluate promotional drug literature
- Prepare "Package insert"
- Calculate and interpret pharmacokinetic parameters of a drug from a given data
- Demonstrate skills to prepare material for teaching-learning and assessment.

ii. The students after training in the MD (Pharmacology) course should be able to do/perform following procedures under supervision:

10. Test and predict efficacy of drugs following appropriate guidelines and regulations e.g. drugs affecting memory and psychomotor functions (e.g. critical flicker fusion tests in human volunteers), pain, cardiovascular functions, respiratory functions etc.
11. Observe and understand basic principles of working of important contemporary drug analytical techniques, interpret the observations about the drug levels and their therapeutic applications.
12. Demonstrate skills for contributing to antibiotic stewardship program of the institute to manage antimicrobial resistance.
13. Demonstrate Standard Operating Procedures (SOPs) for various methods and techniques used in pharmacology including SOPs in clinical trials and research.
14. Administer drugs by various routes (subcutaneous, intravenous, intraperitoneal) in simulations and hybrid models.
15. Demonstrate acquisition of writing skills for scientific publications and research projects for funding agencies and approval by Ethics Committee.
16. Demonstrate scientific writing skills.

b. Desirable: The students after training in the MD (Pharmacology) course should be able to:

17. Collect blood samples and oral gavage from experimental animals.
18. Administer drugs by various routes (subcutaneous, intravenous, intraperitoneal) in experimental animals.

19. Perform in vivo and in vitro screening/evaluation of various pharmacological agents like analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensives, hypocholesterolemic agents, antiarrhythmic drugs, antidiabetics, local anaesthetics, antifertility agents, diuretics, adrenergic blocking drugs, drugs used in peptic ulcer diseases and drugs affecting learning and memory etc in animals or simulated experiments and interpret the observations and relate these to potential clinical applications of the experimental drug and man

20. Perform experiments to demonstrate and interpret the dose response curve and effect of agonists (in the presence or absence of an antagonist) on various biological tissues.

Note : All animal experiments shall be compliant with the Regulations of Government of India, notified from time to time. Amphibian/Dog/Cat experiments shall be conducted by computer assisted simulation models/facilities. Other experiments shall be performed as permissible by existing 'Committee for the Control and Supervision of Experiments on Animals (CCSEA)' guidelines and other Government regulations.

Syllabus

Course content

Theory:

✧ **Basic and General Pharmacology:**

Basic Principles of Pharmacodynamics and Pharmacokinetics, Molecular Pharmacology, Historical aspects of drug discovery, Evaluation of new drug in animals and man, Gene based therapy and drug abuse, Pharmacoepidemiology, Pharmacogenomics, pharmacogenetics, P-drug, Drug delivery systems, Over the counter drugs, generic drugs, drugs banned in India, Dietary supplements and herbal medicines

Toxicology:

General principles of toxicology including pathophysiological basis and management of common poisonings, Heavy metal poisoning, non-metallic toxicants like air pollutants, pesticides etc.

✧ **Clinical Pharmacology :**

- Principles of rational use of drugs and rational prescribing, Essential drug concept
- Principles of Clinical Pharmacokinetics and their application in drug treatment, including use of drugs in special population like different age groups, Pregnancy, lactation and Disease conditions
- Clinical trials –conduct of clinical trials, ethical issues in clinical trials, informed consent and SOP-Standard operating procedures of clinical trials
- Therapeutic drug monitoring, Adverse drug event monitoring and reporting (Pharmacovigilance),Adverse drug interactions, Drug information
- Pharmacometrics- methods of drug evaluation
- Pharmacoeconomics
- Functioning of the Drugs and Therapeutics Committee.

- Hospital formulary development
- Drug information services.
- Medication error detection and mitigation advice.
- Antimicrobial resistance and antibiotic stewardship.
- Prescription auditing
- Drug counselling - explain to patients, the effects and adverse effects of drugs, including the need for medication adherence
- Emergency drugs used in crash cart/ resuscitation

✧ **Systemic Pharmacology and Therapeutics:**

Pharmacology of drugs acting on various organ system & drug treatment of disease conditions :

- Autonomic Pharmacology
- Drugs acting on Smooth muscles
- Drugs acting on Synaptic and Neuro effector Junctional sites
- Drugs acting on Central Nervous System (Sedative, Hypnotics, Antiepileptics, General Anesthetics, Local Anesthetics, Skeletal Muscle Relaxants, Antipsychotic, Antidepressants, Drugs used in Parkinson's disease and other neurodegenerative disorders, opioid agonists and antagonists, Drugs of abuse)
- Drugs modifying renal function
- Drugs acting on cardiovascular system and haemostatic mechanisms (Antihypertensives, Antianginal, Antiarrhythmics, Drugs used in heart failure, Drugs used in Dyslipidemias, Fibrionolytics, Anticoagulants, Antiplatelets)
- Reproductive Pharmacology
- Agents effecting calcification and bone turnover
- Autacoids and related pharmacological agents (NSAIDs) and drugs used in Rheumatoid arthritis and Gout
- Gastrointestinal drugs

- Pharmacology of drugs affecting the respiratory system (drugs used in Bronchial Asthma and COPD)
- Chemotherapy: General principles and various Antimicrobials
- National programmes for infectious and vector borne diseases including the regimes
- Chemotherapy of neoplastic disease
- Drugs used in Autoimmune disorder and Graft versus Host Disease
- Dermatological pharmacology
- Ocular pharmacology
- Immunomodulators - immunosuppressants and immunostimulants
- Pharmacology of drugs used in endocrine disorders (drugs used in diabetes mellitus, hypothalamic and pituitary hormones, thyroid and antithyroid drugs, adrenocorticotropic hormones and their antagonists, gonadal hormones and their inhibitors)
- Screening procedures for various drug categories in humans and animals.
- Antiparasitics, disinfectants, antiseptics

✧ **Biomedical research (in humans and animals) and related Regulations**

- Literature search
- Principles of Good Clinical Practice (GCP)
- Good Laboratory Practice (GLP) guidelines Good publication practices
- Recent regulatory guidelines for drugs/research and clinical trials
- Drug development and research and ethical issues involved in it
- Research protocol development, research study conduct, experimental observations, analysis of data using currently available statistical software
- Emergency use authorization for drugs eg., vaccine development
- Ethical issues related to research on animals, humane animal research (principles of 3Rs) and alternatives to animal experimentation
- Ethical guidelines of ICMR, INSA for Breeding and conducting Experiments on Animals (Control and Supervision) Rules 1998.

- Animal experiments: Regulatory Guidelines (CPCSEA), humane animal research (principles of 3Rs) and alternatives to animal experimentation.
- Anaesthetics used in laboratory animals

✧ **Experimental Pharmacology:**

- Describe the methods for screening/evaluation of various pharmacological agents like analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensives, hypocholesterolemic agents, antiarrhythmic drugs, antidiabetics, local anaesthetics, antifertility agents, diuretics, adrenergic blocking drugs, drugs used in peptic ulcer diseases and drugs affecting learning and memory etc in animals and man.

✧ **Biostatistics:**

- Basic principles and their application in drug research.
- Recent advances in Pharmacology

✧ **Biochemical Pharmacology**

- Basic principles and applications of simple analytical methods
- 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).

✧ **Education**

- Salient features of Undergraduate Medical Education Curriculum in India.
- Postgraduate Medical Education Curriculum and Guidelines in India.
- Principles of teaching - learning methods and technology
- Principles of assessment of learners

Practicals:

1) Experiments on Laboratory Animals:

A. Isolated tissue experiments: (BIOASSAY)

a) Rat – uterus, phrenic nerve diaphragm, fundus, vas deferens, colon, etc.

b) Guinea Pig – ileum, vas deferens, heart (Langendorff's preparation), tracheal chain, duodenum etc.

c) Rabbit – heart (Langendorff's preparation), jejunum, duodenum, aortic strip etc

B. Principles of EC50, ED50, pD2 and pA2 values of drugs

C. General screening and evaluation of whole animal experiments:

i. Screening of the drugs for the following activities:

- Anti-anxiety
- Anti depressant
- Anti – convulsant
- CNS stimulants
- Sedative and hypnotic
- Muscle relaxants
- Anti-inflammatory
- Analgesic, Antipyretics
- Anti-diabetic
- Antihypertensive
- Anti-arrhythmic
- Anti adrenergic
- Antipsychotics
- Hypocholesterolemic agents
- Diuretics
- Drugs used in peptic ulcer diseases/Prokinetic agents/ antiemetics
- Antitussives, /anti-asthma agents
- Oxytocics, antifertility agents
- Behavioral pharmacology models and evaluation of drugs affecting learning and
- memory

ii. In rabbit & guinea pig to screen the drugs for their :

- Local anesthetic activity
- Mydriatic and miotic activity

iii. In cat / dog (Computer Aided) to identify the nature of the drug by observing its effect on :

- Blood pressure
- Respiration
- Nictitating membrane
- Intestinal movement

2) Technique demonstration:

i) Blood withdrawal :

- Rat– Tail vein, retro-orbital sinus puncture, cardiac puncture.
- Rabbit – Marginal ear vein.

ii) Intravenous/intraperitoneal/subcutaneous/oral drug administration in rat, rabbit and mouse

iii) Measuring pedal volume

iv) Rat vaginal smear preparation & interpretation.

v) Anesthetics used in laboratory animals

3. Clinical Pharmacology

- Demonstration of drug administration through various routes on Mannequines
- Demonstration of effects of drugs/interpretation of results in humans
- Protocol Writing for various phases of clinical trials
- ADR reporting (Pharmacovigilance)
- Analysis of Prescriptions
- Calculation of kinetic parameters
- Selection of P-drug
- Estimation of Pharmacoeconomic parameters

4. Biochemical Pharmacology Experiments

- Immunoassays: Concept and their application/s
- Simple tests for detecting the chemical nature of drugs (alkaloids, glycosides, steroids, lead, fluoride etc).
- 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).

TEACHING AND LEARNING METHODS

All students joining the postgraduate courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a log book for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Theory:

a) Lectures:

A minimum of 10 lectures per year on certain selected topics shall be taken as lectures.

b) Journal Club

Journal club shall be conducted once a week. Topics shall include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

A time table for the subject with names of the students and the moderator shall be announced in advance.

c) Subject Seminar

Recommended to be held once a week. Important topics shall be selected and allotted for in- depth study by a postgraduate student. A teacher shall be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student shall be graded by the faculty.

d) Student Symposium/ Interdepartmental colloquium Minimum once every 6 months.

A broad topic of significance shall be selected, and each part shall be dealt by one postgraduate student. A teacher moderator shall be allocated for each symposium and moderator shall track the growth of students during moderation. Such Symposium shall aim at complete evidence-based review of the topic. All participating postgraduates shall be graded by the faculty. Alternately, post graduates shall attend Interdepartmental colloquium meetings between the Department of Pharmacology and other departments on topics of current/ common interest or clinical cases.

e) PG students shall attend additional sessions in the form of workshops on basic sciences, biostatistics, research methodology, teaching methodology & assessment and salient features of Undergraduate/Postgraduate medical curriculum with relevant entries in the log book.

f) UG Teaching: Post graduate students shall teach undergraduate students by taking lectures, small group teaching and demonstrations using Computer Animal Simulation Laboratory (CASL)

g) PG students shall attend accredited scientific meetings (CME, symposia, and conferences)

PRACTICAL/CLINICAL TRAINING:

1) Research Activities : The Post-graduate students should conduct dissertation work and in addition carry out a short research project in the department other than dissertation work.

2) Experimental Pharmacology- In vitro (including bioassays), in vivo (including common methods of evaluation), computer simulation and toxicity tests

3) Clinical Pharmacology -

(1) Evaluation of drugs in healthy volunteers as well as patients

(2) Critical evaluation of drug literature, Pharmacoeconomics, pharmacovigilance and Pharmacoepidemiology

(3) Short project

(4) Rotational 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 by attending rounds during clinical postings and learn about the recent drugs used presently in clinical practice, also discuss the rationality of the prescription with the staff. Postings in the wards of the Clinical departments will help the candidate get acquainted with the patterns of drug use, adverse drug reactions and interactions etc. Such postings will also help them to improve their communication skills. Every posting shall have defined learning objectives derived in conjunction with the collaborating department/s or unit/s.

The following clinical postings are recommended:

Clinical Postings	REVISED (duration)
Medicine	2 weeks
Anaesthesia	2 weeks
Dermatology	1 week
Pediatrics	1 Week
Psychiatry	2 weeks
Microbiology/ Infection control unit or dept	2 weeks
Biochemistry / BSRC	2 weeks
Clinical trial unit (SMO) /Research unit / Pharmaceutical industry	2-8 weeks (as per availability)
Pharmacovigilance	2 weeks
DRP	3 months
Total Duration of postings	8 1/2 months

(Monitoring of clinical postings, would be through weekly discussions about interesting cases with critical appraisal of prescriptions).

In addition candidate shall be posted for Pharmacovigilance posting in hospital to get acquainted to procedures involving in reporting adverse drug reactions

Biochemical Pharmacology-

- Candidate shall be posted at BSRC (Basic Science Research Centre)/ Department of Biochemistry to get acquainted to procedures like Identification of drugs/toxins by using chemical, biological and analytical tests and Quantitative estimation – use of colorimeter, spectrophotometer and/or other advanced analytical equipment.

- Microbiology/ Infection control unit or dept: Candidate shall be posted to Department of Microbiology to get acquainted to infection control measures and antimicrobial stewardship

Candidate shall be posted at SMO (Site Management Office) to get acquainted to procedures or skills for conducting clinical trials. Alternately, candidate desirous to attend industrial posting shall be posted at renowned pharmaceutical industries to get hands on experience of the working culture and skills of the industries.

Posting under "District Residency Programme" (DRP):

All postgraduate students pursuing MD in Pharmacology shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation shall be termed as "District Residency Programme" and the PG medical student undergoing training shall be termed as "District Resident".

Objectives :

The main objectives of the District Residency Programme (DRP) would be

4. To expose the post-graduate student to the District Health System/ District Hospital and involve them in health care services being provided by District Health System /District Hospital for learning while serving;

5. To acquaint them with the planning, implementation, monitoring, and assessment of outcomes of the National Health programmes at the district level.

6. To orient them to promotive, preventive, curative and rehabilitative services being provided by various categories of healthcare professionals under the umbrella of the National Health Mission.

   In doing so, the post-graduate medical students would also be contributing towards strengthening of services of the District Health System as Speciality resident doctors working as members of the district teams.

Training and Responsibilities of District Residents:

The District Resident will work under the overall directions and supervision of the District Residency Programme Coordinator (DRPC). During this rotation, the Resident doctor will be posted with the concerned/allied Speciality team/unit/ sections/ services at the District Health System/ District Hospital. The clinical responsibilities assigned to the Residents would include serving in outpatient, inpatient, casualty, and other areas pertaining to their Speciality and encompass night duties.

Post-graduate students of specialities where direct patient care is not involved will be trained by District Health System/ District Hospital teams within the available avenues in coordination with the District Health Officer/Chief Medical Officer. They would be trained in and contribute to the diagnostic/laboratory services, pharmacy

services, forensic services, general clinical duties, managerial roles, public health programmes etc., as applicable. They may also be posted in research units / facilities, laboratories and field sites of the Indian Council of Medical Research and other national research organizations.

Stipend and Leave for District Residents:

The District Residents shall continue to draw full stipend from their respective medical colleges for the duration of the rotation subject to the attendance record submitted by the appropriate district authorities to the parent medical college/ institution, based on methods and system as prescribed. Subject to exigencies of work, the District Resident will be allowed one weekly holiday by rotation. They shall also be entitled to leave benefits as per the rules/ guidelines of the parent college/university.

The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution by phone and e-communication for guidance, learning, and for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.

4) Leave Rules for Post-graduate Students

The following leave rules will be followed:

Every post-graduate student will be given minimum 20 days of paid leave (casual leave) per year.

Subject to exigencies of work, post-graduate students will be allowed one weekly holiday.

Female post-graduate students shall be allowed maternity leave as per existing Government rules and regulations.

Male post-graduate students shall be allowed paternity leave as per existing Government rules and regulations. In addition to 20 days' paid leave, the candidates will be allowed academic paid leave of 5 days per year. If candidate avails leave in excess of the permitted number of days, his/her term of course shall be extended by the same number of days to complete the training period. However, one shall be able to appear in the examination if one has 80% (eighty per cent) of the attendance.

Common Course work

COURSE DURATION : 3 Years (6 Terms of 6 months each) WORK SCHEDULE

Terms :

I. TERM

- Search and identify dissertation topic in consultation with guide and collect the relevant literature. Preparation of synopsis and submission of the same to the university for registration.
- Participation in undergraduate teaching programmes
- Journal review meetings
- Seminars
- Experimental pharmacology practical
- Student Symposium/Interdepartmental seminars

II. TERM

- Journal review meetings
- Seminars
- Participation in undergraduate teaching programmes.
- Experimental pharmacology practical
- Preparation of synopsis for dissertation
- Symposium/Interdepartmental seminars
- Biochemistry/BSRC posting
- Microbiology posting

III. TERM

- Journal review meetings
- Seminars
- Participation in undergraduate teaching programme
- Clinical postings
- Dissertation experiments
- Experimental pharmacology practical

- Clinical pharmacology practical
- Student Symposium/Interdepartmental seminars
- District Residency Programme

IV. TERM

- Journal review meetings
- Seminars
- Participation in undergraduate teaching programme
- Clinical postings
- Dissertation experiments
- Dissertation writing
- Test on CNS and chemotherapy
- Clinical pharmacology practical
- Student Symposium/Interdepartmental seminars
- District Residency Programme

V. TERM

- Dissertation writing and submission to university
- Journal review meetings
- Seminars on selected topics.(Recent advances)
- Participation in undergraduate teaching programme.
- Experimental pharmacology practicals.
- Visit to pharmaceutical industry/SMO
- Clinical pharmacology practical.
- Student Symposium/Interdepartmental seminars
- Test on Endocrinology, Blood and Autacoids
- District Residency Programme

VI. TERM

- Journal review meetings
- Seminar on selected topics (Recent advances)
- Experimental pharmacology practicals
- Student Symposium/Interdepartmental seminars
- Clinical pharmacology practical

ASSESSMENT

Formative Assessment

During the training, Formative assessment shall be continual and shall assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self- directed learning and ability to practice in the system.

Annual Internal Assessment (IA) shall be conducted at the end of each year to assess Theory and Practical skills through OSPE The third annual examination (Preliminary Examination) will be according to the University Summative Assessment format.

In addition, quarterly assessment shall be conducted to cover all domains of learning including professionalism and communication skills. Such assessment shall be used to provide feedback to improve learning.

Quarterly Assessment during the MD training programme shall be based on:

Case presentation, case work up, case handling / management	once a week
Laboratory performance	once a week
Journal club	once a week
Seminar	once a week
Case discussions	once a fortnight/month
Interdepartmental case or seminar	once in 6 months
Attendance at Scientific meetings, CME programmes	at least 01 each in a year

e- log book

During the training period, the postgraduate student shall maintain an e- log book indicating the work done in Departmental teaching programmes including Seminars, Journal clubs, Case discussions etc/Laboratory/Research/ Clinical and other postings. In addition, components of good teaching practices shall be assessed for at least two teaching sessions. The log book entries shall be done in real time. e- log book shall be used for the formative assessment of the student, that shall be checked and assessed periodically by the faculty members as per the appraisal form elaborated in Annexure I. The PGstudents shall be required to produce completed log book in original at the time of final practical examination. It shall be signed by the Head of the Department.

SUMMATIVE ASSESSMENT

The following criteria are mandatory to be eligible to appear for University Examination

a) Course in Research Methodology

All postgraduate students shall complete an online course in Research Methodology. The students shall have to register on the portal of the designated training institutions. The students have to complete the course within one year of the commencement of the course. The online certificate generated on successful completion of the course and examination thereafter, will be acceptable evidence of having completed this course. The above certification shall be a mandatory requirement to be eligible to appear for the final examination of the respective postgraduate course.

b) Training Course in teaching skills

Medical Education Unit (MEU)/ Department of Medical education (DOME) shall train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and will be assessed by faculty.

The postgraduate trainees must participate in the teaching and training program of undergraduate students attending the department.

c) Course in Good Clinical Practice and Good Laboratory Practice

All postgraduate students shall complete course in Ethics including Good Clinical Practices and Good Laboratory Practices, whichever is applicable to them, to be conducted by Institutes themselves or by any other method. The

students have to complete the course within one year of the commencement of the course. No Postgraduate Student shall be permitted to appear in the examination without completing the above course.

d) Course in Basic Cardiac Life Support Skills (BCLS) and Advanced Cardiac Life Support (ACLS)

All postgraduate students shall complete a course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills and get duly certified. The students have to complete the course within one year of the commencement of the course. No Postgraduate Student shall be permitted to appear in the examination without the above certification.

e) PG students shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.

f) The postgraduate trainees must undergo training in information technology and use of computers.

g) Have minimum one Poster presentation or Podium presentation at a National / Zonal / State Conference of his / her specialty.

h) Have minimum one Research paper published in journal of his / her specialty as first author.

i) Dissertation acceptance by all evaluators before the conduct of University Examination.

The summative examination would be carried out as per the Rules given in

POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2023.

The post-graduate examinations should be conducted in 3 parts:

1. Thesis

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. Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. 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 examination. A post graduate student shall be allowed to appear for the Theory and Practical/ Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory Examination

The examinations shall be organized on the basis of 'Grading 'or 'Marking system' 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 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degree examination shall be mandatory.

There should be 4 theory papers:

Paper I	Basic sciences as applied to Pharmacology and General Pharmacology including Toxicology
Paper II	Systemic & Clinical Pharmacology: Autonomic Nervous System Central Nervous System Peripheral Nervous System Autacoids Cardiovascular System Blood Renal System
Paper III	Systemic & Clinical Pharmacology: Endocrinology Chemotherapy Gastrointestinal System Respiratory System Immunomodulators Miscellaneous
Paper IV	Experimentation, Research, Biostatistics Medical Education and recent advances in Pharmacology

4. Practical and oral examination

Obtaining of 50% marks in Practical examination shall be mandatory for passing the examination as a whole in the said degree examination as the case may be. Hence a candidate shall secure not less than 50% marks in each head of examination which shall include Theory and Practical including Viva voce examination. No grace mark is permitted in Postgraduate Examination either for Theory or for Practical.

Practical examination shall be spread over for two days and Viva should be conducted on 2nd day.

Practical Examination Exercises:

a) Long exercises:

- Perform experiments or simulated experiments (as per PG Regulations)
- Protocol design for a given scenario
- Case audit for a given case

b) Short exercises:

- Interpretation of results of a previous tracing - Table exercise
- Demonstration of effects of drugs/interpretation of results in small, animals - optional (as per Regulations notified)

c) Objective Structured Practical Examination (OSPE) Exercises:

OSPE shall be conducted for 100 marks and shall include exercises selected from the following:

- Various drug delivery systems
- Calculating pharmacokinetic parameters
- Pharmaceutical calculations
- Statistical exercise
- Pharmacoeconomics
- Critical appraisal of a published paper
- Abstract writing of a published paper
- Evaluation of drug promotional literature.
- Adverse Drug Reaction (ADR) reporting and causality assessment
- Assessment of preclinical toxicity data
- Analysis of rational and irrational formulations
- Selecting a P-drug and writing rational prescriptions
- Analytical instruments - use and interpretation
- Identifying ethics related dilemmas / mistakes in clinical trial documents

d) Discussion on dissertation : Candidate shall make a presentation for 8-10 min on the dissertation of topic

Oral Viva

- **Grand viva**

SCHEME OF EXAMINATION

The post-graduate examinations should be conducted in 3 parts:

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

A. Theory : 400 Marks

The format of each paper will be same as shown below.

Type of Questions	No. of Questions	Marks for each question	Total marks.
Essay Question	10	10	100
Grand Total			100

Note : The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

B) Practical Examination – 300 marks

	Experiments	Marks
1	Long experiment • Bio assay using isolated tissue • Case discussion • Computer Animal Simulator Experiments (CASL) • Protocol Writing	 60 25 25 30
2	Short experiment Interpretation of results of a previous tracing Short Techniques • Demonstration of effects of drugs/interpretation of results in small animals • Technique Demonstration Journal Critiquing	10 30 25 10
3	Objective Structured Practical Examination (OSPE)	25
4	Dissertation	20
5	Log Book	10
6	Pedagogy	20
	TOTAL	300

C) Viva – Voce Examination: 100 Marks (There shall be 4tables for each examiner & the marks distributed shall be 25 Marks for each examiner)

Grand Viva -The Viva-voce would be on all components of all syllabus.	100 marks

All examiners shall conduct viva-voice conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It shall include all components of course contents and discussion on dissertation also.

D) MAXIMUM MARKS

Maximum marks for M.D. Pharmacology	Theory	Practical	Viva	Grand Total
	400	300	100	800

VII. RECOMMENDED BOOKS (LATEST EDITIONS):

Sl.No	Name of the textbook	Authors	Publishers
1	The Pharmacological Basis of Therapeutics	Goodman & Gilman's	Mc Graw Hill
2	Pharmacology	Rang H. P. & Dale M. M.	Churchill Livingstone
3	Clinical Pharmacology	Laurence D. R., Bennett P. N. & Brown M. J.	Churchill Livingstone
4	Basic and Clinical pharmacology	Katzung B. G.	Mc Graw Hill
5	Lewis's Pharmacology	Crossland J	Churchill Livingstone
6	Fundamentals of Experimental Pharmacology	Ghosh M. N.	Hilton and company
7	Screening methods in Pharmacology	Turner R. A.	Academic Press Inc Ltd
8	Evaluation of Drug Activities : Pharmacometrics" Volume - 1 & 2	Laurence D. R. & Bacharach A. L.	Academic Press Inc Ltd
9	Essentials of Medical Pharmacology	K. D. Tripathi	JAYPEE Brothers Medical Publishers Ltd

10	Pharmacology and Pharmacotherapeutics	R. S. Satoskar Nirmala Rege Raakhi Tripathi Sandhya Kamat	ELSEVIER
11	Lippincott Illustrated Reviews Pharmacology	Sangeeta Sharma and Dinesh K. Badyal	Wolters Kluwer

VIII. RECOMMENDED JOURNALS:

Sl. No.	Name of the Journal
1	Annual Review of Pharmacology and Toxicology
2	Journal of Pharmacology and Experimental Therapeutics (Monthly).
3	Indian Journal of Pharmacology (Bimonthly).
4	Clinical Pharmacology and Therapeutics (Monthly)
5	Journal of Pharmacy and Pharmacology (Monthly).
6	Indian Journal of Experimental Biology (Monthly)
7	Other relevant periodicals available in the library or internet.

Sl. No.	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, Ministry of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi.
2	National Health Policy, Ministry of Health & Family Welfare, Nirman Bhawan, New Delhi.
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.
6	Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi.
7	Mahajan B K, Methods in Bio statistics for medical students, 5th Ed.

Websites:

1. National Guidelines on national programs e.g. https://cdsco.gov.in/opencms/opencms/en/Home
2. MOHFW Website https://www.mohfw.gov.in/
3. WHO Website https://www.who.int/

JOURNAL REVIEW SHEET

Name of the student : Name of the faculty :

Sl.No.	Parameters to assess	Date				
	Title of the paper:					
	Journal Name:					
	Moderator:					
1	Preparation					
	a) Purpose for choosing					
	b) Identifies learning issues					
	c) Reviews relevant information					
	d) Slides					
2	Presentation					
	a) Clarity					
	b) Confidence					
	c) Use of audio visual aids					
3	Critical appraisal					
4	Ability to respond questions					
5	Overall performance					
TOTAL SCORE						

Total points: 50

(SCALE = Poor/ satisfactory-1, Average-2, Good- 3, Very Good - 4, Excellent-5)

SEMINAR EVALUATION SHEET

Name of the student: Name of the faculty:

Sl.No.	Parameters to assess	Date				
	Topic:					
	Moderator:					
1	Preparations					
	a) Depth					
	b) Extent					
	c) Slides					
2	Presentation					
	a) Order					
	b) Clarity					
	c) Use of audio visual aids					
3	Ability to respond questions					
4	Overall performance					
	TOTAL SCORE					

Total points: 40

(SCALE = Poor/ satisfactory-1, Average-2, Good- 3, Very Good-4, Excellent-5)

Annexure 1

Pre / Para / Clinical Name of the Department / Unit :

Name of the PG Student :

Period of Training : FROM ..... TO .....

Student appraisal form for MD in Pharmacology											
	Elements	Less than Satisfactory			Satisfactory			More than Satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	Scholastic aptitude and learning										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Poster publications etc.)										
1.4	Documentation of acquisition of competence (e.g. Logbook)										
1.5	Performance in work-based assessments										
1.6	Self-directed Learning										
2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										

2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional atributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee	Yes	No								
	If not explain										
	Name and signature of the assesse										
	Name and signature of the assessor										
	Date:										

Annexure 2

Criteria for evaluation of dissertation (Tick whichever is appropriate)

Sl. No.	Criterion	Adequate	Inadequate
1	Title of the study		
2	Research Background & Objectives		
3	Research Methodology utilized in accordance with the objectives		
4	Depiction of results		
5	Discussion		
6	Conclusion		
7	References		

POST GRADUATE DEGREE COURSE
M.D IN MICROBIOLOGY

PREAMBLE:

The aim of postgraduate education in Microbiology is to impart requisite clinical, diagnostic, teaching and research skills with appropriate attitude and communication competencies required in the field of Medical Microbiology.

To fulfill these expectations, with the evolving role of clinical microbiologist and prevailing trends of microbial infections the program of MD Microbiology needs to shift focus to clinical aspects of microbiology, where a student is trained in the clinical setting and is able to contribute in the clinical management along with diagnosis, prevention and control of infectious disease.

The new curriculum guide has given more emphasis on training in patient care setting with integration of concepts of microbiology in various clinical specialties through dedicated postings, ward rounds, case discussion etc. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of "domains of learning" under the heading "competencies".

I. GOALS:

The main aim of this course is to train students of Medicine in the field of Medical Microbiology. Theoretical and Practical is given in the sub-specialties viz, Bacteriology, Virology, Parasitology, Immunology and Mycology so that they can participate in good patient care and prevention of infectious diseases in the Community. They are introduced to basic research methodology so that the can conduct fundamental and applied research. They are also trained in teaching methods which should may enable them to take up teaching assignment in Medical Colleges/Institutions.

II. OBJECTIVES:

A candidate upon successfully qualifying in the MD (Microbiology) examinations, should be able to:

a. Be a competent Clinical Microbiologist.

b. Conduct such clinical/experimental research as would have significant bearing on human health and patient care.

c. Interact with the allied departments by rendering services in advanced laboratory investigations.

d. Conduct collaborative research in the field of Microbiology and Allied Sciences.

e. Demonstrate to the students how the knowledge of Microbiology can be used in a variety of clinical settings to solve diagnostic and therapeutic problems.

f. Undertake teaching assignment of Microbiology in a medical college as per CBME.

g. Play a Pivotal role in Hospital infection control, including formulation of antibiotic policy and management of Biomedical waste.

h. Demonstrate ability to plan, execute and evaluate teaching and training assignments efficiently and effectively in Microbiology for undergraduate students as per Competency Based Medical Education (CBME).

i. Identify public health epidemiology, global health patterns of infectious diseases and effectively participate in community outreach and public health programs for investigation, prevention and control of infectious diseases.

j. Demonstrate self-directed learning skills and keep updated with recent advances in the field of clinical microbiology.

The following specific objective are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The objectives may be considered under the following subheadings.

1. Knowledge
2. Skills
3. Human values, ethical practice and communication abilities.

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain:

At the end of the course, the student should have acquired knowledge in the following theoretical competencies:

General Microbiology (GM) & Immunology (IG)

General Microbiology(GM) :

1. Understand the contributions of various pioneers in Microbiology.
2. Describe the types, working principles and applications of Compound microscope, Phase contrast microscope, Dark ground, Fluorescent Polorised microscope & Electron Microscope.

3. Identify various morphological forms of bacteria and other micro- organisms.
4. Understand nomenclature and classification of microbes.
5. Describe the physiology of growth, metabolism and nutrition of bacteria.
6. Understand various sterilization methods, disinfection and lyophilization.
7. Describe various mechanisms of virulence in bacteria and understand their clinical applications.
8. Understand the principles and applications of bacterial genetics and gene cloning.
9. Understand and apply various antibacterial substance used in the treatment of infection and drug resistance in bacteria.
10. Learn normal flora of human body, ecology of hospital environment, air, water, food & milk.
11. Discuss/ Describe host parasite relationship
12. Various Bio-safety issues including physical & biological containment, universal containment, personal protective equipment for biological agents.
13. Various isolation precautions including standard and transmission based precautions.
14. Applications of quality assurance, quality control in microbiology and accreditation of laboratories.
15. Explain the concept and use of information technology (LIS, WHO NET etc.) in microbiology laboratory effectively.
16. Describe types and applications of Bacteriophages in diagnostic and therapeutic of infections
17. Explain the principles and application of recent technological advances, automation, and application of Artificial Intelligence, nanotechnology, biosensors, bioinformatics, etc. in diagnosis & research in Microbiology.

Immunology (IG)

1. Describe the anatomy and physiology of innate immunity.
2. Differentiate between innate and acquired immunity.

3. Discuss structure and function of antigen and antibodies.
4. Understand the function of complement in health and disease.
5. Describe various antigen and antibody reactions with their applications in the diagnosis of various diseases.
6. Understand the mechanisms of cellular and humoral immunity.
7. Classify various types of hypersensitivity reactions and describe their role in various diseases.
8. Recognize various immunodeficiency disorders & autoimmune diseases.
9. Describe the mechanisms of immunotolerance and surveillance.
10. Describe various types of transplants and mechanisms in graft versus host reactions.
11. Understand the role of immunity in tumours and describe various tumour antigens / markers.
12. Understand and apply the role of immunoprophylaxis and immunotherapy in various diseases / disorders.
13. Discuss the scope of qualitative / quantitative estimation of various antigen & antibodies in health & disease.
14. Measurement of immunological parameters
15. Mechanisms and significance of immune-potentiation and Immune-modulation
16. Explain the role of animals in immunology.

Clinical/Systemic Microbiology-I (CM-I)

Discuss in depth about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines in the situations/ scenario given below:

National and international guidelines in infections caused by below infections.

- Infections of various organs and systems of the human body Microbiological basis of infective syndromes of various organs and systems of human body viz.
    1. CVS and blood,
    2. Respiratory Tract Infections,

3. Urinary Tract Infections,
4. Central Nervous System infections,
5. Reproductive Tract Infections, Gastrointestinal Tract infections,
6. Hepatobiliary System,
7. Skin and Soft tissue infections,
8. Musculoskeletal system,
9. Infections of Eye, Ear and Nose etc.

Clinical/Systemic Microbiology-II (CM-II)

Discuss in depth about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines in the situations/ scenario given below:

- Infectious diseases as per the source/risk
- Opportunistic Infections in special and high risk host
- Infections in special situations/ scenario.

Microbiological basis of infective syndromes as per the source/risk e.g. Blood borne, sexually transmitted infections congenital, vector borne, food, air & water borne, zoonotic, laboratory acquired, occupational infections etc. Opportunistic Infections in special and high risk host eg Pregnancy, neonates, geriatrics, diabetics, immunocompromised host due to any reason, patients with Implants/Devices, dialysis etc, Infections in special situations/ scenario -Tropical, Travel related, Emerging/ Remerging Infectious diseases seen commonly, agents of bioterrorism etc.

- Elicit relevant history, interpret laboratory results with clinic-microbiological correlation and develop diagnostic and treatment algorithms.

Bacteria:

1. Describe the morphology, cultural characteristics, biochemical reactions, antigenic structure, virulence factors, pathogenicity, laboratory diagnosis epidemiology of the disease caused, preventive and control measures and recent advances in detail of all the pathogenic bacteria.

2. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major bacterial pathogens of medical importance given below

    a. Gram positive cocci including Staphylococcus, Micrococcus, Streptococcus, Anaerobic Cocci etc.

    b. Gram negative cocci including Neisseria, Branhamella, Moraxella etc.

    c. Gram positive bacilli including Lactobacillus, Coryneform bacteria, Bacillus and aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.

    d. Gram negative bacilli including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas and other non-fermenters, Pasteurella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.

    e. Helicobacter, Campylobacter, Calymmatobacterium, Streptobacillus, Spirillum and miscellaneous bacteria

    f. Enterobacteriaceae

    g. Mycobacteria

    h. Spirochaetes

    i. Chlamydia

    j. Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.

    k. Rickettsiae, Coxiella, Bartonella etc.

    l. Any newly emerging bacteria.

Virology

I. Systemic virology

    a. Knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major DNA viruses of medical importance including Pox viruses, Herpes viruses, Adeno viruses, Hepadna virus, Papova viruses and Parvo viruses etc.

b. Knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major RNA viruses of medical importance including Entero viruses, Toga viruses, Flavi viruses, Orthomyxo viruses, Paramyxo viruses, Reoviruses, Rhabdo viruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human Immunodeficiency Virus, Arbo viruses, Corona viruses, Calci viruses etc.

c. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major Hepatitis viruses

d. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of unclassified viruses and slow viruses including prions

e. Demonstrate knowledge about any newly emerging virus.

Parasitology

Describe the geographical distribution, habitat, morphology, life cycle, immunology, pathogenicity, clinical features, complications, laboratory diagnosis, treatment and prophylaxis of all the Protozoan and Helminthic parasites of medical importance including the recent advances in the field of parasitology.

a. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of Protozoan parasites of medical importance including Entamoeba Free living amoebae, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Microsporidium, Cyclospora Isospora, Babesia, Balantidium, etc.

b. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of helminthes of medical importance including those belonging to Cestoda (Diphyllobothrium, Taenia, Echinococcus, Hymenolepis, Dipyllidium, Multiceps etc.), Trematoda (Schistosomes, Fasciola, Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis etc.) and Nematoda (Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris Toxocara, Enterobius, Filarial worms, Dracunculus etc.)

c. Demonstrate knowledge about common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops, louse, myasis of medical importance.

b. Neglected tropical parasitic diseases

c. Any newly emerging parasite

Mycology

Describe the structure, classification, morphology, reproduction, pathogenesis, clinical features, laboratory diagnosis and epidemiology of all the fungi of medical importance including the recent advances in the field of mycology.

d. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major fungal pathogens of medical importance given below.

   i. Yeasts and yeast like fungi including Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces etc.

   ii. Mycelial fungi including Aspergillus, Zygomycetes, Pseudallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.

   iii. Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffei etc.

   iv. Dermatophytes

   v. Fungi causing Mycetoma, Chromoblatomycosis, Occulomycosis and Otomycosis.

   vi. Pneumocystis jirovecii infection

   vii. Rhinosporidium seeberi and Lacazia loboi (formerly named Loboa loboi)

   viii. Pythium insidiosum

   ix. Prototheca

e. Able to identify laboratory contaminant fungi

f. Explain Mycetism and mycotoxicosis along with agents involved

Any newly emerging fungi

Applied Microbiology(AM)& Recent advances:

a. Demonstrate knowledge about epidemiology of infectious diseases

b. Demonstrate knowledge about antimicrobial prophylaxis and therapy

c. Demonstrate knowledge about hospital acquired infections

d. Demonstrate knowledge about management of biomedical waste

e. Effectively investigate an infectious outbreak in hospital and community

f. Demonstrate knowledge about infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear and nose, septicaemia, endocarditis, haemorrhagic fever etc.

g. Demonstrate knowledge about opportunistic infections

h. Demonstrate knowledge about various sexually transmitted diseases

i. Demonstrate knowledge about principles, methods of preparation, administration and types of vaccines

j. Effectively use information technology (Computers) in microbiology

k. Demonstrate knowledge and applications of Automation in Microbiology

l. Demonstrate knowledge and applications about molecular techniques in the laboratory diagnosis of infectious diseases

m. Demonstrate knowledge in statistical analysis of microbiological data and research methodology

n. Demonstrate knowledge in animal and human ethics involved in microbiology

o. Demonstrate knowledge in safety in laboratory and Laboratory management

p. Role of microbes in non-communicable diseases - infectious agents in origin and progression of non-communicable diseases like cancer, diabetes, musculoskeletal disorder and influence of these microbes on mental health.

B. Affective Domain:

a. Adopt ethical principles in all aspects of his/her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.

b. Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.

c. Provide leadership and get the best out of his team in a congenial working atmosphere.

d. Apply high moral and ethical standard while carrying out human or animal research.

e. Be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed.

f. Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.

g. Communicate effectively with peers, and consultants for better clinical correlation of laboratory findings as well as research.

h. Demonstrate effective communication and attitudinal skill while teaching undergraduate students.

i. Demonstrate altruistic professional behavior with respect, discipline, responsibility, accountability, punctuality and integrity at all times while dealing with patients and their relatives.

C. Psychomotor domain : (skills)

C1 : The postgraduate student should be able to *perform the following and/or interpret the results independently or as a part of a team* :

Laboratory skills :

a. Collect, transport and store appropriate specimens for microbiological investigations.

b. Receive and process clinical specimens after appropriate preparation of samples for the appropriate investigation (centrifugation, extraction, mincing concentration etc.)

c. Processing of samples by various methods like:

   i. Macroscopic/gross examination of samples.

   ii. Choose the most appropriate microscopic method for demonstration of pathogens.

iii. Prepare, examine, and demonstrate microbes in direct smears for diagnosis of infectious disease/s.

iv. Isolate and identify pathogenic microbe from clinical specimens (by conventional & automated methods).

v. Perform, interpret & record antimicrobial susceptibility testing of the isolate.

vi. Perform rapid, conventional and automated serological techniques for diagnosis of infectious diseases and immunological diseases.

d. Maintain records and ensure quality control in microbiology.

e. Maintain and preserve microbial cultures.

f. Operate and maintain instruments used in the laboratory for sterilization and disinfection and patient care with quality control.

g. Operate and maintain common laboratory equipment like microscopes, water bath, centrifuge, incubator, automated culture system, micro-centrifuge, ELISA washer and reader etc.

h. Perform and assess significance of microbial contamination of food, water and air.

i. Biosafety measures - biosafety cabinets, chemical material safety data sheet (MSDS), fire safety, needle stick injury management.

Organisms (Bacteria, Fungi, Virus and Parasites) based Laboratory skills:

- Direct microscopic methods for demonstration of infectious agents:

a. Wet mount examination for - looking for cells and organisms (bacteria, fungi, parasite)

i. Saline mount stool sample - parasitic morphology

ii. Iodine mount-parasitic morphology

iii. KOH for fungi

iv. Negative staining

b. Staining methods

i. Preparation of stains & quality check

ii. Preparation of peripheral blood smears from various samples

iii. Staining techniques - simple, differential, special staining methods - capsule, spore, flagella etc.

iv. Gram Staining

v. Acid Fast staining (with modifications).

vi. Leishman & Giemsa for demonstration of intracellular pathogen bacteria, parasite, fungi etc.

vii. Albert staining.

c. Fluorescent staining

i. Auramine staining - Mycobacterium tuberculosis.

ii. QBC – for malaria.

iii. Calcoflor white staining for fungus

d. Isolation of pathogens

i. Preparation of glass wares

ii. Sterilization procedures

iii. Media preparation-required for isolation & identification

iv. Quality check of all media - functional as well as sterility check and maintenance of the record

v. Inoculation methods of various samples – surface, streak, stab etc depending on sample

vi. Incubation methods - aerobic, anaerobic, microaerophilic, capnophilic depending on the pathogens.

e. Identification of pathogen

i. Colony characters – various characters to be noted in different media.

ii. Staining to identify – Gram's / Alberts / Acid Fast/ Lactophenol cotton blue depending on pathogen.

iii. Motility by hanging drop preparation and other methods.

iv. Biochemical reactions - phenotypic-enzymatic, oxidative fermentative, sugar fermentation, other special tests helping to identify up to species level.

v. Serotyping.

f. Antibiotic Susceptibility Testing

i. Selection of antibiotic disks as per CLSI/EUCAST based on the probable identification of organism - bacteria, fungi.

ii. Detection of drug resistant strains - MRSA, VISA, VRE, ESBL, MBL, CRE etc.

iii. Broth microdilution methods for bacteria and fungi.

- Immunological tests

i. Collection, preparation and storage of samples

ii. Perform Rapid tests / /Latex agglutination/ ICT/ELISA etc

- Molecular tests

i. PCR/RTPCR – all steps till interpretation

ii. CBNAAT

- Biomedical waste management skills.
- Quality control skills in all areas.

Clinical Microbiology Skills (Infectious Disease Case Based Skill)

i. Demonstrate ability to take and interpret the history of infectious disease case.

ii. Be able to clinically examine the case and diagnose.

iii. Take decision for choice of samples to be collected for diagnosis

iv. Suggest optimum choice of antimicrobial agent to be prescribed with reasons.

Infection Prevention and Control Skills-

i. Hand hygiene skills

ii. Donning and doffing of PPE

iii. Transmission based precautions in patient care

iv. Segregation and disposal of biomedical waste in laboratory and hospital

v. Handling of sharps

vi. Post-exposure prophylaxis when exposed to blood and body fluids

vii. Spillage management

viii. Sterilization policy of environment and devices in the hospital as per the latest guidelines.

ix. Calculation of HAI infection rates.

x. Plan & conduct HAI surveillance & infection control audits

C2. Should be able to perform under supervision and/or interpret the results of the following desirable procedures independently or as a part of a team:

1. Demonstration of microbe by:

   i. IF – autoimmune diseases

   ii. IF – antigen demonstration in fungi/viral infection /cellular changes

2. Isolation & Identification using newer automated systems for bacterial identification, Mycobacterial culture and Mycobacterial susceptibility

3. Immunological test

   i. Nephelometry/ turbidometry method for quantitative CRP/ASO/RA test

   ii. Chemi-Luminiscence Immuno Assay

4. Perform molecular & newer diagnostic tests for diagnosis of infectious disease.

C3. Should observe the following procedures independently or as a part of a team and/or interpret the results of: (optional)

1. Demonstration of microbes by Electron microscope

2. Viral culture & identification of growth of viruses

3. Immunological test

   iii. Quantiferon

   iv. Flowcytometry

4. Molecular -

   i. Genome Sequencing methods

   ii. Molecular typing.

TEACHING AND LEARNING ACTIVITIES

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation- based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used.

A. Theoretical Teaching:

1. Lectures:

Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures. Lectures may be didactic or integrated there should be a minimum of 10 lectures per year

2. Journal Club:

Journal clubs are held Min of once in 1-2weeks is suggested. All the PG students are expected to attend and actively participate in the discussion and enter in the log book relevant details. The presentations are evaluated using check list and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator is announced well in advance.

3. Subject Seminar:

Seminars shall be conducted min of once every 1-2 weeks is suggested on the theory question topic. All the PG students are expected to attend and actively participate in the discussion and enter in the log book relevant details. The presentations are evaluated using check list and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator is announced well in advance. The student should be graded by faculty and peers.

4. Teaching Skills:

Post Graduate students teach undergraduate students (eg. Medical, BDS, Nursing, BPT, Allied Courses) by taking demonstrations and lectures. Assessment is made using checklist by medical faculty as well as by the students. Record of their participation is to be kept in log book. Training of Post Graduate students in educational science and technology is recommended. Training by medical education unit.

5. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

6. Laboratory work / Bedside clinics: Minimum- once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department where a student is posted shall moderate the teaching-learning sessions during clinical rounds.

7. Interdepartmental colloquium/scientific society meetings:

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest or clinical cases.

8. Continuing Medical Education Programmes (CME):

All Post Graduate students should attend at least 1 state CME programmes.

9. Conferences:

Attending conference is compulsory. Post-graduate student should attend one national and one state level conference during the course.

10. Research Activities:

The Post-graduate students are encouraged to carry out research activities in the department other than dissertation work.

11. Culture seminars and discussions:

Culture seminars and discussions are held once a week. Which helps in systematic way of identification of all the routine bacteria for first few months followed by identification of rare cultures.

12. Clinical Case/Bed side clinics:

Clinical case seminars are held once a month by processing the clinical samples for isolation and identification of the microbes causing that condition.

Following is the plan of Rotation for Postgraduate students Postings to Diagnostic Laboratories/Hospital/ Community-

Sr. No.	Schedule of Rotation	Duration	Specific Learning Objectives
1	Microbiology laboratory i. Different sections of Bacteriology ii. Media preparation iii. Mycobacteriology iv. Serology/Immuno logy v. Mycology vi. Virology vii. Parasitology viii. Molecular lab Hospital Infection Control including BMW management	Distributed in various section depending upon training & departmental needs	As per the specific objectives in each section, a student is expected to acquire skills from basic to the most recent ones in diagnostic microbiology*.
2	Sample Collection area	Two weeks	To learn pre-analytical parameters & procedures at sample collection area. ● To communicate effectively with patients at sample collection area. ● Learn to demonstrate respect, empathy & confidentiality when dealing with patients, samples and reports. Demonstrate leadership skills in managing the functioning of the lab (staff management, preparing duty roster)

3	Clinical Pathology i. Hematology ii. Histopathology Blood Bank	Two weeks	• Basic knowledge of clinical pathology (as applied to Microbiology) • Inflammation and repair • Intercellular substances and reaction • Pathological changes in the body in bacterial, viral, mycotic and parasitic infections **Clinical Pathology skills:** • Peripheral smear examination • CBC interpretation • Urine examination Pathological investigations and their significance in infectious disease diagnosis. Blood Bank skills: • Transfusion transmitted infection Blood grouping • Screening of blood & blood donors • Counseling skills **Histopathology skills:** • Various stains and staining techniques used in histopathological examination of infectious agents Identification of pathogen and/or pathological changes in tissue sections in infectious diseases.
4.	Clinical Biochemistry	One week	• Basic understanding of biochemistry as applied to immunological/ molecular methods for study of microbial diseases and pathogenesis of infections. Significance of biochemical markers / profile in diagnosis, prognosis and monitoring of infective syndromes like sepsis

5	ICTC /PPTCT/ART	Two weeks	• HIV counseling skills • HIV Testing strategies • HIV Surveillance strategies • Treatment regimens in HIV positive • case, management of drug resistance, and prophylaxis PEP, prevention & management of opportunistic infection
6	Tuberculosis and RNTCP	Two weeks	• Diagnosis of Pulmonary and extra pulmonary TB • Fluorescent Microscopy for TB • Molecular diagnosis • National tuberculosis Elimination Program • Treatment regimens in susceptible and drug resistant TB cases
7	District hospital postings (mandatory) 3rd or 4th semester for 3 months*	Three months*	• Identify types of infections seen in community • Identify lacuna in KAP in community that promote development of infections • Choice of antimicrobials and treatment plan for infections in community • Infection control in community • Should contribute to strengthen the services of the district health system, the diagnostic laboratory services. • Participate in public health programs & research activities

8	Clinical locations – i. Medicine & allied (General Medicine, Respiratory Disease, Skin & Venereal Disease) ii. Pediatrics iii. Surgery & allied (General Surgery, Orthopedic) Obstetric and Gynecology	Two months Posting to be done for morning half of the day	**Depending on the area of posting-** ● History taking and physical examination skills ● Sample collection and transportation skills ● Identification of common infections and make a differential diagnosis ● Choose the appropriate laboratory investigations required for confirmation of diagnosis ● Interpret the laboratory results and correlate them clinically. ● Learn common treatment plan, particularly choice of antimicrobials and identify factors that influence choice of antimicrobials. ● Acquire reasoning and critical thinking required in decision making when dealing with an infectious disease case ● Infection control practices
9	Critical care units- i. Medical ICU ii. Surgical ICU Neonatal/Pediatri c ICU	Three weeks (in morning half day)	● All above in a critical setting along with Availability and choice of specialized investigations necessary for optimum management of a critical patient with ID. Significance and adherence to antibiotic policy and antibiotic stewardship program Infection control in ICU
10	Institutional Super specialty wing if available Dialysis, Oncology, Cardiology etc	One week (morning half day)	● To study infections seen in special situations along with their management & prevention approach
	Total duration of posting outside microbiology laboratory	33 weeks	

*Posting under "District Residency Programme"

Depending upon the objectives to be achieved, feasibility and availability of resources, the rotational postings can be within the hospital or outside the hospital.

During the clinical posting, opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with clinicians in different hospital setting must be scheduled.

The PG student must be tagged along with the resident of the clinical department for bedside case discussion, under the guidance of an assigned faculty. A minimum of five case histories shall be recorded by a student during course of study. The case history must be representative of different type of Infectious Disease (ID) cases likely to be encountered eg., those caused by different microbes in community and hospital setting, HAI, infections in critical care/ ward

setting, infection in different age groups, infections in special host like Immunocompromised host, traveler, specific occupations etc.

The process of recording case histories can begin in first half of 2nd year of PG program, after students have learnt about various infective syndromes. The severity and complexity of cases must progress gradually, with simple community-based infection to begin with. At least one fourth of the cases recorded must have been discussed with the ID specialist or a clinician and their feedback/remarks documented in log book/ portfolio with their signatures.

Documentation of students learning at the end of each posting is required.

Emergency duty

The student is posted for managing emergency laboratory services in Microbiology.

He/she should deal with all the emergency investigations in Microbiology.

13 A. Rotational clinical /community/institutional Postings.(as per table)

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in- depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/ departments and details to be included in the specialty-based Guidelines.

The period of such assignments/ postings is recommended for 33 weeks. Posting schedules may be modified depending on needs, feasibility and exigencies. For facilities not available in the parent institution as well as for additional knowledge and skill, extramural postings may be undertaken.

Suggested specific learning objectives are to be added in the log book. Each candidate is posted to different sections on rotation.

The three-year training programme in microbiology is arranged in the form of rotational postings to different sections/laboratories/departments/disciplines for specified periods.

Student must be posted for various duration in different sections of Microbiology (like Bacteriology, Serology, Virology, Parasitology, Immunology, Mycobacteriology, Mycology and Hospital infection control), patient care areas in hospital (like emergency, OPDs, critical care areas, surgical and medical wards etc) as well as in community outreach programs, so that they can learn specific requirements of each section and participate in patient care and prevention of infectious diseases in the hospital as well as community.

13 B Posting under "District Residency Programme" (DRP):

The Primary goals of the DRP are :

1. To expose the postgraduate residents to the district Health System (DHS) and involve them in all levels of health care services.

2. To acquint residents with the planning. Implementation, monitoring and assessment of outcomes of National Health Programmes.

3. To orient the resident to promotive, preventive, curative and rehabilitative services being provided by various other categories of healthcare professionals under the umbrella of the National Health Mission.

   - A Secondary goal of the programme is also to reinforce medical manpower at the DHS levels and expand the range and quality of services currently provided therin.

   All Postgraduates have to mandatorily undergo the DRP training for three (03) months and complete it satisfactorily, to be eligible to appear in the final examination.

14. Dissertation:

Every candidate pursuing MD degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of a dissertation.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. If a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work to re-inforce the Diversity of knowledge and skills.

15. Training in teaching & learning skills

MEU/DOME would train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

16. E-Log book

During the training period, the postgraduate student should maintain a E-Log Book indicating the duration of the postings/work done in different posting in the Department of Microbiology and in clinical postings. This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The logbook is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The E-log book is to:

a) Help maintain a record of the work done during training.

b) Enable Faculty/Consultants to have direct information about the work done and intervene, if necessary.

c) Provide feedback and assess the progress of learning with experience gained periodically.

The E-Log Book will be used in the internal assessment of the student, will be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed E-log book at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in E-logbook particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program.

17. Course in Research Methodology: All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Assesment

Candidate will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

1. Formative Assesment

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs
6. Professionalism and communication skills(At least five clinical cases shall be assessed through discussion of case histories recorded by the students while posted in clinical setting and recorded along with feedback (preferably by ID specialist if available/clinician).

The students are assessed periodically as per categories listed in postgraduate student appraisal form (Annexure II).

4. SUMMATIVE ASSESSMENT:

The post-graduate examinations is conducted in three parts:

Essential pre-requisites for appearing for examination include:

1. Log book of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.

2. At least one minimum of one poster presentation or podium presentation at national/Zonal/state conference of his / her speciality.
3. Minimum of One research paper should be published in an indexed journal as first author.
4. Completion of online course in research methodology (NPTEL) in first year and submit the completion certificate.
5. Completion of certificate course in ethics including good laboratory practices in the first year.
6. Completion of certificate course in basic cardiac life support (BCLS) and advanced cardiac life support (ACLS) skills in the first year.

1. Thesis.

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. Work for writing the Thesis 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 shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory Examination:

Attendance: 80% of the total working days of the course.

'Theory' as well as 'Practical' separately 50% is mandatory for passing examination as a whole. The examination for M.D./ MS shall be held at the end of 3rd academic year. Candidate will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

Theory: 400Marks

There shall be four question papers, each of three hours' duration. Total marks of each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

Type of Questions	No. of Questions	Marks for each question	Total marks
Essay	10	10	100
Grand total			100

Description	M.D/M.S.
THEORY	
● No. of Theory papers	04
● Marks for each Theory paper	100
Total marks for Theory papers	400
Passing minimum for Theory	200/400 (40% minimum in each paper and an aggregate of 50% in theory to be declared pass in theory)

PRACTICALS	**300**
● Dissertation	20
● OSPE	25 (5 stations x 5 marks)
● Subject specific assessment	255
VIVA	**100**
● Criteria for passing	A candidate in a subject has to score theory and practical + viva separately with a minimum of 50% marks.
● Criteria for passing	A candidate in a subject has to score theory and practical + viva separately with a minimum of 50% marks.

Details of distribution of topics for each paper will be as follows:

Paper I- General Microbiology and Immunology (GM & IG).

Paper II– Clinical / Systemic Microbiology (CM I).

Paper III– Clinical / Systemic Microbiology (CM II).

Paper IV- Recent Advances & Applied Microbiology (AM).

Note : The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

3. Practical and Oral / Viva voce Examination: 400 Marks.

Practical should be spread over TWO days and include the following components:

To elicit competence in practical skills and to discuss differential diagnostic followed by therapeutic aspects.

Sl. No.	Exercise	Marks
1	Bacteriology	80
2	Slide review	30
3	Mycology	30
4	Serology	20
5	Clinical Microbiology	30
6	Virology	25
7	OSPE*	25
8	Parasitology	20
9	Dissertation	20
10	Pedagogy	20
	Total	300

Ex. No	Day -1	Ex. No	Day-2
1	Clinical Microbiology exercise (Give a real clinical case / paper based scenario addressing commonly seen cases in bacteriology / mycobacteriology / virology / mycology / parasitology / HAI / AMR / out break / national project based etc of infectious diseases to the PG for workup and evaluation with respect to case history, basic physical examination, required investigations, interpretation of diagnostic test results, and therapeutic management decisions including prescription of antibiotics,, along with IC practices)	1 cont	Clinical Microbiology exercise - Conclusion
2	Long Exercise- Bacteriology (Mixed culture given with a clinical history representing any specimen collected from respective systemic infection)	2 cont	Long Exercise - Bacteriology conclusion

3	Short Exercise – Bacteriology (Identification of a pure culture)	3 cont	Short Exercise - Bacteriology conclusion
4	Serology Exercise (In a clinical case, choice of test & technique with interpretation of test results)	4 cont	Serology cont. if required
5	Virology techniques (In a clinical case, choice of test & technique with interpretation of test results. Viral serology/ Molecular techniques depending upon availability)	5 cont	Virology cont. if required
6	Mycology (Identification of fungi in a clinical case)	6 cont	Mycology cont. if required
7	Parasitology (In a clinical case, choice of test & technique with interpretation of test results Stool examination, Examination of Peripheral blood smear etc)	10	Dissertation £, (10-15minutes)
8	Slides (Slides including histopathology for microscopic identification & discussion	11	Pedagogy (Candidate is asked to make a presentation for 8 – 10 minutes on a topic given in the beginning of practical examination for UG teaching.)
9	OSPE: * OSPE will have 2 performance stations, 3 interpretation with 5 marks each station.	12	Grand viva

£ Dissertation will be evaluated by external members only.

Viva-voce - Marks : 100

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. Student shall also be given case reports, charts for interpretation. on Bacteriology, Mycology, Virology, Immunology, and Parasitology topics, it will also include recent advances, history and scope of Microbiology.

A. Maximum Marks:

Maximum marks for M.D. Microbiology	Theory	Practical	Viva	Grand Total
	400	300	100	800

The University shall conduct not more than two examinations in a year for any subject, with an interval not less than 4 months and not more than 8 months between the two examinations.

I. RECOMMENDED BOOKS (REFER LATEST EDTIONS):

Sl. No.	Name of the Textbook	Authors	Publishers
1	Medical Microbiology, 3rd Edn, 1991.	Samuel Baron	Churchill Livingstone Inc.
2	Laboratory Diagnosis of Viral Infections, 3rd Edn, 1999	Edmin H Lennette	Newyork Marcel Dekker, Inc.
3	Manson's Tropical Diseases, 22th Edn, 1999. Manson's Tropical Diseases, 24th Edn, 2024	Gordon Cook Farror	London, ELBS.
4	Bergey's Manual of Determinative Bacteriology, 9th Edn, 1994.	John G Holt et al	Maryland, Williams & Wilkins.
5	Manual of Clinical Microbiology, 5th Edn, 1991.	Albert Balows	Washington D.C, American Society for Microbiology.
6	Bailey & Scott's Diagnostic Microbiology, 15th Edn, 2022	Ellen Jo Baron et al	Missouri, Mosby.
7	Clinical Virology, 4th Edn 2017	Douglas D. Richman	Newyork, Churchill Livingstone.
8	Burrows Textbook of Microbiology, 22nd Edn, 1985.	Bob A Freeman	W.B. Saunders.
9	Anaerobes in Human Disease, 1991.	Brian I Suerden & B. S. Drasar	Great Britain, Edward Arnold.

10	Introduction to Diagnostic Microbiology, 7th Ed. Colour Atlas and Textbook of Diagnostic Microbiology. 2017.	Elmer W Koneman et al	Philadelphia, J.B. Lippincott Company.
11	Field Virology, Vol. 1 & 2, 3rd Edn, 1996.	Bernard N Fields et al	Philadelphia, Lippincott-Ramen.
12	Medical Microbiology, A guide to Microbial Infections, Pathogenesis, Immunity, Laboratory Diagnosis and Control, 15th Edn, 2000.	Danial Greenwood et al	London, Churchill Livingstone.
13	Mackie & McCartney Practical Medical Microbiology, 14th Edn, 1996.	J.G. College et al	London, Churchill Livingstone.
14	Hospital Infections, 5th Edn, 2007	John V Bennett & Philip S Brachman	Little Brown.
15	Fundamental Immunology, 7th Edn, 2013.	William E Paul	Newyork, Raven Press.
16	Medical Immunology, 9th Edn, 1997. or Medical Immunology, 07th Edn, 2020.	Stites D. P. Terr AI, Parslow T.G. VirellaG	Appleton & Lange, USA
17	Cellular and Molecular Immunology, 10th Edn, 2022.	Abbas A.K., Lichtman Att	Saunders.
18	Manual of Clinical Laboratory Immunology, 4th Edn, 1992.	Rose N.R., Macario EC	American Society for Microbiology.
19	Essential Immunology, 13th Edn, 2017.	Roitt IM, Delves PJ, Roitts	Blackwell Scientific Publisher.
20	Microbiology and Microbial infections, 10th Edn, 2006.	Topley & Wilson‘s	Arnold.
21	Parasitology (Protozoology & Helminthology) 13 ed, 2019	K D Chatterjee	CBS
22	Diagnostic Medical Parasitology, 6th ed	Lynne shorre Garcia	ASM Press

23	Textbook of Medical Mycology,4 th ed	Jagadish Chander	Jaypee Brothers Medical Publishers
24	Clinical Mycology, 2nd ed	Michael A Pfaller	Churchill Livingstone
25	Medically Important Fungi,6th ed	Larones	ASM Press
26	Medical Microbiology, 9th ed, 2020	Patrik R Murray	ELSEVIER
27	Jawetz And Melnick And Adelbergs, Medical Microbiology.28 Ed, 2019	Riedel. S.; Morse. S.A.	McGraw Hill / Medical

VIII RECOMMENDED JOURNALS:

Sl. No.	Name of the Journal
1	Journal of Medical Microbiology. 2008. Lippincott-Raven Publishers, Pathological Society of Great Britain & Ireland,
2	Clinical Infectious Diseases. 2008. Pub : The University of Chicago Press, Chicago Illinois 60637,
3	Clinical Microbiology Reviews. Pub : The American Society for Microbiology.
4	Microbiology & Molecular Biology Reviews. (mmbr). 2008. Pub : American Society for Microbiology,
5	Journal of Clinical Microbiology (JCM). 2008. Pub : American Society for Microbiology,
6	The Journal of Infectious Diseases. 2008. Pub : The University of Chicago Press,
7	Journal of Communicable Diseases. 2008. Pub : The Indian Society for Malaria and other communicable disease.
8	Infectious Disease Clinics of North America. 2008. Pub : W.B. Saunde Company, A Division of Harcourt Brace & Company,
9	Indian Journal of Medical Microbiology, 2008. Pub : Indian Associates of Medical Microbiologists,
10	The Indian Journal of Medical Research. 2008. Pub : Indian Council of Medical Research, New Delhi.
11	Annual Review of Microbiology, 2008. Pub : Annual Reviews Inc. Palo Alto. California, USA.

ADDITIONAL READING:

Sl. No.	Name of the Textbook	Authors	Publishers
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	*National Health Policy, Min. of Health & Family Welfare,		Nirman Bhawan, New Delhi, 1983.
3	The elements of Research, writing and editing 1994,	Santosh Kumar.	Dept. of Urology, JIPMER, Pondicherry.
4	Medical Education Principles and Practice, 1995.	Srinivasa D K et.al.	National Teacher Training Centre, JIPMER, Pondicherry.
5	*Indian Council of Medical Research, Policy Statement of Ethical considerations involved in Research on Human Subjects, 1982		I.C.M.R, New Delhi.
6	*Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956.		Medical Council f India, Kotla Road, New Delhi.
7	Francis C M, Medical Ethics, 1993.		J P Publications, Bangalore.
8	*Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, 1994.		New Delhi,
9	Internal National Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991; 424-8		
10	Essentials of Medical Statistics , 1st Ed., 1988.	Kirkwood B R.	Oxford : Blackwell Scientific Publications
11	Methods in Bio statistics for medical students. 6th Ed. 1989.	Mahanjan B.K.	New Delhi, Jaypee Brothers Medical Publishers.
12	A Practical approach to PG dissertation.	Raveendran B. Gitanjali	New Delhi, J P Publications, 1998.

Annexure I :

Following are the competencies to be achieved under Antimicrobial Resistance Detection and Prevention:

1. Demonstrate in depth knowledge of classification, mechanism of action and drug resistance of antimicrobials (antibacterials, antiviral, antifungal, antimycobacterial and antiparasitic agents).

2. Explain various phenotypic and genotypic methods used in laboratory for detection of drug resistant strains and their implications in patient care.

3. Demonstrate skills in performing antimicrobial susceptibility testing with calculations of MIC/MBC by various phenotypic and genotypic methods and interpret results as per standard guidelines (CLSI, EUCAST etc).

4. Detect and report bacterial drug resistance by identification of the commonly isolated drug resistant strains (MRSA, VRSA, VRE, CRE, MBL, AMP-C etc) and choose the most appropriate agent for therapeutic use in a specific clinical scenario.

5. Explain the implications of AST result on antimicrobial therapy to clinicians/ colleagues.

6. Communicate effectively with clinicians to guide and create an antimicrobial treatment plan based on organism identification and susceptibility test.

7. Explain the concept of narrow/broad spectrum of antimicrobials, PK/PD parameters and their significance on response to antimicrobial therapy.

8. Explain significance of monitoring of antimicrobial therapy in patient care.

9. Explain the concept of empiric, syndromic and culture-based treatment strategies for treating infections.

10. Explain the need to de-escalate from empirical broad-spectrum therapy to targeted narrow-spectrum therapy.

11. Explain the importance of appropriate use of antimicrobial agents, risk of antimicrobial resistance and spread of AMR in the health care environment and the community.

12. Explain the concept of normal microbial flora, colonization, contamination and infection with its role in deciding antimicrobial therapy.

13. Demonstrate knowledge about antimicrobial prophylaxis including peri-operative surgical prophylaxis regimens.

14. Describe the concept of first-, second- and third-line antimicrobial therapy for infections.

15. Explain the importance of restricted reporting of susceptibility data by the laboratory to control antimicrobial use.

16. Explain the concept and application of WHO tool for optimizing use of antimicrobial agents: Access, Watch and Reserve (AWaRe).

17. Explain the importance of antimicrobial formularies, consumption data and prescribing policies and processes to monitor use of antimicrobials in hospitals.

18. Effectively use information technology (LIS, WHO NET etc.) for data collection and surveillance of AMR in microbiology laboratory.

19. Explain significance of collecting local antimicrobial resistance data and its use in deciding direct empirical antimicrobial therapy.

20. Demonstrate knowledge and skills to develop antibiotic policy by using local AMR data in hospital.

21. Explain significance of adherence to antibiotic policy and antibiotic stewardship program.

22. Be a part of antimicrobial stewardship team for the institution.

23. Demonstrate knowledge about recent published guidelines that recommend antimicrobial treatment therapy in various clinical situations.

24. Effectively communicate with the patients/ relatives about the role of antimicrobial agents in their disease and advice on appropriate use.

25. Actively engage with patients, relatives and the community to advise on the role of antimicrobial agents in therapy and the threat of resistance.

26. Participate in clinical audit and quality improvement programmes relating to antimicrobial use.

27. Teach students, colleagues and other health professionals regarding antimicrobial use and resistance.

Annexure II

Student appraisal form for MD in Microbiology

	Elements	Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	Scholastic aptitude and learning										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned(e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self-directed Learning										
2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										

2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee?		Yes	No							
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										
	Date										

COMPETENCY BASED POSTGRADUTE TRAINING PROGRAMME

MD - FORENSIC MEDICINE & TOXICOLOGY

Preamble:

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

This programme will standardize and strengthen Forensic Medicine and Toxicology teaching at the post graduate level throughout the country so that it will benefit the judiciary and the legal system of the country in providing justice which will ultimately benefit the community at large. It will also help in achieving uniformity in undergraduate teaching.

SUBJECT SPECIFIC LEARNING OBJECTIVES

GOALS

The Goal of MD Forensic Medicine is to train a doctor to become a competent medico-legal expert, teacher and researcher in the subject who:

1. is aware of medico legal aspects in various settings
2. is aware of contemporary advances and developments in the field of Forensic Medicine.
3. has acquired the competencies pertaining to the subject of Forensic Medicine that are required to be practiced at all levels of health system.
4. is oriented to the principles of research methodology.
5. has acquired skills in educating and imparting training to medical, paramedical and allied professionals.

OBJECTIVES

A post graduate student, upon successfully qualifying in the M.D (Forensic Medicine) examination, should be able to:

1. Become an expert in Forensic Medicine.
2. Identify and define medico-legal problems as they emerge in the community and work to resolve such problems by planning, implementing, evaluating and modulating Medico- legal services.

3. Undertake medico-legal responsibilities and discharge medico-legal duties in required settings.
4. Keep abreast with all recent developments and emerging trends in Forensic Medicine, Medical Ethics and the law.
5. Deal with general principles and practical problems related to forensic, clinical, emergency, environmental, medico-legal and occupational aspects of toxicology.
7. Deal with medico-legal aspects of Psychiatry, mental health and drug addiction.
8. Impart education in Forensic Medicine and Toxicology to under-graduate and post- graduate students with the help of modern teaching aids.
9. Assess the students' knowledge and skills in the subject of Forensic Medicine
10. Oriented to research methodology and conduct of research in the subject

SUBJECT SPECIFIC COMPETENCIES

By the end of the course, the student should have acquired knowledge (cognitive domain), professionalism (affective domain) and skills (psychomotor domain) as given below:

A. Cognitive domain

1. Describe the legal and medico-legal system in India.
2. Acquire knowledge on the philosophy and guiding principles of Forensic Medicine course.
3. Describe the programme goals and objectives of the Forensic Medicine course.
4. Acquire knowledge on conduct of medico-legal autopsy independently with required physical assistance, prepare report and derive inferences.
5. Outline the principles and objectives of postmortem examination.
6. Describe the formalities and procedures of medico-legal autopsies in accordance with existing conventions and the law.
7. Identify the role of anatomy, physiology, biochemistry, microbiology, pathology, blood bank, psychiatry, radiology, forensic science laboratory as well as other disciplines of medical science to logically arrive at a conclusion in medico-legal autopsies and examination of medico-legal cases.

8. Describe the principles of the techniques used in toxicological laboratory namely TLC (Thin Layer Chromatography), GLC (Gas Liquid Chromatography), AAS (Atomic Absorption Spectrophotometry), HPLC (High Performance Liquid Chromatography) and Breath Alcohol Analyzer.

9. Describe 1relevant 1 legal/court procedures 010 applicable t o medico-legal/medical practice.

10. Describe the general forensic principles of ballistics, serology, analytical toxicology and photography.

11. Interpret, analyze and review medico-legal reports prepared by other medical officers at the time of need.

11. Describe role of DNA profile and its application in medico-legal practice.

12. Describe 1the 1 law/s relating 10to 10 poisons, drugs, 101 cosmetics, narcotic 01drugs and psychotropic substances.

13. Describe the legal and ethical aspects of Forensic Procedures including Narco-analysis, Brain mapping and Polygraph etc.

14. Describe the medico-legal aspects of Psychiatry, addiction and mental health.

B. Affective domain

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the clinician or other colleagues to provide the best possible opinion.

2. Should be able to follow ethical principles in dealings with patients, police personnel, relatives and other health personnel and to respect their rights.

3. Follow medical etiquettes in dealing with each other.

4. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should acquire following skills and be able to:

1. Perform medico-legal autopsy independently with required physical assistance, prepare report and derive inferences.
2. Perform medico-legal examination of users of alcohol, drugs and poisons and prepare report.
3. Perform medico-legal examination in cases of sexual offences and prepare report.
4. Interpret histo-pathological, microbiological, radiological, chemical analysis, DNA profile and other investigative reports for medico-legal purposes.
5. Perform medico-legal examination of bones, clothing, wet specimens and weapons.
6. Depose as an expert witness in a court of Law on medico-legal matters.
7. Examine, identify, prepare reports and initiate management on medico-legal cases in emergency set up.
8. Identify and discharge all legal responsibilities in medico-legal matters.
9. Plan, organize and supervise medico-legal work in general/teaching/ district hospitals and in any health care set up.
10. Collect, preserve and dispatch various samples and trace evidences to the concerned authorities in appropriate manner.
11. Help and Advise authorities on matters related to medical ethics and medico-legal issues.
12. Discharge duties in respect of forensic, clinical, emergency, environmental, medico-legal and occupational aspects of toxicology.
13. Plan, organize and manage toxicological laboratory services in any health care set up.
14. Provide information and consultation on all aspects of toxicology to professionals, industry, Government and the public at large.
15. Manage medico-legal responsibilities in mass disasters involving multiple deaths like fire, traffic accident, aircraft accident, rail accident and natural calamities.

16. Do interaction with allied departments by rendering services in advanced laboratory investigations and relevant expert opinion.

17. Participate in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.

Time frame to acquire knowledge & skills:

First year of PG programme :

1. Orientation Programme
2. Basic autopsy skills.
3. Orientation to the applied aspects of Anatomy, Physiology, Biochemistry
4. General principles of Forensic Medicine.
5. Introduction to Medical Toxicology.
6. Assisting in scheduling of teaching sessions.
7. Participation in undergraduate teaching.
8. Posting for autopsy work, clinical forensic medicine and toxicology.
9. Participation in departmental activities
10. Participation in seminar, CME, workshop etc.
11. Orientation to organization and functioning of toxicology/research laboratory.
12. Preparation of thesis protocol.
13. Being self-updated with recent advances in the subject

Second year of PG programme:

1. Conduct of autopsy examination without supervision in routine autopsy cases
2. Conduct of autopsy examination with supervision in expert opinion cases.
3. Conduct of theory and practical sessions for undergraduates
4. Thesis and other research work
5. Clinical forensic medicine work for practical experience in medico-legal procedures and on-the-job practical training in medico-legal aspects of emergency medicine, radiology and other clinical disciplines.
6. Orientation to the applied aspects of Microbiology, Pathology, Blood Bank, Psychiatry as related to forensic sciences.

7. Posting for autopsy work, clinical forensic medicine and toxicology laboratory.

8. Attend court summons for cases conducted by themselves or where deputed to attend in cases where an expert is required to depose by Court of Law

Third year of PG programme:

1. Organize teaching sessions and thesis work.

2. Submission of thesis six months prior to examination.

3. Posting for autopsy work, clinical forensic medicine and toxicology laboratory to continue.

4. The PG trainee shall be required to conduct minimum of 100 autopsy cases and minimum of 100 clinical cases during the entire training period.

5. Attend Court summons for cases conducted by themselves or when deputed where an expert is required to depose by the Court of Law.

6. The PG trainee shall be required to attend or accompany an expert to attend a minimum of 20 court summons, of which at least 5 should pertain to clinical cases.

Syllabus

Course contents:

I. General Principles of Forensic Medicine and Toxicology

i. Identify the role of anatomy, physiology, biochemistry, microbiology, pathology, blood bank, psychiatry, radiology, forensic science laboratory as well as other disciplines of medical science to logically arrive at a conclusion in medico-legal autopsies and examination of medico-legal cases.

ii. Describe the basic principles of techniques used in toxicological laboratory namely TLC, GLC, ASS, HPLC and Breath Alcohol Analyzer.

iii. Execute the skills and knowledge expected at undergraduate level.

iv. Basic bedside screening tests to detect common poisons.

II. Basic Sciences and allied Subjects

A. Anatomy : Anatomy of parts and organs of the body which are important from the medico-legal aspect.

i. Describe surface and regional anatomy of head, neck, chest and abdomen.

ii. Describe gross anatomy and blood supply of heart, brain, lungs, spleen, liver and kidneys.

iii. Describe gross anatomy of male and female genitalia.

iv. Describe the comparative anatomy of male and female skeleton.

v. Perform histological examination of various tissues.

vi. Describe the development of foetus.

B. Physiology and Biochemistry : Mechanism of phenomena that are important in the body from the medico-legal viewpoint.

i. Describe mechanism of fluid and electrolyte balance, thermoregulation in newborn and adults, endocrine functions.

ii. Describe physiology of sexual behavior.

iii. Describe physiological functioning of circulatory system, digestive system, respiratory system, haemopoietic system, central nervous system and reproductive system including pregnancy.

C. Pathology : Pathophysiology of vital processes and response mechanisms that modulate tissue and organ reaction to all forms of injury and have a bearing on antemortem and postmortem appearance in medico-legal cases, assessment of the duration of injuries and correlate trauma and disease.

i. Describe pathology of inflammation and repair, immunity and hypersensitivity, Thrombosis and embolism, electric and ionizing radiation injuries, genetic factors in disease, deficiency disorders and malnutrition.

ii. Describe pathology of myocardial infarction, congenital heart diseases, tuberculosis of lungs, cirrhosis of liver, diseases of glomeruli and tubules and interstitial; tissues of Kidney, tumours, endocrine disorders, venereal diseases, spontaneous intracranial hemorrhages.

iii. Describe the pathology of sudden death.

iv. Describe local and systemic response to trauma and patho-physiology of shock.

v. Describe pathology of common infections and infestations of medico-legal significance.

D. Dentistry : Adequate knowledge of dentistry for solution of medico-legal problems like, injuries, age determination and identification, Bite mark analysis, Interpretation of OPG.

E. Radiology : Adequate knowledge of radiological procedures for solution of medico-legal problems.

F. Fundamentals of Forensic Medicine :

i. Describe the general forensic principle of ballistics, serology, analytical toxicology and photography.

ii. Interpret the scene of crime.

iii. Describe role of DNA profile and its application in medico-legal practice.

iv. Examine bloodstains for blood grouping, nuclear sexing, HLA typing, seminal stains and hair for medico-legal purpose.

v. Describe ethical aspects of Forensic Procedures including Narco-analysis, Brain mapping and Polygraph

III. Medical Ethics and Law (Medical Jurisprudence)

i. Describe the history of Forensic Medicine.

ii. Describe the legal and medico-legal system in India.

iii. Describe medical ethics and the law in relation to medical practice, declarations, oath, etiquette, Medical Council of India (NMC Act), disciplinary control, rights and duties of a registered medical practitioner's professional misconduct, consent, confidentiality, medical negligence (including all related issues) and Consumer Protection Act.

iv. Professional Indemnity insurance.

v. Describe medical ethics and law in relation to organ transplantation, biomedical human research and experimentation, human rights, cloning, genetic engineering, human genome, citizen's charter and international codes of medical ethics; Recent advances of Do not Resuscitate.

vi. Describe the ethics and law in relation to artificial insemination, abortion, antenatal sex, foetus, genetics and euthanasia.

vii. Interpret the ethics and law applicable to the human (clinical trials) and animal experimentation.

viii. Describe ethics in relation to elderly, women and children.

ix. Describe medical ethics and law in relation to nursing and other medical services/practices.

x. Understanding about bio-ethics

xi. Socio-ethical issues of hunger strike.

IV. Clinical Forensic Medicine

i. Examine, assess legal implications and prepare report or certificate in cases of physical assault, suspected drunkenness, sexual offences (Women, child, third gender), consummation of marriage and disputed paternity, disputed maternity.

ii. Collect, preserve and dispatch the specimen/material to the concerned authority and interpret the clinical and laboratory findings which are reported.

iii. Examine injured person, prepare medico-legal report and initiate management.

iv. Determine the age and establish identity of an individual for medico-legal purpose.

v. Examine a person and assess disability in industrial accidents and diseases; Assessment as per Labor law and compensation.

vi. Perform examination and interpret findings for medico-legal purposes in cases pertaining to pregnancy, delivery, artificial insemination, abortion, sterilization, Impotence, AIDS and infectious disease.

vii. Describe normal and abnormal sexual behavior and its medico-legal implications.

viii. Examine and assess the medical fitness of a person for insurance, government service, sickness and fitness on recovery from illness.

ix. Examine medico-legal problems related to clinical disciplines of medicine and allied subjects, Pediatrics, Surgery and allied subjects, ENT, Ophthalmology, Obstetrics and Gynecology, Dermatology and Anesthesiology.

x. Examine medico-legal problems related to children, women and elderly.

xi. Identify the cases of torture and violation of human rights and issues thereto

V. Forensic Pathology

i. Apply the principles involved in methods of identification of human remains by race, age, sex, religion, complexion, stature, hair, teeth, anthropometry, dactylography, foot prints, hairs, tattoos, poroscopy and superimposition techniques.

ii. Perform medico-legal postmortem and be able to exhume, collect, preserve and dispatch specimens or trace evidence to the appropriate authority.

iii. Diagnose and describe the pathology of wounds, mechanical and regional injuries, ballistics and wound ballistics, electrical injuries, lightening, neglect and starvation, thermal injuries, deaths associated with sexual offences, pregnancy, delivery, abortion, child abuse, dysbarism and barotraumas.

iv. Describe patho-physiology of shock and neurogenic shock.

v. Describe patho-physiology of asphyxia, classification, medico-legal aspects and postmortem findings of different types of asphyxial deaths.

vi. Diagnose and classify death, identify the signs of death, postmortem changes, interpret autopsy findings, artifacts and results of the other relevant investigations to logically conclude the cause, manner (suicidal, homicidal and accidental) and time of death.

vii. Manage medico-legal responsibilities in mass disasters involving multiple deaths like fire, traffic accident, aircraft accident, rail accident and natural calamities.

viii. Demonstrate postmortem findings in infant death and to differentiate amongst live birth, still birth and dead born.

ix. Perform postmortem examination in cases of death in custody, torture and violation of human rights.

x. Perform postmortem examination in cases of death due to alleged medical negligence as in operative and anesthetic deaths.

VI. Toxicology

i. Describe the law relating to poisons, drugs, cosmetics, narcotic drugs and

   a. psychotropic substances.

ii. Examine and diagnose poisoning cases and apply principles of general management and organ system approach for the management of poisoning cases.

iii. Describe the basic principles of pharmacokinetics and pharmacodynamics of poisonous substances.

iv. Describe the toxic hazards of occupation, industry, environment and the principles of predictive toxicology.

v. Collect, preserve and dispatch material/s for analysis, interpret the laboratory findings and perform the Medico-legal formalities in a case of poisoning.

vi. Demonstrate the methods of identification and analysis of common poisons

vii. Describe the signs, symptoms, diagnosis and management of common acute and chronic poisoning due to:

a. Corrosives
b. Nonmetallic substances
c. Insecticides and weed killers
d. Metallic substances
e. Vegetable and organic irritants
f. Somniferous compounds
g. Inebriant substances
h. Deliriant substances
i. Food Contamination/adulteration.
j. Substances causing spinal and cardiac toxicity
k. Substances causing asphyxia (Asphyxiants)
l. Household toxins
m. Toxic envenomation
n. Biological and chemical warfare
o. Environmental intoxicants
p. Occupational intoxicants

VII. Forensic Psychiatry

i. Explain the common terminologies of forensic importance in Psychiatry.

ii. Describe the medico-legal aspects of Psychiatry and mental health.

iii. Describe medico-legal aspects of drug addiction.

iv. Describe role of Psychiatry in criminal investigation, punishment and trial.

v. Describe the civil and criminal responsibilities of a mentally ill person.

vi. Describe the role of Psychology in criminal investigation, punishment and trial

TEACHING AND LEARNING METHODS

Teaching methodology

1. **Lectures :** Lectures are to be kept to a minimum (10 per year). They may, however, be employed for teaching certain topics. Lectures may be didactic or integrated.

   The course shall be of three years, organized in six units (0-5). This modular pattern is a guideline for the department, to organize training. Training programme can be modified depending upon the work load and academic assignments of the department.

2. **Journal Club & Subject seminars:**

   Both are recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the E-Log Book relevant details. Further, every PG trainee must make a presentation from the allotted journal(s), selected articles and a total of 12 seminar presentations in three years. The presentations would be evaluated and would carry weightage for internal assessment.

3. **Case Presentations :** Minimum of 5 cases to be presented by every PG trainee each year. They will be assessed using check lists and entries should be made in the log book

4. **Clinico-Pathological correlation \ Conference :** Recommended once a month for all post graduate students. Presentation is to be done by rotation. If cases are not available, it could be supplemented by published CPCs.

5. **Inter-Departmental Meetings :** These meetings should be attended by post graduate students and relevant entries must be made in the Log Book.

6. **Teaching Skills :** The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns for which they are trained at Department of Medical Education (DOME).

7. Undertake audit, use information technology tools and carry out research, both basic and clinical, with the aim of publishing his work and presenting his work at various scientific fora.

8. **Continuing Medical Education Programmes (CME) :** At least two CME programmes should be attended by each student in 3 years.

9. Conferences : The student to attend courses, conferences and seminars relevant to the specialty.

10. Rotation :

Other than the Department of Forensic Medicine, student may be posted for training in the following clinical disciplines for a given period of time on rotational basis:

	Place of posting	First year	Second year	Third year
01	Trauma & Emergency / Casualty / Emergency medicine department	1 month	15 days	15 days
02	Radiology	7 days	5 days	3 days
03	Psychiatry	5 days	3 days	2 days
04	Forensic science lab	7 days	15 days	Not required
05	Histopathology	7 days	5 days	3 days
06	Dentistry	7 days	3 days	5 days

11. e-learning activities to be done by the students wherever applicable.

12. District Residency Programme - All post-graduate students under the purview of the National Medical Commission shall undergo a compulsory residential rotation of three months in District Hospitals/ District Health System as a part of the course curriculum. For 2 months they will be posted in Department of Forensic Medicine and Toxicology, Government Medical College (BIMS), Belagavi and 1 month at Primary Health centre. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduate programme – log book to be maintained for the same.

13. All students will do thesis related research and will write thesis.

14. It shall be the duty of the post-graduate students to maintain record (e-Log) books which needs to be updated on a weekly basis about the work being carried out by them during the period of training and get it assessed monthly from their respective guides.

ASSESSMENT

FORMATIVE ASSESSMENT, i.e., during the training

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

Quarterly assessment during the MD training will be Formative Assessment based on following educational activities –

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs / Conferences

Internal assessment will be conducted for the postgraduates at the end of each year which will include both theory and practical. (At the end of First year, Theory – paper I & II and practical will be conducted. At the end of 2nd year, Theory – paper III & IV and practical will be conducted.) Preliminary examination (Theory and Practical) will be conducted prior to University examination as per the University examination format. Practical examinations will be inclusive of OSPE.

The performance of the candidate in the formative and internal assessment will be updated periodically in the student appraisal form (Annexure I).

Eligibility requirements for PG Students in Board Specialty and Super Specialty for appearing in university examination.

i. Have minimum one Poster presentation or Podium presentation at a National/ Zonal/State Conference of his/her specialty.

ii. Have minimum one Research paper published in journal of his/her specialty as first author.

iii. Complete an online course in Research Methodology (NPTEL) in the first year and submit the certificate generated on successful completion of the course and examination.

iv. Complete a certification course in ethics including Good Clinical Practices and Good Laboratory Practices, (whichever is relevant to them) in the first year of the course conducted by institutions.

v. Complete a certification course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) Skills in the first year of the course conducted by the institution.

vi. Thesis acceptance by all evaluators before the conduct of University Examination.

- Attendance: 80% of the working days of the course is mandatory.

SUMMATIVE ASSESSMENT, i.e., assessment at the end of each year

The Postgraduate examination will be in three parts:

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2023.

The examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. 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 practical examination. A PG trainee shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory, dissertation is accepted and the candidate has fulfilled all the eligibility criteria required as mentioned above.

2. Theory Examination:

The examinations shall be organized on the basis of 'Grading 'or 'Marking system' to evaluate and to certify PG trainee'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. shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

A. Theory: 400 Marks

There shall be four papers, each of three hours duration. Total marks of each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

Type of Questions	Number of questions	Marks for each question	Total Marks
Long Essay questions	10	10	100

There shall be four papers each of three hours duration. These are:

Paper I : Basic of Forensic Medicine, basic sciences and allied subjects.

Paper II : Clinical Forensic Medicine and medical jurisprudence.

Paper III : Forensic pathology and toxicology.

Paper IV : Recent advances in Forensic Medicine, Forensic Psychiatry, Medical Toxicology, applied aspects of clinical disciplines and forensic sciences.

THEORY	
No. of Theory paper	04
Marks for each Theory paper	100 marks
Total marks for Theory Paper	400 marks
Passing minimum for Theory	200/400 (40% minimum in each paper)

3. Practical Examination:

Practical examination & Viva-voce would be spread over two days and should be as follows:

PRACTICAL		
1.	Dissertation presentation	20 marks
2.	OSPE	30 marks (6 stations x 5 marks)
3.	Long Case	100 marks
4.	Short Cases	2 x 40 = 80 marks
5.	Subject specific assessment	70 marks
Total		300 marks

Passing minimum for Practical's 150/300 (50%)

1. Dissertation presentation – 20 marks.

Dissertation will be evaluated by the 2 external examiners from outside state for 10 marks each. They will look into Timely collection and compiling of data, proper statistical analysis if any, results discussion and conclusion. They will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce.

2. OSPE – 6 stations of 5 marks each

i. Station 1 – Microscopic slide 1

ii. Station 2 – Toxicological specimen 1

iii. Station 3 – X-ray

iv. Station 4 – Photograph

v. Station 5 – Microscopic slide 1

vi. Station 6 - Toxicological specimen 1

3. Long case – Adult / Fetal autopsy or Organ dissections – 100 marks

4. Short Cases – 2 cases 40 marks each

i. Examination of Victim and accused of sexual assault.

ii. Examination and certification of injuries followed by Weapon examination.

5. Subject Specific Assessment exercises – 6 exercises – 70 marks

i. Skeletal remains examination – 10 marks

ii. Age estimation by physical, dental and radiological examination – 10 marks

iii. Examination and certification of mentally ill person – 10 marks

iv. Examination and certification of drunkenness – 10 marks

v. Expert opinion – 10 marks

vi. Pedagogy – 20 marks

VIVA-VOCE – 100 marks

- Viva-voce examination – 100 marks

Maximum marks for M.D. in Forensic Medicine & Toxicology	Theory	Practical	Viva	Grand Total
	400 marks	300 marks	100 marks	800 marks

The candidate shall secure not less than 50% marks in each head of passing which shall include

(1) Theory – aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%)

(2) Practical/Clinical and Viva voce - aggregate 50%

(3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination.

No grace mark is permitted in post-graduate examination either for theory or for practical.

Day 1

- Short Cases – 2 cases
- Subject Specific Assessment exercises - 5 exercises
- OSPE – 6 stations

Day 2

- Long case – Adult / Fetus Adult / Fetal autopsy or Organ dissections.
- Dissertation Presentation.
- Pedagogy - For assessment of research/teaching ability
- Grand Viva Voce.

* The University shall conduct not more than two examinations in a year for any subject, with an interval of not less than 4 months and not more than 8 months between two examinations.

Recommended Reading

Books (latest edition)

1. Subramanyam BV. Modi's Medical Jurisprudence and Toxicology. Butterworths India, New Delhi.
2. Nundy A. Principles of Forensic Medicine, New Central Book Agency Calcutta.
3. Lyon's Medical Jurisprudence for India. Delhi Law House, Delhi.

4. Reddy KSN. The Essentials of Forensic Medicine and Toxicology, K. Saguna Devi Publishers, Hyderabad.

5. Parikh CK. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology, CBS Publishers and Distributors, New Delhi.

6. Bernard Knight. Forensic Pathology. Arnold Publishers London.

7. Di Maio VJ, Di Maio D. Forensic Pathology. CRC Press New York.

8. Camps FE. Gradwohl's legal Medicine. Bristol: John Wright and Sons Ltd.

9. American College of Legal Medicine Textbook Committee. Legal Medicine Mosby Publishers, USA.

10. Di Maio VJM. Gunshot Wounds, CRC Press USA.

11. Gordon I, Shapiro HA, Berson SD. Forensic Medicine – A Guide to Principle. Churchill Livingstone New York.

12. Mant AK. Taylor's Principles and Practice of Medical Jurisprudence, Churchill Livingstone, New York.

13. Parikh CK. Medicolegal Postmortems in India. Medical Publications, Bombay.

14. Gresham GA, Turner AF. Postmortem Procedurs An illustrated Text Book. Wolfe Medical Publications.

15. Ludwing J. Current Methods of Autopsy Practice. WB Saunders Company, London.

16. Gordon I, Turner R. Medical Jurisprudence E and S Livingstone Ltd. London.

17. Spitz WU, Fisher RS. Medico-legal Investigation of Death. Charles Thomas Publishers.

18. Schroeder O.C. Dental Jurisprudence. PSG Publishing Company, Littleton, Massachussetts.

19. Stark MM. A Physicians Guide to Clinical Forensic Medicine. Humana Press Totowa, New Jersey.

20. Olshakar JS, Jackson JS. Jackson MC, Smock WS. Forensic Emergency Medicine. Lippincott William and Wilkins, Philadelphia.

21. Norah Rudin, Keith Inman. An introduction to Forensic DNA Analysis. CRC Press, London.

22. Robertson J, Ross AM, Burgoyne LA. DNA in Forensic Science - Theory, Technique and Application. Ellis Horwood, UK

23. Curry AS. Method of Forensic Science Vol. I-III. Inter-science Publishers London.

24. Clement JG, Ranson DL. Craniofacial Identification in Forensic Medicine. Arnold Publishers, London.

25. Sellier GK, Kneubuechl BP. Wound Ballistics and the scientific background. Elsevier, Amsterdam.

26. Bernard Knight. Simpson's Forensic Medicine. Arnold Publishers London.

27. Bernard Knight. Legal aspects of Medical Practice. Churchill Livingstone New York.

28. Gunn and Taylor. Forensic Psychiatry Clinical, Legal and Ethical issues. Butterworth Heinemann

29. G Gustafson. Forensic Odontology. Staples Press.

30. Gonzalez TA. Legal Medicine, Pathology and Toxicology - Appleton Century-Crofts Inc. New York.

31. Hirsch CS, Morris RC, Moritz AR. Handbbok of Legal Medicine. CV Mosby Company London.

32. Lincoln PJ, Thomas J. Forensic DNA Profiling Protocols. Methods in Molecular Biology, Vol. 98, Humana Press, Totowa, New Jersey.

33. Lee HC, Gaensslen RE. DNA and other polymorphism in Forensic Science. Yearbook Medical Publishers, London.

34. Bergaus G, Brinkmann B, Rittner C. Staak M. (Eds.). DNA Technology and its Forensic Application. Springer- Verlag. Berlin

35. Beveridge A. Forensic Investigation of Explosions. Taylor and Francis USA.

36. Jay Dix. Colour Atlas of Forensic Pathology. CRC Press New York.

37. Bernard Knight. (ed.) The Estimation of Time since Death in the early Post Mortem Period. Arnold Publishers London.

38. Mant AK. Modern Trends in Forensic Medicine 1-3. Butterworth, London.

39. Luntz and Luntz. Handbook for Dental Identification. JB Lippincott. Toronto.

40. Buttler JM. Forensic DNA Typing. Academic Press New York.

41. Mason JK. Forensic Medicine- an illustrated reference. Chapmann and Hall, London.

42. Mason JK. Paediatric Forensic Medicine and Pathology. Chapmann and Hall, London.

43. Patnaik VP. MKR Krishnan's handbook of Forensic Medicine. Paras Publishing.

44. Lundquist Frank. Methods of Forensic science, vol. II, Interscience publishers.

45. Mehta HS. Medical, Law and Ethics in India. The Bombay Samachar Pvt. Ltd.

46. Gaur's firearms, Forensic Ballistics, Forensic Chemistry and Criminal Jurisprudence. Law Publishers (India) Pvt. Ltd. Allahabad.

47. Tedeschi Eckert. Forensic Medicine Vol. I -IV, WB Saunders Company.

48. Polson, Gee, Knight. The Essentials of Forensic Medicine. Pergomann Press, UK.

49. Redsicker DR. Forensic Photography, CRC Press USA.

50. Krogmann. Human skeleton in Forensic Medicine.

51. Abdullah Fateh. Handbook of Forensic Pathology

52. Simpson K. Taylor's Principle and Practice of Medical Jurisprudence. Vol. I-II.

53. Krishan Vij. Textbook of Forensic Medicine and Toxicology, Churchill Livingstone.

54. Pillay VV. Textbook of Forensic Medicine and Toxicology, Paras Publishing, Hyderabad.

55. Mukherjee JB. Textbook of Forensic Medicine and Toxicology, Arnold's Publishers, London.

56. Henry J, Wiseman H. Management of Poisoning. Published by WHO, UNEP and ILO.

57. Flanagan RJ et al. Basic Analytical Toxicology. Published by WHO, UNEP and ILO.

58. Guidelines for Poison Control. Published by WHO, UNEP and ILO

59. Genetics in Medicine – J. S. Thompson and M.W. Thompson.

60. Research – How to plan, speak and write about it – C. Hawkins and M. Sorgi.

Journals

International Journals

1. Medicine, Science & the Law
2. American Journal of Forensic Medicine & Pathology
3. Egyptian Journal of Forensic Sciences
4. Forensic Science International
5. Australian Journal of Forensic Sciences

National Journals

1. Journal of Indian Academy of Forensic Medicine
2. Journal of South India Medicolegal Association
3. Journal of Indian Society of toxicology
4. Journal of Forensic Medicine Science and Law
5. Journal of Forensic Medicine and Toxicology
6. Indian Journal of Forensic Medicine and Pathology

Annexure 1

Postgraduate Students Appraisal Form Para – Clinical Disciplines

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory			Satisfactory			More Than Satisfactory			Remarks
		1	2	3	4	5	6	7	8	9	
1.	Journal based / recent advances learning										
2.	Patient based / Laboratory or Skill based learning										
3.	Self-directed learning and teaching										
4.	Departmental and interdepartmental learning activity										
5.	External and Outreach Activities / CMEs / Conferences										
6.	Thesis / Research work										
7.	Log Book Maintenance										

Publications Yes / No

Remarks*

*REMARKS : Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE **SIGNATURE OF CONSULTANT** **SIGNATURE OF HOD**