

Dr. M.G.R. EDUCATIONAL AND RESEARCH INSTITUTE
Deemed to be University

Maduravoyal, Chennai – 600 095, Tamilnadu, India
(An ISO 2001:2018 Certified Institution)

University with Graded Autonomy Status



SYLLABUS & CURRICULUM
for
M.D. ANATOMY

2020 onwards

Sponsored by

Dr. M.G.R. EDUCATIONAL AND RESEARCH INSTITUTE TRUST

M.D. ANATOMY

INDEX

1. Goals
2. Objectives
3. Course contents
4. Teaching and Learning Methods
5. Posting
6. Thesis
7. Assessment
8. Suggested books & References

1. GOALS

The goal of MD course in Anatomy is to produce a trained ,competent anatomist who has comprehensive knowledge of all aspects of anatomy (Gross, Microscopic, development, clinical applications and recent advances) and is oriented to the principles of research methodology and has skills in educating medical and paramedical professionals.

2. OBJECTIVES

After completing the 3 year course in MD Anatomy, the student must achieve the following skills & Competencies:

1. Acquire competencies in Gross and Surface Anatomy, Neuroanatomy, Embryology, Genetics, Histology, Radiological anatomy, Applied Aspects and recent advances.
2. Acquire necessary dissection skills, embalming tissue preparation, staining and museum preparation.
3. Must motivate and devise innovative teaching & research strategies in order to collaborate in integrated teaching and research.
4. Acquire attitude and communication skills to interact with colleagues, teachers & students.
5. To be relevant and responsive to the needs of student community.

3. COURSE CONTENTS

A. Theory

1. History of Anatomy
2. General Anatomy
3. Elements of Anatomy
4. Gross Human Anatomy including Cross Sectional Anatomy and Applied Anatomy

5. Principles of Microscopy and Histological techniques.
6. General and Systemic Histology
7. General, and Systemic Embryology including Growth, Development and Teratology
8. Neuro Anatomy
9. Surface Anatomy
10. Radiological Anatomy including Principles of newer techniques and interpretation of CT Scan, Sonography and MRI
11. Human Genetics.
12. Museum Techniques, embalming techniques including medico legal aspects, and knowledge of Anatomy Act
13. Medical ethics
14. Recent Advances in Anatomy
15. To incorporate PBL training under different sections during PG training. One such example in Museum setting is enclosed.

B. Practical

1. During the course-the PG students should dissect the entire human cadaver
2. They should embalm and maintain the record of embalming work done
3. They should prepare and mount at least 10 museum specimens
4. In Histology section
Collection of tissues, fixing, block making, section cutting: use of different types of microtomes and preparation of general and systemic slides Haemotoxylin& Eosin –
 - i. Preparation of stains
 - ii. Staining techniques

Knowledge of special staining techniques like Silver Nitrate, PAS staining, Osmium Tetroxide, Van Gieson etc.

Embryo (Chick embryo) mounting and serial sections of embryo should be taken, stained with Haematoxylin and Eosin.

Knowledge of light Microscope and electron microscope

Detailed microscopic study of all the tissues (General and Systemic slides)

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. Demonstrate knowledge about 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. Demonstrate knowledge about 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. Demonstrate knowledge 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. Demonstrate knowledge 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. Demonstrate knowledge about common techniques employed in cellular immunology and histocompatibility testing.
16. Demonstrate applications of knowledge of 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, cryobanking 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. Demonstrate knowledge about different anthropological traits and use of related instruments.
22. Demonstrate knowledge about 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

- i. Demonstrate self-awareness and personal development in routine conduct. (*Self awareness*)
- ii. Communicate effectively with peers, students and teachers in various teaching learning activities. (*Communication*)
- iii. 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*)
- iv. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
- v. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure. (*Equity and social accountability*)

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 tanks for preserving bodies
- 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

2. HISTOLOGY

- 2.1 Preparation of common fixatives embalming fluid 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 file in which LM and EM 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:

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.
- ❖ Physiological correlations of congenital anomalies.

SECTION - 3

HISTOLOGY (Microscopic Anatomy) 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.

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, Cross Sectional anatomy of brain and spinal cord.
- ❖ 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 including barium studies, cholecystography, pyelography, salphingography. Normal CT Scan, MRI and Ultrasound.

ANTHROPOLOGY

- ❖ Different anthropological traits, Identification and use of Anthropological instruments.

FORENSIC MEDICINE

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

- ❖ Outline of comparative anatomy of the whole body and basic human evolution

4. TEACHING AND LEARNING METHODS

Teaching Methodology

During the course, students should have formal training in teaching and research. The sessions should be in the form of:

1. Didactic Teaching
Topics in gross, surface and cross sectional anatomy, microanatomy, embryology, neuroanatomy, histochemistry, and genetics taught by faculty members.
2. Training in communication skills- journal club, seminars, demonstrations, tutorials, lectures, quizzing.
3. Hands-on experience - techniques in microanatomy, neuroanatomy, gross anatomy, embryology, histochemistry, genetics, microscopy. Embalming and preservation of cadavers
4. Teaching: participate in the teaching and training programme of undergraduate students and interns.
5. Participate in seminars, symposia, group-discussions and Journal clubs.
6. Educational technology - preparation of Audio Visual aids for teaching, posters/manuscripts for presentation in conferences/workshops and publication in journals.
7. Participation in formulating evaluation methods: Setting objective questions, Short Answer Questions, Multiple Choice Questions and Objective Structured Practical Examination (OSPE).
8. Prepare teaching modules and museum specimens.
9. Participation in organization of symposia/workshops
10. Explain and interpret normal radiological anatomy and sectional anatomy of the human body as studied by various imaging techniques.
11. Comprehend and demonstrate surface and living anatomy of the human body.

12. Relate forensic anatomy to the study with medico-legal aspects of bone in particular.
13. Explain the general principles of Anatomy Act and Organ Transplantation Act.
14. Comprehend ethical aspects of biomedical research.
15. Comprehend the basis of disposal of biomedical waste.
16. Comprehend horizontal integration of various subdivisions of anatomy with relevant physiology and biochemistry.
17. Log Book: Every student should maintain a logbook in which a record of the practical exercises completed should be entered. The Log books shall be checked and assessed periodically by the faculty members imparting the training.
18. A postgraduate student of a postgraduate degree course in broad specialties/super specialties would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.
19. Department should encourage e-learning activities.

Suggested outline for the course:

FIRST YEAR

Teaching	Should get involved in teaching of Gross Anatomy/applied to first year MBBS students during dissection hours on all working days	12 hrs/week
	Should get involved in small group teaching session– teaching of bones and microscopic slides of histology– demonstration classes	Osteology 4hrs/week Histology 4hrs/week

Learning	Should be posted in departments of Medical and Surgical Disciplines and in Cytogenetics to acquire surgical anatomy skills and knowledge of clinically oriented problems	About one month in each department
Laboratory skill	Should assist and guide first year MBBS students in the dissections of the cadaver. Should assist and guide in identification of general & systemic histology slides of various tissues and organs for MBBS students. Should acquire knowledge and be acquainted with the knowledge of various types of microscopes their configuration and applications. Should acquaint him/herself with and necessary training in computer operations for data retrieval and power point presentations etc. for teaching & research.	12 hrs/week Histology 4hrs /week
Research	Should get involved in preparation of research protocol for PG dissertation work– selection of problem, literature search, application of methods, selection of material, methods of analysis of data and hypothesis. Discussion with Supervisor/ Guides & Coguides	2 hrs/week

SECOND YEAR

Teaching	Should get involved in teaching of Gross Anatomy/applied to first year MBBS students during dissection hours on all working days	12 hrs/week
	Should get involved in small group teaching sessions—teaching of bones and microscopic slides of histology—demonstration classes. Should be involved in correction work/assessment by Periodic Notified Test conducted for the first year MBBS students— both in theory and practical including viva voce.	Osteology 4hrs/week Histology 4hrs/week
Learning	Communication skills and knowledge through seminars and journal clubs	2 hrs/week
Laboratory skill	In addition to the above, candidate should acquire the necessary training in 1. embalming of cadavers of all types 2. tissue processing viz. fixation, dehydration, clearing and embedding 3. staining— routine hematoxilin and eosin staining 4. special staining for epithelium, connective tissue, muscle, gland & nervous tissue 5. museum technique – mounting of specimens for museum both wet and dry, making of various type of models, injection corrosion cast & 6. plastination techniques. Cytogenetics techniques— cell culture, harvesting and processing blood samples for karyotyping. Various types of banding techniques.	

	<i>Optional</i> (If facilities available) Automated karyotyping using software	
Research	Maintenance of work book/logbook pertaining to dissertation work undertaken and the same to be documented in electronic format. Discussion with Supervisor/Guides & Co-guides	2 hrs/week

THIRD YEAR

Teaching	Should get involved in teaching of Gross Anatomy/applied to first year MBBS students during dissection hours on all working days	12 hrs/week
	Should get involved in small group teaching session–teaching of bones and microscopic slides of histology–demonstration classes	Osteology 4hrs/week Histology 4hrs/week
	Should be involved in correction work / assessment of Periodic Notified Test conducted for the first year MBBS students– both in theory and practicals including viva voce.	
	Should be involved in organizing/delivering lectures for first year MBBS students on selected topics of interest in Gross Anatomy, Human Embryology & Medical Genetics Learning programmes.	12 hrs/week
Learning	Should obtain the necessary skills in delivering lectures through computer assisted teaching – Power point presentation	
Laboratory skill	Should have equipped appropriately with the guidelines required to undertake and perform	Minimum of two cadavers Should

	<p>embalming procedures.</p> <p>Should be aware of Anatomy Act and other Techniques tissue processing viz. fixation, dehydration, clearing and embedding, staining– routine hematoxylin and eosin special for epithelium, connective tissue, muscle, gland & nervous tissue museum technique – injection corrosion cast, resin cast of organs and plastination technique.</p>	<p>submit a minimum of five H&E slides and at least one model of any one among the procedures stated</p>
Research	<p>Discussion with Supervisor/Guides & Co-guides to achieve the following:</p> <p>Analyze the data of dissertation work and present it comprehensively in the required format</p> <p>Should attend and present the work done on dissertation in Scientific bodies – either in the regional or at national conferences.</p> <p>Should be aware of ethical issues related to human and animal investigative procedures.</p>	<p>In the scheduled time</p> <p>Minimum one paper 2 hrs/week</p>

The candidate shall attend all the Undergraduate Theory and Practical Classes regularly.

5. POSTING

The candidate shall attend all the Undergraduate Theory and Practical Classes regularly. Clinical postings of PG students shall be made in **II year** of the course as follows: Objectives of these postings – to learn the following from the respective postings

- | | | |
|--------------------------|---|---------|
| 1. General Surgery | - | 1 week |
| 2. Orthopedics | - | 1 week |
| 3. Radio diagnosis | - | 2 weeks |
| 4. Pathology | - | 2 weeks |
| 5. Forensic Medicine | - | 1 week |
| 6. Genetics / Pediatrics | - | 2 weeks |

LEARNING OBJECTIVES

i. **Pathology**

- i. Special staining techniques at least one hands on experience.
- ii. Principle of Frozen microtomy or Cryostat, Electron microscopy

ii. **Forensic Medicine**

- i. Anthropometry and age estimation
- ii. If embalming is not available in Anatomy department, it should be learnt in Forensic Medicine

iii. Any other topics relevant to Anatomy

iii. **Radio diagnosis** - Principles and recent advances in the following: CT, MRI, USG plain & contrast radiography

iv. **General Surgery** - Laparoscopic and Endoscopic visualization of viscera

v. **Orthopaedics** - Arthroscopic visualization of structures, nerve injury cases etc.,

vi. **Genetics / Paediatrics** - Syndromes and Karyotyping, Counseling

At the end of the posting, a certificate has to be obtained from the concerned heads of the departments for satisfactory learning.

During the three years of the course, the Postgraduate students shall take part in teaching undergraduate students in gross anatomy, histology, tutorials, group discussions and seminars

SEMINARS & JOURNALS REVIEW MEETINGS

The postgraduate students should actively participate in departmental seminar and journal reviews. A record showing the involvement of the student shall be maintained. A dairy should be maintained. Seminars journal review are suggested to be conducted alternatively once in every 15 days. These are to be assessed by the faculty.

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

JOB RESPONSIBILITIES

FOR TEACHING

1. Be able to take a class using audiovisual aids right from the blackboard-chalk to laptop & multimedia projection.
2. Must be able to make good museum specimens
3. Must be well versed with making power point presentations & construct multiple choice questions.
4. Must be well versant with all radiological & Imaging techniques.
5. Must attend all lecture classes conducted by senior teachers & professors during the 3 years tenure as postgraduate .
6. Must play an active role in table teaching in all practical classes.

FOR RESEARCH WORK

1. Must look up to references from recent journals & present seminars
2. Must familiarize themselves with standard methods of preparing a bibliography and preparation of manuscripts & illustrations for publications.

ESSENTIAL SKILLS

1. To embalm cadavers independently.
2. Collection of tissues for histology, preservation, processing for paraffin block and sectioning, staining with H & E & other special stains, mounting & identification.

6. THESIS

During the course of study every candidate has to prepare a dissertation individually, on a selected topic under the direct guidance and supervision of a recognized postgraduate teacher as per MCI regulations. The suggested time schedule for dissertation work is:

1. Preparation work for dissertation synopsis including pilot study and submission of the synopsis to the University within 6 months from the commencement of course or as per the dates notified by the University from time to time.
2. Data collection for the dissertation and writing the dissertation.
3. The candidates shall report the progress of the dissertation work to the concerned guide periodically and obtain clearance for the continuation of the dissertation work.
4. Submission of the dissertation six months prior to the final examination or as per the dates notified by the University from time to time.

Registration of dissertation topic. Every candidate shall submit a synopsis in the prescribed proforma for registration of dissertation topic by the University after it is scrutinized by the PG training cum Research Committee of the concerned institution.

The synopsis shall be sent to within the first 6 months from the commencement of the course or as notified by the University in the calendar of events, to the Registrar (Academic).

Submission of dissertation The dissertation shall be submitted to the Registrar (Evaluation) of the University six months prior to the final examination or as notified in the calendar of events. Approval of the dissertation by the panel of examiners is a prerequisite for a candidate to appear for the University examination.

7. ASSESSMENT

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.

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 and
- There will be periodical examinations during the course of training. The pre-final theory and practical examination will be conducted by the department. During last six months the post graduate student will have weekly assessment tutorials conducted by the faculty. All activities will be evaluated.

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.

Quarterly assessment during the MD training should be based on:

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

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

COMPETENCY ASSESSMENT: OVERALL:

- | | | |
|--|---|-----------------|
| 1) a) Communication / commitment / Contribution /
Compassion towards patients and Innovation | - | 5 Marks |
| b) Implementation of newly learnt techniques/skills | | |
| 2) Number of cases presented in Clinical Meetings/
Journal clubs/seminars | - | 5 marks |
| 3) Number of Posters/Papers presented in Conferences/
Publications and Research Projects | - | 5 marks |
| 4) No. of Medals / Certificates won in the conference /
Quiz competitions and other academic meetings with details. | - | 5 marks |
| TOTAL= | | 20 marks |

SUMMATIVE ASSESSMENT

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./ MS 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** : Gross Anatomy
- Paper II** : Embryology, Microscopic Anatomy and Genetics
- Paper III** : Neuroanatomy
- Paper IV** : Applied Human Anatomy and recent advances in anatomical Sciences

Theory Papers

Paper I: Gross Anatomy

- a). Gross Anatomy of whole human body i.e. upper limb, lower limb thorax, abdomen, pelvis, head and neck
- b). Method of preservation of human body and its parts, radiological anatomy, sectional anatomy.

Paper II: Embryology, Microscopic Anatomy and genetics

- a). General Principles of genetics, Cytogenetic as applicable to medicine and different genetic disorders, gene therapy.
- b). General Embryology, Systemic Embryology, methods of experimental embryology, clinically oriented embryology and teratology
- c). Histology (including fine structure) of tissues and organs of the body.

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

Paper III: Neuroanatomy

Neuroanatomy - gross and applied aspects

Paper IV: Applied Human Anatomy and recent advances in medical sciences

- (a) Clinical and applied aspect of Anatomy
- (b) Recent advances in the application of knowledge of anatomy on human body
- (c) Collection, maintenance and uses of stem cells
- (d) Cryobanking
- (e) Basics of principles of organ donation from recently dead bodies.

** The topics assigned to the different papers are generally evaluated under those sections. However, a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.*

3. Practicals: spread over a minimum of 2 days

First Day Practical:

(a): Gross Anatomy

Dissection and related viva voce

(b): Histology

Spotting (10 spots) and viva voce

Techniques paraffin block making, section cutting. 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

Practical and Oral/Viva-Voce Examination

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 & ultrasonographs.

SCHEME OF EXAMINATION

A. THEORY EXAMINATION

There shall be four question papers, each of three hours duration. Each paper shall consist of 10 short essay questions carrying 10 marks each. Total marks for each paper will be 100.

Paper I	= 100 Marks
Paper II	= 100 Marks
Paper III	= 100 Marks
Paper IV	= 100 Marks
Total	400 Marks

B. Practical and Viva-voce Examination**Total 300 Marks**

DAY 1	<u>PRACTICAL I</u> Gross Anatomy - Dissection	75 marks
	<u>PRACTICAL II</u> Histology (Spotters, Embedding + Section Cutting + Staining) Breakup Details 1. Spotters & Discussion (10 Slides) - 50 Marks 2. Embedding of one Paraffin Block - 05 Marks 3. Section Cutting – 10 Marks 4. Staining of one Paraffin section – 10 Marks	75 marks
DAY 2	<u>PRACTICAL III</u> OSPE (20 Stations) - 40 marks Embryology Slides - 5 marks Neuroanatomy Slides - 5 marks Pedagogy (Microteaching) Viva	50 marks 40 marks 60 marks
TOTAL		300 marks
MINIMUM REQUIRED FOR PASS (50 %)		150 marks
DISSERTATION		Approved /Not Approved

Maximum marks for M.D. Anatomy	Theory	Practical & Viva	Grand Total
	400	300 (Practical – 200 & Viva – 100)	700

MARKS QUALIFYING FOR A PASS

Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degree examination. Obtaining of 50% marks in Practical examination shall be mandatory for passing the examination as a whole in the degree examination.

8. SUGGESTED BOOKS & REFERENCES (suggested Latest Editions)

GROSS ANATOMY

- 1) Susan Strandring: Gray's Anatomy: The anatomical basis of clinical practice, Churchill Livingstone Elsevier.
- 2) Dutta A.K. Human Anatomy vol. I-III , 4th Edition , Current Publisher, 1997.
- 3) Dutta A.K. Principle of General Anatomy. Current Publisher.
- 4) Romanes. Cunningham's Manual of Practical Anatomy vol. I-III, Oxford.
- 5) Keith and Moore Clinical Oriented Anatomy. Lippincot Williams and Wilkins, 3rd Edition ,1992 .
- 6) R.S Snell. Clinical Anatomy by regions. Lippincot Williams and Wilkins.
- 7) J.V. Basmajin. Grant's Method of Anatomy. Williams and Wilkins.
- 8) R.J. Last. Anatomy Regional and Applied. Churchill Livingston.
- 9) Lee McGregor. Surgical Anatomy. K.M. Varghese.
- 10) A.G. R Deckeg, D.J du Pless Lee. Mc Gregor's Synopsis of Surgical Anatomy. 12th Edition. Varghese Publishing House, 1986.
- 11) Snell. Clinical anatomy by regions. Lippincotts, Williams and Wilkins.
- 12) S. Chummy Sinnatanmy. Last's Anatomy Regional and Applied. Churchill Livingston.
- 13) Hollinshed W Henry. Anatomy for surgeons. Vol. I-III Lippincotts, Williams and Wilkins 1989.
- 14) Vishram Singh. Clinical and Surgical Anatomy. Elsevier.
- 15) Vishram Singh. Textbook of general anatomy. Elsevier.
- 16) Frank H. Netter. Atlas of Human Anatomy. Saunders Elsevier.
- 17) McMinn R M.H lasts , Anatomy-8th Edition ELBS ,1990
- 18) Snell .S .Richard, Clinical Anatomy for Medical Students – 5th Edition , Little Brown and Company,1985.

- 19) Grant boileau., An Atlas of Anatomy -5th Edition, Williams and Wilkins - 1984.
- 20) Graggs Hall E.C.B , Anatomy as a basis for Clinical Medicine- 2nd Edition . Williams and Williams, 1990.
- 21) McMinn M.H., Robert, McMinn's Functional and Clinical Anatomy- 1st Edition, Mosby Publications 1995.

NEUROANATOMY

1. Richard S. Snell. Clinical Neuroanatomy for Medical Students. Williams and Wilkins.
2. A Parent. Carpenter's Human neuroanatomy. Williams and Wilkins.
3. Vishram Singh. Clinical Neuroanatomy. Elsevier.
4. A.K. Dutta. Essentials of Neuroanatomy. Current books international.
5. John A. Kiernan. Barr's the human nervous system, Lippincott, Williams and Wilkins.
6. Everett N.B , Functional Neuroantaomy , 6th edition , Lee and Febigger,1971.
7. Chursid .G.Joseph , Correlative Neuroantomy and Functional Neurology - 16th Edition, Lange Medical publication , 1976.
8. InderbirSingh , Neuroanatomy-5th Edition ,1997 Jaypee Brothers Medical Publications.

HISTOLOGY

1. Young B. and Heath J. Wheater's Functional Histology.Churchill Livingstone.
2. M.H. E Ross. Histology: A textbook and atlas. Williams and Wilkins.
3. V. Bharihoke. Text book of human histology. Delhi AITBS.
4. Difiore's. Atlas of histology with functional co-relation.
5. Bloom and Fawcett. Text book of histology.
6. Carlton's. Histology Technique.

7. E.C. Clayden. Practical of section cutting and staining.
8. Cormack .H .David , Ham's Text Book of Histology -9th Edition , J.B.Lippincott Company , 1987.
9. Bloom and Fawcett. Textbook of Histology
10. Le Gross Clark , Tissues of the Body -6th Edition ,1980 Oxford University Press.
11. Copenhaver M Wilfred etl, Bailey's text book of Histology,17th Edition , William and Wilkins,1978.
12. Janqueira .C.Luisetal , basic histology-2nd edition , Large Medical Publications , 1971.
13. Drury R.A.B., Wallington E.A . Carlton's Histological Technique -5th Edition , Oxford University , Preces,1980.
14. Cullings , Histological Technique- 3rd Edition ,1994 Butterworths .
15. John D Bancroft , Manual of Histological Technique -1st Edition ,1984 Chruchill Livingstone.

EMBRYOLOGY

1. Hamilton, Boyd. and Mossman. Human Embryology.
2. TW Sadler. Langman's Medical Embryology. Lippincotts, Williams and Wilikins.
3. Keith L Moore and T.V.N. Persaud. The Developing Human. Saunders.
4. Rani Kumar. Text book of embryology. I.K. International New Delhi
5. A.K .Datta, Essentials of Human Anatomy, Human Embryology -2nd Edition, Current Books International ,1991.
6. Larsen, Human Embryology -2nd Edition ,1997, Churchil Livingstone

GENETICS

1. J.S Thompson and Thompson . Genetics in medicine. W.B. Saunders and Co. Philadelphia, London.
2. George Fraser and Oliver Mayo. Text book of Human Genetics. Blackwell Scientific Publications London, Oxford Edinburg, Melbourne.

3. Hann Sellwerger and Jame Simpson. Chromosomes of Man. Sparsher's International Medical Publications.
4. Robert F Mueller , Emery's Elements of Medical Genetics- 9th Edition , 1995 Churchil Livingstone.
5. Nora and Frazer, Medical Genetics Principles-1974 Lee & Gebiger, Philadelphia
6. Freidman, NMS Genetics -2nd Edition,1996
7. Alfred G Kudson JR., Genetics & Disease-McGraw Hill Book Company N.Y.,
8. Thomas D. Gelehrtar, Principles of Medical Genetics – 2nd Edition ,1990 William and Wilkins.
9. J.M.Conner MA Ferguson Smith –Essentials of Medical Genetics- Blackwell Scientific publications.

RADIOLOGY

1. T.B. Moeller et.al. Sectional Anatomy CT and MRI Vol. I, II, III New York, Theme Stuttgart
2. J.B. Walter et.al. Basic Atlas of Sectional Anatomy with correlated imaging. Saunders Elsevier

SURFACE ANATOMY

1. SP John, Lumley editors. Surface Anatomy, The Anatomical basis of clinical examination. London: Churchill Livingstone
2. Halim. and A.C. Das. Surface Anatomy Lucknow. ASI, KGMC.

EMBALMING TECHNIQUES

1. Tompsett RH Anatomical Techniques .
2. Edwards JJ, Medical Museum Techniques, Oxford University Press

STATISTICS

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

LIST OF JOURNALS

1. Journal of Anatomical Society of India
2. Journal of anatomy
3. Acta Anatomica
4. American Journal of anatomy
5. American Journal of Physical Anthropology
6. Journal of Morphology, Embryology
7. Anatomical Record
8. American Journal of Medical Genetics
9. Annual Review of Genetics

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 and Family Welfare, Govt. of India, Nirman Bhawan , New Delhi.
3. Santosh Kumar, the elements of Research, writing and editing 1994, dept of urology, JIPMER, Pondicherry.
4. Srinivasa D.K.etal, Medical Education Principles and Practice, 1995, National Teacher Training centre, JIPMER Pondicherry
5. Indian Council of Medical Research, “Policy statement of Ethical Consideration involved in research on Human Subjects”, 1982, I.C.MR., New Delhi.
6. Code of Medical ethics framed under section 33 of the Indian Medical Council Act 1956. Medical Council of India, Kotla Road, New Delhi.
7. Francis C.M medical Ethics , JP Publications 2nd edition 2004.
8. Indian National Science Academy, Guidelines for care and use of animals in Scientific research, New Delhi, 1994.

9. International Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical Journals , N Engl J Med 1991.
10. Kirkwood B.R , Essentials of Medical Statistics, 1st Ed., Oxford : Blackwell Scientific Publications 1988.
11. Mahajan B K. Method in Biostatistics for medical students , 5thEd.New Delhi , Jaypee Brothers Medical Publishers ,1989.
12. Raveendran , B Gitanjali, A Practical approach to PG Dessertation , New Delhi JP Publications 1998.

ANEXURE I

POSTGRADUATE STUDENTS APPRAISAL FORM

Pre / 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										
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