

**All INDIA INSTITUTE OF MEDICAL SCIENCES, RAIPUR**  
**Curriculum / Syllabus for Postgraduate course MD/MS**  
**Subject: Anatomy**

**Goal/Aim/Objective:** Providing comprehensive training to postgraduate students to make them Anatomist for teaching and research methodology. At the end of the 3 years of training program, the student should:

1. Acquire a detailed knowledge of the gross and microscopic structure of human body; ontogeny i.e. development of the entire tissues/organs/systems of body and be able to correlate all the structures and system of the body in their altered state in various diseases and common anomalies by understanding their nature and cause including genetic inheritance.
2. Be able to plan, implement & evaluate teaching program for medical/paramedical courses by using various teaching/learning methods & modern resources.
3. Have ability to plan, execute procedures & complete research project and able to appraise/evaluate published literatures, use information technology, interpret data to broaden his knowledge abreast with modern developments in the specialty and finally draw his own conclusion and presentation.
4. Be a competent anatomist and capable of organizing specialty department.

**Period and Training:** The training period of 3 years of MD/MS Anatomy course should include:

I. **Teaching to PG students:** It should include:

- (i) **Didactic/Educational Theory Lectures** on detailed anatomy of the human body (specified in course below) including gross, sectional, developmental & genetics, evolutionary & comparative, microscopic, functional, clinical, radiological, surface & living anatomy and advanced investigative procedures & imaging techniques. The PG students will attend the theory classes for undergraduate students.
- (ii) **Practical Exercises** parallelly with theory by faculty members regularly during practical classes for undergraduate and also separately.
- (iii) **Group Discussions** to discuss the demonstration topics with faculty members before teaching the undergraduate students.
- (iv) **PG Seminars** include special topics in current medical practice to be prepared and presented by the students and moderated by the faculty members.
- (v) **PG Journal clubs** – presenting recent topics by the students.

II. **Assisting to PG students:** For improving their:

- (i) **Communication Skills** in dealing with institutional and social activities by involving them in Demonstration, Seminars, Group discussions, Journal Club etc.
- (ii) **Hands on experience** by making them familiar with Techniques in gross-anatomy like embalming, dissection, mounting of specimens; Histological techniques like microtomy, tissue mounting & staining; Embryological & Genetical techniques like USG, charts & models preparation, karyotyping, Barr body, Y-chromosome and chromosomal anomalous testing etc.
- (iii) **Teaching Skills** by involving them in undergraduate teaching programs like demonstrations, tutorials and practicals. They are trained from the 2nd year to take lectures under the supervision of a senior faculty member.
- (iv) **Ability to use Educational technology** including module, specimens, casts etc.
- (v) **Ability to prepare** audiovisual aids, posters etc. for the presentations in seminars / symposia / conferences / workshops etc.
- (vi) **Ability to prepare** manuscripts for the publications in journals.
- (vii) **Ability to participate and organize** seminars / symposia / conferences / workshops etc.

III. **Monitoring/Guiding and encouraging to PG students** should include:

- (i) **Research projects and thesis** preparation & submission by developing skills in planning, designing and conduct of research studies. A committee of the P.G. teachers, headed by the

Chairman should monitor the postgraduate teaching and research program. This committee should meet at least once in every three months to consider the performance of the P.G. Students. The cases of non-performing students (if any) shall be reported to the Dean, Faculty of Medicine by the Chairman on the recommendation of the committee. Each P.G. Student/Junior Resident should be allotted a PG teacher, within three months of his/her joining the department by the Chairman, committee of the P.G. teachers of the department. Then under the guidance of that PG teacher, the proposed 'Topic and Synopsis' of the thesis should be drafted & submitted by the student to the Chairman within one month for consideration and approval in the meeting of the Committee of the PG Teachers and Ethics committee of the institute if formed. Every student should be allotted a topic of research under a supervisor / recognized postgraduate teachers and if necessary also a Co-supervisor from the department or from another medical faculty. The student should carry out the experiments, analyse the observations and reach the scientific conclusions. The research work should be written and submitted in the form of a thesis containing a discussion and critical analysis of relevant published research literatures, six month before commencement of theory examination.

- (ii) The PG students should be encouraged & allowed to participate in the teaching & training programs for undergraduate students, by attending lectures & practicals by faculty members. They should develop skills in using educational methods and techniques as applicable to teaching to medical students. The PG students may be given practical/demonstration classes (like osteology, radiology, surface anatomy) for undergraduate students
- (iii) The PG students should actively participate in the P.G. Seminar. The topics of seminar should cover sub-divisions of Anatomy like gross anatomy, neuroanatomy, developmental anatomy, molecular biology & genetics, microanatomy, clinical anatomy, surface anatomy, radiological anatomy etc.
- (iv) The PG students should actively participate in Journal Club through their training period. Selected published research papers based on gross, microscopic, developmental and clinical anatomy should be entertained from the following journals.
  1. Journal of Anatomy
  2. Clinical Anatomy
  3. Journal of the Anatomical Society of India
  4. Surgical and Radiologic Anatomy
- (v) Internal Assessment: There should be regular internal assessment of P.G. students by involving them in (1) Taking viva on the dissection work by the 1<sup>st</sup> year MBBS students (2) Evaluation of Gross Anatomy and Histology practical drawing books/Manuals of MBBS/Nursing students and (3) Demonstration from 1<sup>st</sup> year and Lectures from 2<sup>nd</sup> year to the 1<sup>st</sup> year MBBS students on all aspects of anatomy like gross, development, microanatomy clinical, radiological, surface & living anatomy as well as various laboratory teaching.

#### IV. Evaluating to PG students: (Periodic tests)

Regular internal evaluation of PG students should be done in the form of written & oral examination including theory & practicals in each semester (completion of each year) and graded as follows:

A (>80%), B (70-79%), C (60-69%), D (50-59%), E (40-49%), F (<40%)

Each student should be given a formal feedback on his/her weak points in teaching/training programs and how to overcome his/her deficiencies.

## **Course content to study**

### **1. GROSS ANATOMY:** (Theory and practical)

Theory should include:

1. **General anatomy:** Introduction and history of anatomy, nomenclature/terminology, skin, fasciae and modifications, skeleton, joint, muscle, CVS & lymphatic system, nervous system, respiratory & digestive system, urogenital system.
2. **Upper limb:** Introduction, pectoral region and breast, pectoral muscles, clavipectoral fascia, axilla, brachial plexus, cutaneous nerves of back, trapezius, latissimus dorsi, veins and lymphatic drainage of upper limb, cutaneous nerves and dermatomes of upper limb, scapular region and

intermuscular spaces, shoulder joint, front of arm (muscles, vessels, nerves), cubital fossa, back of arm and radial nerve, front of forearm (muscles, vessels, nerves), palm (superficial muscles, vessels, nerves, deep muscles, vessels, nerves), back of forearm and hand, joints of UL (elbow joint to interphalangeal joints). Osteology: Clavicle, scapula, humerus, radius, ulna, articulated hand. Surface anatomy of UL. Radiology of UL.

3. **Head & Neck**: Scalp and temple, face, lacrimal apparatus, superficial & deep cervical fascia, posterior triangle of neck, sternocleidomastoid muscle, back of neck, muscles, suboccipital triangle, anterior triangle of neck, median region, submental & digastric triangle, carotid & muscular triangles, cranial cavity, meninges, dural folds, cavernous sinus, pituitary gland, trigeminal ganglion and meningeal vessels, thyroid & parathyroid glands, trachea, esophagus, brachiocephalic & subclavian vessels, carotid arteries, jugular veins, nerves of the neck, glossopharyngeal, vagus, accessory and hypoglossal, sympathetic trunk, cervical plexus, scalene muscles, prevertebral muscles, vertebral vessels, lymph vessels & nodes of H & N, submandibular region, suprahyoid muscles, orbit (structures in orbit, muscles, vessels & nerves), parotid gland, temporal fascia, muscles of mastication, maxillary vessels, TM joint, mandibular nerve, otic ganglion, pharynx (mouth, pharyngeal wall, constrictor muscles, interior of pharynx, tonsils, soft palate, auditory tube), nose (cavity, septum & lateral wall), pterygopalatine fossa & ganglion, paranasal sinuses, larynx (structure, cartilages, interior, muscles, vessels & nerves), tongue, ear (external, middle & internal), eyeball, joints of H & N. Osteology: Skull anatomical position, norma verticalis and occipitalis, norma frontalis, norma lateralis, norma basalis, interior of skull and cranial fossae, mandible, cervical vertebrae. Surface anatomy of Head & Neck, Radiology of Head & Neck.
4. **Neuroanatomy / Brain and spinal cord**: Introduction & parts of nervous system, spinal cord, meninges, arteries & veins, contents of vertebral canal, meninges and CSF, base of the brain, interpeduncular fossa, superficial attachments of cranial nerves, vessels of brain, medulla oblongata, pons, cerebellum, cerebellar peduncles, 4<sup>th</sup> ventricle, midbrain, cerebrum, white matter of cerebrum, internal capsule, third ventricle, lateral ventricle, diencephalon, basal nuclei, limbic system, reticular formation, neural pathways.
5. **Thorax**: Introduction of thorax, inlet, outlet, landmarks, thoracic wall, intercostal muscles, nerves and vessels, internal thoracic artery, azygos vein, thoracic sympathetic trunk, mediastinum, pleura, lungs, bronchopulmonary segments, pericardium, external features of heart, coronary arteries, veins & nerves of heart, cardiac plexuses, right atrium and ventricle, left atrium and ventricle, ascending aorta, arch of aorta, descending aorta, conducting system of heart, pulmonary trunk, thoracic part of trachea, esophagus and thoracic duct. right lymphatic duct, joints of thorax and respiratory movements. Osteology: Sternum, ribs, vertebral column and thoracic vertebrae. Surface anatomy of thorax. Radiology of thorax.
6. **Abdomen**: Introduction, anterior abdominal wall, cutaneous nerves, vessels, lymphatics, muscles of anterior abdominal wall, rectus sheath, Inguinal canal, spermatic cord, hernia, male external genitalia, scrotum, testis, epididymis, penis, nine regions of abdomen, peritoneum (lesser & greater sac, vertical & transverse disposition, mesenteries, fossae), spleen, coeliac trunk, stomach, differences between small & large intestine, duodenum, jejunum, ileum, large intestine, caecum, appendix, ascending, transverse, descending, sigmoid colon, mesenteric vessels, portal vein, portocaval anastomoses, pancreas, liver, extra hepatic biliary apparatus, autonomic nervous system, coeliac plexus, suprarenal gland and chromaffin system, kidney and ureter, diaphragm, abdominal aorta, IVC, lymph nodes of posterior abdominal wall, cistern chili, muscles, fascia, nerves of posterior abdominal wall, lumbar plexus, lumbar arteries & veins, lesser pelvis, position of pelvic viscera & pelvic peritoneum, perineum, female external genital organ, anal region & ischioanal fossa, urogenital region, superficial & deep perineal spaces, lymph vessels of perineum, ovaries, uterine tubes, uterus & vagina, urinary bladder, male and female urethra, prostate, ductus deferens, seminal vesicle & ejaculatory duct, rectum and anal canal, vessels, lymph nodes & nerves of pelvis, pelvic fascia and muscles, joints of pelvis. Osteology: Lumbar vertebrae, sacrum, pelvis, pelvimetry. Surface anatomy of abdomen Radiology of Abdomen.

7. **Lower limb:** Introduction, front of thigh, fasciae, great saphenous vein, cutaneous nerves, femoral triangle, sheath, canal & hernia, femoral vessels & nerve, adductor canal, iliotibial tract, intermuscular septa, muscles of front of thigh, adductor compartment of thigh, muscles, vessels and nerves, gluteal region (fasciae, cutaneous nerves, gluteus maximus & structures deep to it, sciatic foramina, nerves, vessels, gluteus medius & minimus, small muscles on the back of hip joint), popliteal fossa, back of thigh, muscles, nerves, vessels, hip joint, front of leg & dorsum of foot, muscles, vessels & nerves, lateral & medial sides of leg, muscles, vessels & nerves, back of leg, muscles, vessels & nerves, venous & lymphatic drainage of lower limb, sole of foot (fasciae, 1<sup>st</sup> to 6<sup>th</sup> layers), knee joint, tibiofibular joints, ankle joint & joints of foot, arches of foot. **Osteology:** Hip bone, femur, tibia, fibula, articulated foot. **Surface anatomy** of lower limb. **Radiology** of lower limb.

**Practicals** should include:

1. Dissection of entire body, study of osteology, viscera, models, charts, specimens etc.
2. Neuroanatomy, brain and spinal cord sections.
3. Anatomical techniques: Embalming -normal for teaching and soft for cadaveric workshops, fixation and preservation of dead bodies, preparation of museum specimens, bones, casts etc.
4. Plastination.
5. Surface anatomy.
6. Interpretation of the normal plain & special X-rays of whole body, Computerized Tomography (CT) Scan, Sonogram, MRI etc. and correlation with the sectional anatomy of the body.
7. Rotation in related departments (like Radiology, Medicine, Surgery, O&G, CFM, Forensic etc) for depth knowledge in clinical anatomy

## **2. MICROANATOMY / CYTOHISTOLOGY:**

**Theory** should cover:

Study of general and systemic microanatomy light and electron microscopic detailed structure of cell and its components, tissues, organs & systems of body and structural basis of function, general principles of light & other microscopes and principles of basic histological and cytological techniques.

**Practicals** should include:

1. Light & electron microscopy and its applications; identification of normal and abnormal organelles in electron micrographs.
2. Tissue processing, microtomy, routine & special staining, H and E staining, Trichrom staining, special staining for nervous system like Nissl staining, Golgi Staining, Silver staining etc. identification of artifacts and three-dimensional interpretation.
3. Common techniques employed in cellular immunology and histocompatibility testing, histochemistry, immunocytochemistry.
4. Barr body / Sex chromatin and Y chromosome testing.
5. Study of the Weigert-Pal technique stained human brain tissue slides.
6. Cross sections of chick and pig embryo slides.

## **3. DEVELOPMENTAL ANATOMY / EMBRYOLOGY:**

**Theory** should include: Study of Introduction of developmental anatomy, embryology and postnatal development, general embryology covering gametogenesis, ovarian follicles, ovulation, corpus luteum, menstrual cycle, contraceptive methods, fertilisation & early development of zygote, primary & secondary mesoderm, notochord, neurulation, foldings of embryo, deciduas, implantation, placenta, abnormal placenta, umbilical cord, amniotic fluid, twins & multiple pregnancies and systemic embryology covering development of skin & appendages, mammary gland, limbs, musculoskeletal system, pharyngeal apparatus, clefts & pouches, thyroid, face, palate, digestive system, cardiovascular system, respiratory system, body cavity & diaphragm, urinary system, male & female gonads, genital duct system & external genitalia, suprarenal, nervous system, various anomalies or congenital malformations with their developmental & physiological correlation.

**Practicals** should include: Study and preparation of Charts/Models/Specimens of human development & congenital malformations.

**GENETICS** should cover: Introduction, Mendel's law, normal chromosomes: classification, sex chromatin, Lyon's hypothesis, banding techniques; abnormal chromosomes: structural and numerical anomalies, important syndromes, mosaicism, chromosomal aberrations, molecular genetics: Genes, DNA, RNA, nucleic acids, genetic code, replication, protein synthesis and its control, transcription, translation, mutations, mode of inheritance: genotype, phenotype, pedigree chart, autosomal dominant and recessive, sex linked inheritance, co-dominant and intermediate inheritance, pleiotropy, polygenic inheritance, genome imprinting, cancer genetics, pharmacogenetics, reproduction genetics, male & female infertility, assisted reproduction, preimplant genetics, prenatal diagnosis, biochemical genetics (inborn error of metabolism, hemoglobinopathies), immunogenetics (transplantation, blood groups, Rh-incompatibility), genetic counseling (dermatoglyphics, pre-natal diagnosis). Teratogens, genetic mutations; environmental hazards and postnatal growth & development.

**4. EVOLUTION** theories, erect posture, evolution of man (cercopithecus, ramapithecus, astralopithecus, Neanderthal man), limb, teeth, speech, auditory apparatus.

**5. COMPARATIVE ANATOMY & ANTHROPOLOGY** Classification of animal kingdom, comparison of skull, girdle, limbs, respiratory system, CVS, GIT, excretory, reproductive system, CNS, special senses.

**6. APPLIED ANATOMY AND RECENT ADVANCES** should cover applications of detailed knowledge of anatomy of the human body to comprehend deviations from normal and application of recent advances in medical sciences to solve clinical problems.

**7. MODERN TREND, ADVANCES AND INVESTIGATIVE PROCEDURES** Anatomical basis of imaging techniques (CT, MRI, USG), teaching techniques (projection, endoscopy, video, computer), investigative procedures in infertility, assisted reproductive techniques (ART), angiography, stem cell banking, skin banking, embalming techniques, body-donation & organ transplantation, coronary artery bypass graft (CABG) etc.

**Final preparation of Examination:**

Completion and submission of dissertation

Completion of Journals / Manuals / Log-book

PG discussion and viva

Window dissection- Infra temporal fossa, orbit, relations of hyoglossus muscle, submandibular region, carotid triangle, posterior triangle, suboccipital triangle, stellate ganglion, brachial plexus, cubital fossa, arteries and nerves in hand, femoral triangle, inguinal canal, popliteal fossa, 2<sup>nd</sup> muscle layer of foot, branches of superior mesenteric artery etc.

Histology- preparation and identification of slides

Embryology- study of models and charts

Genetics- karyotyping and study of chromosomes in various anomalies

Surface anatomy- on cadaver and living

Radiology- study of plain and special radiography, USG, CT scan and MRI

**Examination pattern/scheme** should include:

**Thesis evaluation** Thesis should be sent to external examiners for evaluation and satisfactory result from them should be mandatory and declared before the final University Examination.

**Theory Examination** should consist of four papers on the following major aspects:

**Paper I:** Gross anatomy including neuroanatomy. Sectional, functional and radiological anatomy.

**Paper II:** Microanatomy. Histochemical techniques, Anatomical techniques (Embalming, museum specimens, plastination etc) and advanced investigative procedures & imaging techniques.

**Paper III:** Developmental Anatomy, Genetics, evolutionary & comparative anatomy.

**Paper IV:** Applied/Clinical Anatomy and recent advances.

Each paper should have 3 questions, Q1. Structured long question Q2. Three short questions and Q3. Three short notes

**Practical Examination** should be conducted for 2 days to test student's ability to:

- (i) Dissect & clearly display the anatomical structures with their relations; and to perform gross anatomical techniques like embalming process, preparation of museum specimens, bones, casts and plastination. Window dissection of any body part allotted should be followed by viva-voce test.
- (ii) Acquire the skill of routine microanatomy of all the structures of body and the common histocytological techniques including tissue processing, paraffin/plastic resin blocks preparation, microtomy, slide preparation, routine & special staining, storage of slides, cellular immunology, histocompatibility testing, Barr body / Sex chromatin testing, Y chromosome testing etc. 10 stained slides given for identification under light microscope should be followed by viva voce test.
- (iii) Viva-voce test on Gross anatomy including soft & hard parts, surface & living anatomy, radiological anatomy, embryology and genetics.
- (iv) Microteaching/Demonstration/Lecture/Seminar presentation on given short topic after preparation.
- (v) Present Thesis and methodology used in research projects & thesis preparation & submission by developing skills in planning, designing and conduct of research studies.

First day will cover (i) and (ii) and Second day (iii), (iv) and (v) points mentioned above. All internal and external examiners should give grades after assessment of theory and practical testing and a candidate must secure grade D and above in both theory and practicals to pass.

**Recommended Books to PG Students:**

1. GRAY'S Anatomy: Susan Standring, 41<sup>st</sup> Edition, Churchill Livingstone (Correlation with Text books of Anatomy recommended for UG)
2. MOORE Clinically Oriented ANATOMY: Moore, Dalley, Agur, 7<sup>th</sup> Edition, Wolters Kluwer
3. Snell RS: Clinical Anatomy by Regions, 9<sup>th</sup> Edition, Wolters Kluwer
4. Grant's Dissector: Detton AJ, Tank PW, 16th ed., Wolters Kluwer
5. Cunningham's Manual of Practical Anatomy - Vol. 1, II, III by G. J. Romanes, Oxford
6. Atlas of Human Anatomy: Netter FH, 6<sup>th</sup> edition, Saunders
7. Anatomy: A Photographic Atlas: Rohen JW, Yokochi C, Lutjen-Drecol E, LWW
8. Junqueira's Basic Histology: Text and Atlas, Fourteenth Edition, McGraw-Hill Education;
9. Wheater's Functional Histology: A Text and Colour Atlas, 6<sup>th</sup> Edition, Churchill Livingstone
10. Difiore's Atlas of Histology with Functional Correlations: Eroschenko VP, 12<sup>TH</sup> edition, Wolter Kluwer.
11. Bancroft's Theory and Practice of Histological Techniques: 7<sup>TH</sup> EDITION, Elsevier Health Sciences
12. Langman's Medical Embryology: T.W Sadler, 13th Edition, Wolters Kluwer
13. The Developing Human: Clinically Oriented Embryology: Clinically Oriented Embryology: Keith L. Moore, Elsevier Health Sciences - India; 9 edition
14. Thompson & Thompson Genetics in Medicine, Nussbaum RL, McInnes RR, Willard HH, 8edition, Elsevier

**Journals:**

1. Journal of Anatomy
2. Clinical Anatomy
3. Journal of the Anatomical Society of India
4. Surgical and Radiologic Anatomy