

MD RADIO DIAGNOSIS

SYLLABUS

BASIC SCIENCES:

- Lectures, by the faculty members.
- Models and specimen demonstration, by the faculty members. Seminars, by students, supervised by the faculty members.
- Practicals, to be trained under the supervision of the faculty members.

Physiology - 10 hrs

- CSF – production and circulation
- Blood flow dynamics in various organs as applied in Doppler Study.
- Relevant Gastro Intestinal, Hepatobiliary and Renal Physiology.
- Physiology of endocrine systems and also of Puberty.
- Relevant Physiology of other systems applicable to Radiological Imaging, including fracture healing.
- Physiology related to Gestation.
- Foetal circulation
- Physiology relevant with Paediatric patients.
- Physiology of normal and abnormal growth.
- Physiology of Contrast Agents in Radiology

Pathology - 10 hrs

- Basic general Pathology.
- Basics of the Pathology of tumours, infection, inflammation, vascular diseases etc. as applied to Radiological Imaging of various organs and systems.
- Basics of the Pathology of Congenital malformations.

Pharmacology - 10 hrs

- Pharmacology of intravenous contrast media – dose, uses, adverse reactions and management of adverse reactions.
- Ionic and non-ionic contrast media - advantages and disadvantages.
- CT, MR and Ultrasound contrast agents.
- Pharmacology and properties of Isotope pharmaceutical agents, tracers, dose, applications.
- Essential drugs in the management of adverse contrast reaction, dose application and route of administration.

Radiological Anatomy and Applied Embryology - 30 hrs.

The candidate should be familiar with Radiological Anatomy and applied embryology of Gastro Intestinal Tract, Genito Urinary Tract, Central Nervous System, Cardio Vascular System, Skeletal System and Cranial Nerves. They should have the knowledge of the basic

anatomy relevant to all common radiological investigations and cross sectional anatomy in the axial, coronal and sagittal planes and also in oblique planes.

□□ Planar and Radiological Anatomy of Head (including Brain, Eye, Para Nasal Sinuses), Neck, Thorax, Heart, Abdomen, Pelvis and Musculoskeletal System.

□□ Gross Radiological Anatomy of Heart and major vessels, Gastro Intestinal Tract, Central Nervous System, Thorax, Genito Urinary System, Soft Tissues, Endocrine organs.

RADIATION PHYSICS - 100 hrs

- Lectures, by the faculty members.
- Models and specimen demonstration, by the faculty members.
- Seminars, by students, supervised by the faculty members.
- Practicals, to be trained under the supervision of the faculty members.

Basic physics of radioactivity, production of X-Ray, interaction of X-Ray with matter, effects of X-Ray, measurements of X-Ray quantity and principles and methods of radiation protection in Diagnostic Radiology.

Physics of Diagnostic Radiology

1. Structure of X-Ray tube and electrical circuit of x ray unit.
2. Various types of X-Ray tubes, tube assembly and Tube rating.
3. Production, effects and measurement of X-Rays.
4. Interaction of X-Rays with matter.
5. Image Intensification.
6. Conventional Fluoroscopy and IITV Systems.
7. Physics of DSA.
8. Xeroradiography
9. X –Ray Radiography, Photofluorography. Angiography.
10. Physics of Radiographic Cassettes, Films and Intensifying Screens
11. Conventional and Computerised Tomography.
12. Mammography (including Digital Mammography).
13. Image quality and factors controlling the same in conventional and modern techniques.
14. Dark room techniques including Dark room Design.
15. Factor's influencing the radiographic image and assurance of quality control in radiography.
16. Various artefacts in Radiology and Imaging.
17. Effects and control of scattered radiation.
18. Physics of Collimators, Filters and Grid.
19. Radioactivity-Basic principles.
20. Radioactive decay, production of radioisotope imaging, uptake studies, clinical applications.
21. Gamma camera, Radionuclide scanning
22. Radiological aspects and nuclear medicine.
23. Physics of Bone Densitometry
24. Image processing (Conventional-Manual and automatic)
25. Image processing (Digital)
26. Digital Radiography and Computer Radiography.
27. Physics of Ultrasonography.

28. MRI, MR Spectroscopy.
29. Physics of PET and SPECT.
30. Picture Archival and Communication System(PACS)

Radiation protection

- Radiations hazards in Diagnostic Radiology.
- Essential of radiobiology and biological effects of Radiation.
- Personal monitoring, Dosimeters, permissible dose, ICRP recommendation.
- Departmental protection - National and Intentional regulations.
- Radiation Protection for Radiology workers and for the general public.
- Planning and layout of Diagnostic Radiology Department.
- Basics of X– ray equipment installation, AERB regulations, radiation acceptance test.
- Radiation units and measurements.
- Exposure – dose, dose equivalent,
- Dosimetric instruments: Ionisation Chamber Systems, GM counters, Scintillation Detectors, TLD and Photographic Dosimetry.
- QA & control systems.

RADIOGRAPHY AND DARK ROOM PROCEDURES - 100 hrs

- Lectures, by the faculty members.
 - Models and specimen demonstration, by the faculty members.
 - Seminars, by students, supervised by the faculty members.
 - Practicals, to be trained under the supervision of the faculty members.
- Conventional Radiography including views of extremities, Spine, Skull, PNS Abdomen, Thorax and Pelvis.
 - Special Radiographic Techniques like, Stress Views ,Trauma Radiography, Axial and Oblique views
 - Contrast techniques of Gastro Intestinal System, Respiratory, Hepatobiliary System, Urogenital System, Central Nervous System, Cardio Vascular System, Soft tissues and Salivary glands.
 - Contrast techniques in other Systems.
 - Conventional Tomography.
 - OPG and Dental Radiography
 - Magnification techniques, Portable Radiography.
 - MMR/Photofluorography.
 - Chemistry of processing & dark room procedures.
 - Dark room design

RADIODIAGNOSIS

- Lectures, by the faculty members.
- Models and specimen demonstration, by the faculty members.
- Seminars, by students, supervised by the faculty members.
- Practicals, to be trained under the supervision of the faculty members.

RESPIRATORY SYSTEM AND CHEST - 100 hrs

- Normal Chest, methods of examination
- Digital Radiography in Chest.
- High KV techniques.
- Mediastinal and pleural disease.
- Inflammatory and interstitial disease of the Lung.
- Pneumothorax, Pneumomediastinum, Cystic disease of Lung
- Infections of Lung, Mediastinum, Pleura and Chest wall.
- Tumours of Lung, Pleura and Chest wall.
- Pulmonary thrombo-embolism.
- Trauma and Postoperative chest.
- Paediatric chest including congenital conditions
- Radiology of Respiratory distress (New born, Child and Adult)
- Miscellaneous Lung conditions including pneumoconiosis, emphysema, chronic bronchitis, foreign bodies, Post Radiation, Post Chemotherapy, Drowning and Poisoning.

CARDIO VASCULAR SYSTEM - 60 hrs

- Methods of examination.
- Normal Heart and Pulmonary circulation.
- Basic ECG, Cardiac Ultrasonography (Echocardiography).
- Congenital Heart Disease.
- Arteritis, Aneurysms, Dissections and complications.
- Acquired Heart Diseases, Cardiac Scintigraphy.
- Ischemic Heart Diseases, Cardiomyopathy.
- Cardiac Tumours including Myxoma, Rhabdomyoma.
- Pericardium-Pericardial infection, Effusion, Constrictive Pericarditis, Cardiac Tamponade.
- Pericardial Calcification.
- Arteriography, Venography and Lymphangiography.
- Perfusion studies and MRI of CVS
- Radiology of Post-operative Chest, Pace Maker, Electrode and Prosthetic valve.

GASTRO INTESTINAL TRACT - 120 hrs

- Methods of examination and interpretation of normal and diseases of pharynx, oesophagus.
- Methods of examination and interpretation of normal and diseases of stomach, Small Bowel and Large Bowel.
- Methods of examinations and interoperation of normal appearance and disease of Hepato-Biliary System, Spleen, Pancreas, Mesentery and Retro peritoneum
- Acute abdomen - investigations and interpretations
- Radiology of Post-operative Abdomen and organ transplantation (Liver, Pancreas, etc.).
- Paediatric Gastrointestinal Radiology
- Abdominal Trauma.
- Tumour and predisposing conditions
- Infections and inflammatory conditions.
- Ischaemic conditions of Bowel and Mesentery and role of arteriography and Doppler study

- Endocrine Tumours and Venous Sampling
- Upper and lower GI bleeding and GI radiological investigations including Scintigraphy
- Radiological Interventions.

GENITO-URINARY SYSTEM - 60 hrs

- Methods of invitation and normal appearances.
- Congenital lesions.
- Calculus disease of Genito-urinary System.
- Infection and inflammations involving Genito Urinary System.
- Tumours of Genito Urinary System.
- Reno vascular disease and Radiological interventions.
- Renal failure & transplant kidney.
- Miscellaneous including cystic disease of kidney, nephrocalcinosis, lower urinary tract obstruction/infection and post-operative problems.
- Trauma of Genito-urinary tract.
- Male Infertility imaging and interventions

ENDOCRINE SYSTEM - 30 hrs

- Anatomy and basic physiology of various endocrine organs.
- Various imaging modalities (including Scintigraphy, PET, SPECT) and their interpretations.
- Imaging of Pituitary, Thyroid, Adrenal, Pancreas and other endocrine organs using various Radiological techniques.

SKELETAL SYSTEM - 100 hrs

- Radiographic and other imaging modalities
(like Isotope study including PET and SPECT, MRI, CT etc.)
- Structure of Bone, Bone formation, remodelling and growth.
- Congenital; skeletal anomalies and dysplasia.
- Bone and joint inflammation and infection – different types of arthritis.
- Degenerative disorders.
- Neoplasm including lymphoid and haemopoietic disorders.
- Metabolic and endocrine disorders.
- Skeletal trauma.
- Bone and Marrow injury.
- Avascular necrosis.
- Miscellaneous conditions – joint prosthesis, instruments – application imaging, Complications.
- Radio Frequency Ablation.

CENTRAL NERVOUS SYSTEM AND SKULL - 60 hrs

- Methods of examination and normal appearance of Skull, Brain and Spine and the Spinal cord.
- Applied embryology related to CNS.
- Infections and Inflammatory conditions of CNS
- Tumours and Tumour like conditions of CNS, Skull base and Calvarium.

- White matter diseases.
- Radiology of Dementia and epilepsy.
- Imaging in Hydrocephalus
- Cranio-cerebral trauma.
- Congenital and degenerative lesions of Brain and Spinal cord.
- Disorders of Spine and Spinal cord.
- Cerebral Scintigraphy and its applications.
- Vascular lesions and interventions of CNS.
- Post-operative, Post Chemotherapy and Post Radiation changes.

OBSTETRICS AND GYNAECOLOGY

- Obstetrics imaging (Normal/Abnormal).
- Gynaecological imaging (Normal/Abnormal).
- Infertility imaging and interventions, including ART.
- Gestational Trophoblastic Tumours.
- Radiology of ambiguous genitalia and Hermaphroditism.
- Doppler Study and IUGR.
- Radiological interventions in Gynaecology and Obstetrics.
- Miscellaneous conditions-Amniotic fluid embolism, Remnant Syndrome, Ovarian Hyper stimulation Syndrome etc.

ENT, EYE AND DENTAL IMAGING 60 hrs

- Normal appearance and anatomy of Orbit, Eye Ball, PNS and Temporal bone.
- Disease involving Larynx, PNS, Obits and Eyeball, Ear and Mastoids.
- Imaging and interpretation of teeth and jaws
- Dental Radiography
- Pan tomography.
- Application of various imaging modalities like CT, MRI, and Isotope studies, PET, SPECT etc. in head and neck region.

SOFT TISSUES AND SMALL PARTS 30 hrs

- Various disease, imaging and interpretations related to soft tissues and small parts (including Thyroid, Testis and Breast)
- Mammography and Sonography - Techniques and interpretations.
- Soft Tissue Radiography, Ultrasonography, Computerised Tomography and MRI.

EMERGENCY RADIOLOGY 30 hrs

- Special Radiographic technique in acute trauma and life threatening situations
- Skill for airway maintenance
- Deciding appropriate optimal imaging in situations like acute abdomen and other emergency situations.

SPECIAL TECHNIQUES 80 hrs

- Ultrasonography: physical principles, techniques and interpretation.
- Computed Tomography: physical principles, techniques and interpretation.
- Magnetic Resonance Imaging: physical principles, techniques and applications.
- Digital Subtraction Angiography: physical principles, techniques and applications
- PET, SPECT: physical principles, techniques and interpretation.
- Nuclear medicine as applied to Diagnostic Radiology.
- Newer developments in Diagnostic Radiology and Imaging- like picture archival and communication System (PACS).
- Filmless Radiology environment.
- Special Techniques and newer developments in Conventional Radiology, US, CT, MRI, PET, SPECT

INTRVENTIONAL RADIOLOGY 60 hrs

- Interventional Hepatobiliary procedures,
- Interventional Cardio-vascular procedures,
- Interventional Genito-urinary procedures,
- Interventional Gynaecological and Obstetrics Procedures.
- Venous Sampling Techniques.
- Radio frequency Ablation Techniques.
- Interventions in GIT.
- Other Ultrasonography and Computerised Tomography/MRI guided procedures.
- Newer developments in Interventional Radiology

TRAINING PROGRAMME**THEORY LECTURES**

Will be on Basic sciences, Radiation Physics, Diagnostic Radiology and Imaging and interventional techniques.

Practical Training Programme will be as follows,

1st year Duration

Dark room techniques, Plain Radiography and 3 months reporting

Ultrasonography 2 months

CT 2 months

MRI 1 month

Special Radiological investigations 3 months

Other departmental postings 1 month

(Anaesthesia, Casualty, Pathology)

2nd year

Conventional Radiology 2 months

Special Radiological investigations 2 months

Ultrasonography & Doppler 3 months

CT 2 months

MRI 1 month
Interventional Radiology 1 month
Nuclear Medicine 1 month

3rd year

Conventional Radiology 1 month
Special Radiological investigation 1 month
Interventional procedures 2 months
Ultrasonography including doppler 3 months
CT 3 months
MR 2 months

Each student will be assigned research topic for the thesis and a qualified post graduate teacher (faculty member) as a guide. Protocol for the chosen topic to be submitted to the University by the student in three months after admission. The candidate has to submit his/her thesis work 6 months prior to the final examinations.

Teaching schedule

1. Journal club once in a fortnight
2. Topic presentation by PG student (Moderators– faculty members). 3 days in a week.
3. Inter Departmental discussions.
 1. General medicine once in every fort night.
 2. General Surgery once in every fort night.
 3. Obstetrics and gynaecology once in every fort night.
 4. Paediatrics once in every fort night.
 5. Neurology (Medical) once in every fort night.
 6. Neurology (Surgical) once in every fort night.
 7. Gastroenterology (Medical) once in every fort night.
 8. Gastroenterology (Surgical) once in every fort night.
 9. Nephrology once in every fort night.
 10. Urology (Surgical) once in every fort night.
 11. Respiratory Medicine once in every fort night
 12. Thoracic Surgery once in every month
 13. Orthopaedics once in every month.
 14. Cardiology once in every month.
 15. Ophthalmology once in every month.
 16. ENT once in every month.
 17. Oncology, Radiotherapy once in every month.
 18. Morbidity/ Mortality conference once in every month.

PROCEDURE OF EVALUATION

Examination will be conducted on satisfactory completion of three years of training. There will be a Theory and Practical examination followed by oral / viva voce. (Thesis work will be separately evaluated prior to this).

Dissertation evaluation

Dissertation will be separately evaluate prior to the examination by examiners other than the practical examiners. Only if the dissertation is accepted, the candidate can appear for the examination.

Marks allotted after final Examinations.

1. Theory paper I to IV 400

There will be **four** theory papers.

Practical

Spotters	50
Specimen	50
Clinical one long case	100
Two short cases	100
4. Viva voce	100
Total	400

- **Paper I** Basic Sciences, Radiation Physics, Radiological Anatomy, Radiography and Contrast Media.
- **Paper II** Respiratory System, Cardiovascular System, Gastro Intestinal Tract, Hepatobiliary System, Genito Urinary Tracts and Endocrine System.
- **Paper III** Skeletal System, Skull and Central Nervous System, Obstetrics and Gynaecological imaging, ENT, Eyes, Dental, Jaw and Soft tissues.
- **Paper IV** Nuclear Medicine, PET,SPECT and Recent advances

Spotters for Practical examination

Each examiner will; show at least 25 spot films to the candidate for the evaluation during Practical examination.

Specimen for practical examination

Related to basic sciences and applied clinical science, Radiology, special and interventional procedures and dark room Techniques

Clinical

One long case (worked out/active current cases) 1 hour

Two short cases (worked out/active current cases) 30 minutes each

Viva voce

Viva Voce shall be conducted by all the examiners appointed.

Internal assessment

Students shall be evaluated after each posting and teaching schedule, they will be required to maintain a log book. Student will be assessed after each posting. It is desirable for the candidate to have articles published or accepted for publication in the indexed journals / and or presentation in National or Regional conference.

Annexure – 1

TEXTBOOKS AND JOURNALS RECOMMENDED

1. Textbook of Radiology and imaging– by David Sutton.
2. Radiology: diagnosis, imaging, intervention – by Taveras and Ferrucci.
3. Alimentary Tract Radiology – by Alexander R. Margulis.
4. Textbook of Gastrointestinal Radiology– by Richard M. Gore MD, Marc S. Levine MD
5. Grainger and Allison's Diagnostic Radiology– by Grainger and Allison.
6. Text book of diagnostic imaging– by Charles E. Putman, Carl E. Ravin
7. Clarks positioning in Radiology.
8. Merrill's atlas of Radiographic positions and procedures.
9. Abram's Angiography: Vascular and Interventional Radiology– by **Herbert L Abrams**, D Baum Stanley, Michael J Pentecost.
10. Caffey's Pediatric Diagnostic Imaging
11. Interventional Radiology of the Abdomen – by Joseph T. M. D. Ferrucci, Jack Wittenberg
12. Taveras And Ferrucci's Radiology– by Ferrucci, Charles B. Higgins, Joseph T. Ferrucci
13. CT and a MR Imaging of the whole body– by John. R, Haaga, Charles F. Lanzieri , Robert C. Gilkeson
14. Diagnostic Neuroradiology: A text/Atlas – by Anne G. Osborn
15. Clinical ultrasound – by Cosgrove.
16. Bone and Joint Imaging – by Donald Resnick
17. Diagnosis of bone and joint disorders – 6 volumes – by Donald Resnick.
18. Paediatric orthopaedic Radiology – by Ozonoff.
19. The Radiology of Skeletal Disorders – by Murray and Jacobson.
20. Medical Radiation physics– by W J Meredith
21. The fundamentals of X– Ray and Radium Physics – by Joseph Selman.
22. Diagnostic ultrasound – by Carol and Rumak. S.R Wilson and J.W. Charboneau.
23. Imaging of new born, infant and young adult – by Leonard E Swischuck.
24. Hand book of cardiovascular Magnetic Resonance Imaging– by Gerald M. Pohost, Krishna S. Nayak
25. Neuroimaging – by William W Orrisson
26. Magnetic Resonance Imaging in orthopaedic and Sports Medicine – by David W Stoller
27. Felson's Principles of Chest Roentgenology – by Lawrence R. Goodman MD
28. Clinical Urography – by Howard M. Pollack MD, Bruce L. McClennan M
29. Christensen's Physics of Diagnostic Radiology – by Thomas S Curry , James E Dowdey, Robert E Murry

JOURNALS

1. American journal of Roentgenology (AJR).
2. British Journal of Radiology.
3. Seminars in Roentgenology
4. Radiological Clinics of North America
5. American Journal of Neuroradiology.
6. Indian journal of Radiology and Imaging.
7. Clinical Radiology.
8. Radiographics.
9. Radiology.
10. Pediatric Radiology.
11. Pediatric Radiology Journal
12. Acta Radiologica
13. Journal of Clinical Ultrasound
14. Ultrasound in Medicine and Biology
15. Ultrasound International
16. Ultrasound in Obstetrics and Gynecology
17. Neuroradiology
18. Skeletal Radiology (The Journal of Skeletal Radiology).
19. Clinical Imaging.
20. Seminars in ULTRA SOUND, CT and MR.
