

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

No. 69, ANNA SALAI, GUINDY, CHENNAI – 600 032.

M.D. / M.S.
POST GRADUATE DEGREE COURSES



SYLLABUS AND CURRICULUM

2021 – 2022

M.D. RADIO DIAGNOSIS

THE TAMIL NADU Dr. M.G.R MEDICAL UNIVERSITY, CHENNAI

M.D. RADIO DIAGNOSIS

1. GOAL

To optimally train a student in all aspects of medical imaging and image guided procedures to obtain ability to be a safe and efficient radiologist with the requisite Skillsets and Academic knowledge.

The candidate is fully competent to practice, teach and do research in the broad discipline of radiology. A resident on completing his/her MD (Radio-diagnosis) should be well versed with legal and regulatory aspects of imaging / intervention including medical ethics.

2. OBJECTIVES

In order to achieve the goal of this course, following objectives are to be accomplished by the time the candidate completes the 3 years course.

Three broad domains of the objectives are:

2 (A) Knowledge – Cognitive Domain.

Principles of the various imaging equipment

Imaging anatomy, anatomical variations

Relevant etiology, pathology

Knowing the approach to a clinical problem

Patient positioning

Imaging protocols

Imaging appearances of various abnormalities

Contrast agents, medicines used in Radiology

Safety in the work area including self, colleagues, patients and the equipment – in terms of radiation, biohazard etc.

Familiarity of the existing governing rules from the concerned government ministries (like PCPNDT act) and AERB.

Audit of reports and image guided procedures

An enthusiasm for knowledge and understanding to support lifelong learning.

A reflective attitude allowing accurate self-assessment and learning from practice. maintenance of equipments, documents

2 (B) Attitude–Affective Domain.

Follow the commitment and ethical principles of medical practice

Respect patient's rights

Empathetic attitude towards patients' needs

Understanding human values and commitment to the society

Clinical Radiology relies on a multi professional team and so radiologists should work with other healthcare professionals to put the needs of the patient above their own.

scientific attitude

commitment to clinical excellence

2 (C) Skills – Psychomotor Domain.

Ability to interact with the patients with communication skills Ability to examine the patients

Communication skills with patients and colleagues

Critical reporting in case of acute findings, potentially requiring an immediate intervention

Sound judgment through intelligent application of knowledge. Basic life support; ability to manage anaphylactic reactions.

Image guided interventions – including vascular and non-vascular procedures Teaching skills – role in teaching undergraduates, juniors, technician students etc.. Interdepartmental conferences-clinico radiologic meetings.

Life long learning : Update oneself by self-study and by attending courses, seminars, conferences and workshop which are relevant to the field of radio-Diagnosis.

Carry out research with the aim of publishing his/her work and presenting work at various scientific fora.

Leadership and mentorship: The student must take on a leadership role where needed in order to ensure clinical productivity and patient satisfaction.

Organize CME in the speciality utilizing modern methods of teaching and evaluation.

3. COMPONENTS OF THE POSTGRADUATE CURRICULUM

Theoretical Knowledge

Clinical imaging has significantly grown expanded over a period of time, especially in the last few decades. This knowledge to be acquired in a comprehensive manner during the postgraduate period. A detailed plan is mentioned in the subsequent section.

Practical and Clinical Skills

The practical and clinical skills are important as the subject is a clinical specialty. Interaction with the patients and the accompanying persons is very important in deciding the right choice of imaging. As some of the imaging involve ionizing radiation, one should be careful in using such imaging technology.

Image guided interventions help in the diagnosis and management. The postgraduate student should learn under supervision these skills. Consenting and counseling are essential.

Writing Thesis/Research Articles

A formal training with respect to writing thesis and research articles is important. This can be from a centralized system within the institution along with the postgraduates of other broad specialties. Time to time appraisal by the guide and the head of the department is strongly recommended.

Attitudes including Communication Skills

Knowing the patients' requirement helps in deciding which imaging is needed in problem solving. At the same time, unnecessary imaging, especially the ones with ionizing radiation should be implemented only when required. Role of radiology during medical emergencies is even higher, as the decision making needs to be quick. Learning and practising empathetic approach while interacting with the patients is essential component of the training.

Training in Research Methodology, Medical Ethics /Bioethics and Medico-legal aspects

The subject specific medico-legal aspects to be studied in the department like PCPNDT act, AERB rules etc.

Students should compulsorily attend the research Methodology workshop conducted by the University within first six months of the M.D course.

Students are encouraged to attend workshops/CME's on Bioethics conducted by the University and other reputed Institutions.

Medical ethics, bioethics, moral and legal issues and medical audit are part and parcel of the curriculum and syllabus.

4. THEORY SYLLABUS

4 (A) Physics of Medical imaging

X-ray Production

Discovery – Production – Properties of X-rays – Characteristics and continuous spectra – Design of hot cathode X-ray tube – Basic requirements of Medical diagnostic and therapeutic radiographic tubes – Rotating anode tubes – Hooded anode tubes – Rating of tubes – safety devices in X-ray tubes – Ray proof and shock proof tubes – Insulation and cooling of X-ray tubes – Mobile and dental units – faults in X-ray tubes – Limitations on loading. Modern xray tubes

Generators

Electric Accessories for X-ray tubes – Filament and high voltage transformers – High voltage circuits – Half-wave and full-wave rectifiers – Condenser discharge apparatus – Three phase apparatus – voltage doubling circuits – Current and Voltage stabilizers – Automatic exposure control – Automatic Brightness control – Measuring instruments – measurement of kV and mA - timers – control panels – Complete X-ray circuit

Radioactivity: Natural and artificial radioactivity-alpha decay-beta decay and spectra – gamma emission-positron decay electron capture and internal conversion- Exponential decay- Half life-Unit of activity-specific activity. Nuclear Fission-Nuclear reactor. Radiation sources- Natural and artificial-production of radio isotopes-reactor produced isotopes-Fission products- Gamma ray source for Medical uses.

Interaction of X-and Gamma rays: Attenuation of X-ray or Gamma rays-absorption and scattering-half value layer-coherent scattering-Photo electric absorption-compton scattering pair production and photoelectric disintegration. X-Ray transmission through medium-linear and mass attenuation coefficients. HVT - TVT and interaction of charged particle and neutrons with matter. Interaction of X-and Gamma rays in body-fat-soft- tissue-bone-contrast medium-Total attenuation coefficient. Relative important of different types of interactions.

Radiation detection and Measurements:

Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters- scintillation detectors – liquid semiconductor detectors – DAP meter. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber –electrometer – secondary standard dosimeters – film dosimeter – chemical dosimeter- thermoluminescent Dosimeter. -Pocket dosimeter- Radiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle function and uses.

Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement.

Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell -Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation,dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects-stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radiosensitivity. .

Principles of X-ray Diagnosis & Conventional Imaging

Physical Principle of diagnostic radiology:

Interactions of X-rays with human body, differential transmission of x-ray beam, spatial image formation, visualization of spatial image, limitations of projection imaging technique viz. superimposition of overlying structures and scatter, application of contrastmedia and projections at different angles to overcome superimposition of overlying structures.

Radiography techniques:

Prime factors (kVp, mAs and SID/SFD), influence of prime factors on image quality, selection criteria of prime factors for different types of imaging, different type of projection and slices selected for imaging, objectives of radio-diagnosis, patient dose VsImage quality.

Scatter reduction:

Factors influencing scatter radiation, objectives of scatter reduction, contrast reduction factor, scatter reduction methods; **beam restrictors** (diaphragms, cones/cylinders &collimators). **Grids** (grid function, different types of stationary grids, grid performance evaluation parameters, moving grids, artifacts caused by grids, grid selection criteria),air gap technique. **Filtration:** Inherent and added filters, purpose of added filters, beryllium filters, filters used for shaping X-ray spectrum (K-edge filters: holmium, gadolinium, molybdenum)

Radiography:

Radiographic Film: Components of Radiographic Film, physical principle of imageformation on film, double and single emulsion film, sensitometric parameters of film (density, speed, latitude etc.) **Intensifying screens:** Function of intensifying screens, screen function evaluation parameters, emission spectra and screen film matching, conventional screens Vs rare earth screens. Quality assurance in film, developer etc

Digital radiography: Computed Radiography (C.R) –equipment parts –advances- principle of imaging –applications- advantages & disadvantages. Photostimulable phosphors-image acquisition- Direct and indirect DR systems. Laser imager and multiframmer- recent trends

Mammography

Imaging requirements- Mammography system - construction/types accessories - tube, compression, grids, AEC etc.- nature of X-Ray beam suitable – accessories for immobilization - film processing - image quality - image recording devices - interventional procedures – accessories-biopsy equipment attachments - radiation dose- & digital mammo.

Dental Radiography – Equipment Basics –types of equipments- Intra oral radiography, orthopantomography, cone beam CT, image reconstruction techniques

Fluoroscopy and angiography: Fluoroscopic equipment- Conventional fluoroscopy – factors affecting the Fluoroscopic image. Image intensifier tubes – principle construction and function regarding intensified image- cine fluorography-mode of operation – Image intensifiers - optical coupling - cameras - Automatic brightness control- over and under couch tubes safety features. Flat panel fluoroscopy systems, digital subtraction techniques. Quality assurance tests for fluoroscopic equipment. Angiography, DSA, road mapping, pixel shift, reconstruction techniques.

Dexa Scan & Bone Mineral Densitometry : Physics ,Principles, Applications

Tomography and Computed tomography

Conventional tomography (Principle only), orthopan tomography (OPG), Basic physics – Tomography principle - detectors technology - Basic data acquisition concepts - Image reconstruction- artifacts- Equipment for computed tomography – Table, scanning gantry X-Ray generator – CT control console. Scanner types -technologic considerations of sequential /spiral volume zoom - image processing system- QA of CT equipment. CT dosimetry

Magnetic Resonance Imaging (MRI)

Magnetic Resonance image – proton density, relaxation time T1 & T2 images – Image characteristics – MRI system components – Magnets, Magnetic fields, Gradients, Magnetic field shielding, Radio Frequency systems, Computer functions – Imaging process – Pulse sequences, Advanced sequences – spectroscopy, fMRI, BOLD, DTI, SWI etc, Image artifacts – MRI safety.

Ultrasound Imaging

Basic acoustics principle- Basic physics of sound propagation in different media, production of Ultrasound (piezoelectric effect), ultrasound terminologies – interaction of ultrasound with matter – ultrasound properties propagation in tissue, absorption, scattering, reflection and refraction- acoustic impedance – piezoelectric effect – transducer – Pulsar – receiver – beam/sensitivity and gain - generators- A, B and M scanning & echo modes- transducers techniques of sonography - equipment selection- display methods – ultrasound image formation - data storage and display – image and artifacts – Doppler instrumentation – Doppler equation – transducer – quality assurance and performance tests – bio effects and safety considerations. Types of machines – portable systems- acoustic coupling agents ingredients/ preparation.

Image quality and PACS:

Image quality parameters: sources of un-sharpness, reduction of un-sharpness factors influencing radiographic contrast, resolution, factors influencing resolution, evaluation of resolution (point spread function (PSF), line spread function (LSF), edge spread function (ESF), modulation transfer function (MTF), focal spot size evaluation. PACS, archival systems, DICOM,

Nuclear Medicine Equipments: Nuclear Physics - basics in Nuclear Medicine- Nuclear medicine equipments – Gamma Cameras- rectilinear scanners- radioisotope generators- Handling of isotopes- SPECT-CT & PET-CT- introduction basic physics and principle involved- equipments basic structure—differences- fusion techniques- image formation-storage devices—advantages- limitations.

Radiation protection:

Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey –ALARA- personnel dosimeters (TLD and film batches)- occupational exposure. Radiation safety accessories in Radiology modalities.

Regulatory Bodies & regulatory Requirements:

Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material. Evaluation of workload versus radiation factors – Occupational exposure and protection Tools/devices.

National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements. e LORA
,Registration/ license of X-Ray /other equipment installation- Certification.

PCPNDT, clinical establishment act, NABH

International bodies: ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection.

Quality Assurance (QA) in Diagnostic Radiology

Meaning of the terms used and aspects of a QA programme, equipment and staff requirements, benefits of QA procedures in an imaging department –NABH guidelines. QA in X-ray unit, CT scanner, Mammography, DEXA, OPG, Dental, Lithotripsy, Angiography/Fluoroscopy

Picture archiving and communication system (PACS) and Radiology informationsystem(RIS)

Basic sciences related to radiology as applied physics

4 (B) Radiology (diagnostic and interventional) Image Interpretation.

The student should be able to interpret images on all imaging modalities of diseases of following organs :

1. Musculo-skeletal System - Interpretation of diseases of muscles, soft tissue, bones and joints including congenital, inflammatory, traumatic, endocrine and metabolic, neoplastic and miscellaneous conditions.
2. Respiratory System - Interpretation of diseases of the chest wall, diaphragm, pleura and airway; pulmonary infections, pulmonary vasculature; pulmonary neoplasm; diffuse lung disease; mediastinal disease, chest trauma; post-operative lung and X-ray in intensive care.
3. Cardiovascular System - Interpretation of diseases and disorders of cardiovascular system (congenital and acquired conditions) and the role of imaging by conventional radiology, ultrasound, colour Doppler, CT, MRI, Angiography and Isotopes Studies.
4. Gastro-intestinal tract and hepato-biliary pancreatic system - Interpretation of diseases and disorders of mouth, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, diseases of omentum, peritoneum and mesentery: acute abdomen, abdominal trauma. Diseases and disorders of liver, biliary system and pancreas.

5. Urogenital System - Interpretation of various diseases and disorders of genitor- urinary system. These include: congenital, inflammatory, traumatic, neoplastic, calculus disease and miscellaneous conditions.

6. Central Nervous System (C.N.S.) - Interpretation of diseases and disorders of the head, neck and spine covering, congenital, infective, vascular, traumaticneoplastic degeneration metabolic and miscellaneous condition.

7. Imaging in Emergency Medicine.

8. Imaging in Obstetrics and Gynecology.

9. Imaging of Breast and interventional procedures.

11. ENT, EYE and Dental Imaging.

11. Imaging of endocrine glands and those involved with metabolic diseases.

12. Clinical applied radionuclide imaging.

13. Interventional Radiology

In respective systems, knowledge regarding the **patient positioning, imaging protocolsetc** should be emphasized.

The relevant imaging like **plain radiography, ultrasound, Doppler, CT, MRI, Angiogram ,Nuclear medicine** including **contrast studies**

Role of **image guided interventions** like FNA, FNAB, drainage procedures, angiogram, vascular interventional procedures, foetal interventions, radiofrequency ablations etc. in all the systems.

Special emphasis on **emergency radiology** findings in all the systems.
Understanding of **multi-system involvement of diseases**.

Ability to give **differential diagnosis** and to suggest **further relevant management**
To have some idea regarding the medical and surgical management.
Recent advances are to be learnt from the journals.

5. TEACHING LEARNING METHODS (including Clinical Study)

Students are trained by

I. Rotational postings

II. Various teaching methods. Some recommendations are below

1. Theory classes / lectures by Faculties -2/week.
2. Clinical symposium organized every month with 3 senior residents &faculty
3. clinical seminars - Every day floor presentation of short topic by residents
4. practical classes by faculty- like ultrasound demonstration-1/week.
5. Once in a week journal club –presented by the student and critical review by faculty

6. Case presentations -3 days a week of all modalities to be covered (with due importance to X ray, contrast, methodology, description of procedures and reading the films)- discussion for a period of 45 min to 60 min. Competitive/interesting case presentation by PG s -once in a week (case of the week)
7. Clinico radiological Inter-departmental meets -every week
8. Guest lectures – once in a month
9. Group discussions-2 days a week Special practical classes with images - clinikoradiologic approach and possible differential diagnosis - discussion by faculty & residents
10. Special focus on recent advances once in 3 months- paper discussion/ implementation in dept / AJC staging / implementation of newer classifications e.g. – Thyroads, Pirads, Atlanta etc.
11. Audits: Mortality, Reporting, Image guided procedures etc. – once in every month
12. Every day lobby quiz/ electronic quiz –open to all.
13. Thesis/dissertation review/competency assessment - once in every month
14. logbook ,journal publication and research review -- once in every month
15. Spotters /Quiz & film reading session By faculty-every week

Weekly Post Graduate Academic Timetable (Model)

	Number per week	Day in which held	Time	Number per month	Number / year
Theory Classes	2	Tuesday / Thursday	1.30 pm to 2.30pm	8	96
Clinical Seminars	1	Friday	8 to 9 am	4	48
Journal Clubs	1	Wednesday	12 noon to 1 pm	4	48
Case presentations	3	Mon / Wed / Friday	12:30 to 1:30 pm	12	144
Group Discussions	2	Tuesday / Thursday	12:30 to 1:30 pm	8	96
Guest lectures	-	Fourth Saturday	11 am to 12 noon	1	12

Note: All sessions will be co-ordinated by the faculty members. Time table may be modified depending on the feasibility and exigencies.

III. ACADEMIC REQUIREMENTS:

Students are encouraged to attend conference and CME

Basic life support (BLS / ATLS) certificate

Bioethics and statistics training certificate

IV. Various assessment methods.

Formative Assessment :

The formative assessment is continuous as well as end-of-term. The former is based on the feedback from the senior residents and the consultants concerned. End-of-term assessment is held at the end of each semester (upto the 5th semester). Formative assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.

6. STRUCTURED TRAINING PROGRAMME

Students are trained by the following methods.

PROPOSED SCHEDULE FOR ROTATION

1 ST Year(1/6)	Conventional Chest & abdomen	Conventional skull, spine, musculo- skeletal etc.	US	Contrast studies - GIT & other fluoro- scopic investigations	Contrast studies - G.U. tract	US
	US & inter- ventions	Conventional skull, spine, musculo- skeletal etc.	CT	Contrast stud- ies -- GIT & other fluoro- scopic inves- tigations	Contrast studies - G.U. tract	US &inter- ven- tions
2 nd Year(3/6)	Conventional Chest & ab- domen	Contrast stud- ies - GIT & other fluoro- scopic inves- tigations in- cluding angiography	Contrast studies - G.U. tract	US & inter- ventions	Emergency	CT
	Conventional skull, spine, musculo- skeletal etc.	Contrast stud- ies - G.U. tract including pediatric MCU/genito- gram	US & in- tervent- ions	US & Doppler	Emergency	MRI

3 rd year (5/6)	Conventional Chest & mammography	Contrast stud- ies - GIT & oth- er fluoroscopic investigations including an- giography	US & Doppler	Emergency	CT & interventions	Elective
(6/6)	Conventional musculo- skeletal & mammography	Contrast stud- ies -G.U. tract including pediatric MCU / Genitogram	CT& inter- ven- tions	CT & inter- ventions	MRI	Elective

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently. For this purpose, provision of skills laboratories in medical colleges is mandatory.

II .Practical skill assessment with scores using structured skill modules

E.g. Structured skill module to demonstrate segments of the liver in the ultrasonography for radiology residence

S. NO	DEMONSTRATION	SCORE (MAX)	SCORE
1.	Clinical History	1	
2.	Position and proper exposure for USG	1	
3.	plane of scanning - inter costal and sub costal	2	
4.	Position – supine / right anterior oblique, depends on the patient built	2	
5.	To show all the 3 hepatic veins from confluence into IVCup to margin of liver	3	
6.	To show horizontal segment of right and left portal vein	2	
7.	Gall bladder fossa, falciform ligament and IVC	3	
8.	To show hepatic artery and CBD at porta hepatis	2	
9.	To identify caudate lobe	1	
10.	Show divisions of right and left lobe	1	
11.	To identify the segment 5, 6,7 and 8	4	
12.	To identify the segment 2,3 and 4	3	
	Total	25	

Total score of 25 given and each radiology post graduate student was evaluated.

This will help both the student and training faculty to identify the mistake to specific areas and correct at ease. This will improve the confidence of the students a lot. The bias in assessment is also removed.

To device this kind of modules for each and every system / organs / modality in radiology in a feasible way to individual training institute.

Specific scores to be fixed by the institutes to allow the students to do the cases under a faculty and to allow them to handle the patients individually.

During IInd year, the Students are encouraged to undergo special postings for learning new advanced techniques / procedure / skills in institutions of higher repute where the requisite facilities are available without affecting the duties of the parent department.

7. Evaluation of the candidates in both theory and practical aspects will help the candidate in improvement of his/her knowledge, skills and attitude.

8. COMPETENCY ASSESSMENT:

- **OVERALL:**

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

Total		20 Marks

PG CLINICAL COURSES

VIVA including Competency Assessment	- 80 Marks (60 + 20)
Log Book	- 20 marks

ASSESSMENT SCHEDULE IS AS FOLLOWS

Year of study	Period				Total Max.20 marks
I year	Upto Dec	10 marks	Upto June	10 marks	20 Marks
II year	Upto Dec	10 marks	Upto June	10 marks	20 Marks
III year	Upto Oct	10 marks	Upto Feb	10 marks	20 Marks
	AVERAGE				20 Marks

9. Dissertation and University Journal of Medical Sciences:

As per the 49th SAB Resolution under Point No. 2 and in the 52nd SAB it was reiterated regarding the topic for dissertation

The topic for the dissertation should be registered and sent to the University after Ethics Committee approval before 31st of December of the first Post Graduate Year. Only one change of topic with proper justification from the Head of the Department is permitted before 31st March of the first Post Graduate Year. The change of dissertation title will not be permitted after 31st March of the First Post Graduate Year. This modification in regulation will be scrupulously followed from the academic year 2015-16 admission onwards.

As per Medical Council of India Post Graduate Medical Education Regulations 2000 (amended upto 10th August 2016) clause 13.9 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.

As per MCI Clause 14 (4)(a), thesis shall be submitted atleast 6 Months before the Theory and Clinical/Practical Examination.

A candidate shall be allowed to appear for the Theory and Practical/Clinical Examination only after the acceptance of the Thesis by the Examiners.

The periodical evaluation of dissertation/log book should be done by the guide / HOD once in every six months. The HOD should ensure about the submission of dissertation within the stipulated time.

Regarding submission of articles to the University Journal of Medical Sciences for all the PG Degree/Diploma courses, it is mandatory that the students have to submit at-least one research paper. Case Reports are not considered as Research Paper

10. THEORY EXAMINATION

Paper I: Basic sciences related to Radiology (consists of Anatomy, Pathology, Basic and Radiation Physics, Imaging Techniques, and Film processing).

Paper II: Chest, CVS, CNS including Head & Neck, Eye, ENT, musculo-skeletal, pediatric radiology and Mammography.

Paper III: Abdominal Imaging including GI, GU, Hepatobiliary, endocrine and metabolic, Obstetrics and Gynaecology and Interventional Radiology.

Paper IV: Recent advances, nuclear medicine; Radiology related to clinical specialties

Question Paper pattern

Elaborate on $2 \times 15 = 30$

Write Notes on $10 \times 7 = 70$

Total

100 marks

11. PRACTICAL EXAMINATION

LONG CASE :(1X60 MARKS)	60 MARKS
SHORT CASE :(3 X 30 MARKS EACH) Including one ULTRASOUND CASE DEMONSTRATION	90 MARKS
SPOTTERS / OSCE (40 x 1.25 mark)	50 MARKS
TOTAL	200 MARKS (A)
VIVA VOCE	80 MARKS (B)
LOG BOOK	20 MARKS(C)
AGGREGATE (CLINICAL+VIVA)TOTAL	300 MARKS(A+B+C)
MINIMUM REQUIRED FOR PASS (50%)	150 MARKS
DISSERTATION	APPROVED/NOT APPROVED

12. LOG BOOK

Log book should be regularly maintained, signed by the faculty supervising the area. This should represent the academic and clinical work done by the candidate. The presentations and procedures carried out by the candidate.

Periodic review of Log book and Dissertation have to be done in the Department by guide/HOD once in every 6 months.

Table 1: Academic activities attended

Date	Type of Activity CME , conferences by national societies	Particulars

Table 2: Academic papers/posters presentation

Date	CME , conferences by national societies	Particulars

Table 3: Academic presentations made by the student in the department

Date	Topic	Type of Presentation Specify Seminar, Journal Club, Presentation, UG teaching etc.

Table 4: Diagnostic and interventional procedures performed

Date	Patient particulars	Procedure	Diagnosis/DD	Remarks/ followup

Table 5: Abstract of Diagnostic and interventional procedures performed

period	Procedure	Number seen	Number done

Table 6: Publications in Indexed Journals

Date	Journal	Title	Authours

13. VIVA-MD Radiodiagnosis

VIVA including Competency Assessment: (60 + 20 = 80 marks)60

marks Viva, 20 marks competency assessment

VIVA (4 X15=60 marks)

1. RAPID FILM READING
2. INSTRUMENTS/ RADIOLOGIC PHYSICS
3. COPETENCY ASSEEMENT /CONTRAST AGENTS
4. CATHETERS/NEEDLES QUALITY CONTROL AND REGULATIONS

14. SPOTTER / OSCE -Objective Structured Clinical Examination (OSCE)

The following items in different combinations can be used as OSCE.

Medical images with a clinical scenario, asking for a diagnosis and suitable management. Digital images of medical grade high resolution are acceptable. Contrast agents, Emergency drugs relevant to treating anaphylaxis Interventional Radiology material Radiology physics items ,regulatory bodies and quality assurance

15. REFERENCE BOOKS

Text books of Physics:

- Curry, T.S. Dowdey, J.E. Murry, R.C. (1990), Christensen's introduction to the Physics of diagnostic radiology, 4th edition, Philadelphia, Lea & Febiger
- Bushberg, S.T.; Seibert, J.A.; Leidholt, E.M. & Boone, J.M. (1994), The essential Physics of Medical imaging, Baltimore, Williams & Wilkins
- David J. Dowsett; Patrick A. Kenny; Eugene Johnston R. The Physics of
- Diagnostic imaging
- Johns, H.E. & Cunningham, J.R. The Physics of radiology, 4th edition
- Hendee, W.R. & Ritenour, R. (1993) Medical Imaging Physics, 3rd edition
- Dendy, P.P. & Heaton, B. Physics for diagnostic radiology, 2nd edition
- E. Seeram, X-ray imaging equipment, An introduction
- Hashemi, R.H. Bradley, W.G. & Lisanti C.J. MRI the basics
- RF Farr and PJ Allisy-Roberts Physics for Medical Imaging
- Sprawls, P.; Magnetic resonance imaging principles, methods and techniques
- Chesney, D.N. & Chesney, M.O. X-ray equipment for student radiographers
- Chesney, D.N. & Chesney, M.O. Radiographic imaging

Radiology text books

1. Diagnostic Radiology-An Anglo American Text Book of Imaging – Grainger & Allison
2. Text Book of Radiology & Imaging – Sutton
3. CT & MRI Imaging of the Whole Body – Haaga
4. Diagnostic ultrasound by- Rumack
5. Essential of skeletal Radiology – Yochum and Rowe's
6. Thoracic Imaging – W. Richard Webb & Charles B. Higgins
7. Chapman's Radiological Differential Diagnosis
8. Chapman's Radiological Procedures

9. Radiology review manual – Wolfgang Dahnert
10. Radionuclide section scanning. An atlas of clinical practice-khan
11. Alimentary tract Radiology – Abdominal Imaging – Margulies
12. Diagnostic Imaging of Neuro Radiology – Osborn
13. Christensen's physics of Diagnostic Radiology
14. Clark's Positioning Radiology – A. Stewart Whitley Charles Sloane, Craig Anderson, Graham Hoadley, Gail Jefferson, & Ken Holmes
15. Bushberg, S.T; Seibert, J.A; Leidholt, E.M & Boone, J.M. (1994), The essential Physics of Medical imaging, Baltimore, Williams & Wilkins
16. Hashemi, R.H. Bradley, W.G; & Lisanti C.J. MRI the basics
17. Sprawls, P; Magnetic resonance imaging principles, methods and techniques

REFERENCE BOOK: (Latest Editions)

1. Text Book of GastroIntestinal Radiology – Richard M. Gore
2. Head & Neck Imaging - Som & Curtin
3. Clinical Urography – Pollack
4. Diagnostic Imaging – Brain & Spine Anatomy
5. Diagnostic Imaging - Brain
6. Diagnostic Imaging - spine
7. Diagnostic Imaging - ultrasound
8. Diagnostic Imaging - abdomen
9. Diagnostic Imaging - Head & Neck
10. Diagnostic Imaging - Interventional Radiology
11. Diagnostic Imaging - Caffey's Pediatric
12. Applied Radiological Anatomy – Paul Butler, Adam W.M. Mitchell & Jeremiah C. Healy
13. Orthopedic Imaging – A Practical Approach – Adam Greenspan & Javier Beltran
14. Caffey's Paediatric X-Ray Diagnosis – Frederic Silverman

15. Abrams Angiography – Interventional Radiology – Jean-Francois H. Geschwind & Michael D. Dake
16. Callen's Ultrasonography in Obstetrics and Gynecology – Mary E. Norton, Leslie M. Scoutt, Vickie A. Feldstein
17. Breast Imaging – Daniel B. Kopans
18. Introduction to Vascular Ultrasonography – Zwiebel & Pellerito
19. A Practical Guide to Fetal Echocardiography - Normal and Abnormal. Hearts – Alfred Abuhamad & Rabih Chaoul
20. MRI of the Musculoskeletal System – Thomas H. Berquist
21. Nuclear Medicine in Clinical Diagnosis & Treatment – I.P.C Murray & P.J. Ell
22. Essentials of Nuclear Medicine Imaging

**** Note : The editions are as applicable and the latest editions shall be the part of the syllabi.**

16. JOURNALS

1. Radiographics
2. Radiology
3. British Journal of Radiology
4. Clinical Radiology
5. American Journal of Roentgenology
6. Radiology Clinics of North America
7. Recent Advances in Radiology and Medical Imaging
8. American Journal of Neuroradiology
9. Indian Journal of Radiology & Imaging
10. Seminars in Roentgenology
11. Journal of Ultrasound
12. JCIR (Journal of Clinical Interventional Radiology)
