

## MD RADIO – DIAGNOSIS AND IMAGING

### PROGRAMME GOALS

To develop a skilled and competent clinician who can diagnose and practice all broad disciplines of radiology and imaging (conventional and special radiography, USG, CT, MRI etc.) and can organize and conduct research in radiolo-diagnosis and allied disciplines.

### PROGARMME OBJECTIVES

The candidate qualifying for the award of MD in Radiodiagnosis and imaging should be able to:

1. To acquire knowledge of Radiation physics related to Radio-diagnosis, Radiography, Image quality, and Radiation Protection.
2. To understand the physical principles, image formation, artifacts, limitations, advantages & clinical applications of various image modalities like Radiography (conventional & digital), US, doppler, CT, MRI, DSA, Mammography & Nuclear Medicine.
3. Enumerate the biological effects of radiation and the steps to ensure radiation protection.
4. To acquire knowledge of recent advances in all imaging modalities in respect to physical principles and clinical approach.
5. To acquire good knowledge of various subspecialties ( including cross sectional Anatomy- Normal and variant) such as chest, C.V.S, C.N.S, G.U.T Hepato-biliary, Endocrinal, metabolic and Musculoskeletal system etc.
6. Independently conduct all routine and special radiological and imaging investigations.
7. Correlate pathology of disease conditions with radiological and imaging features.
8. Identify imaging features in various systems to come to an imaging diagnosis and diagnose problem related to body system.
9. Provide radiological services in acute emergency & trauma with understanding of its medico legal implications.
10. To deal with allergic contrast reactions & be aware of resuscitation methods.
11. Elicit indications, diagnostic features and limitation of applications of ultrasonography, CT and MRI including current techniques, practice & development.
12. Perform basic image guided intervention procedures for diagnosis and therapeutic management.

13. Describe proper cost effective algorithm of various imaging techniques in a given problem setting.
14. To develop the ability to understand and answer a specific clinical problem with the help of available imaging modality.
15. Knowledge of Radio nuclear pharmaceuticals, imaging techniques and interpretation of abnormal nuclear Scans.
16. Demonstrate capacity and motivation and continued self learning.
17. Teach the undergraduates and post graduates in other specialties and to train related medical, paramedical and technical personnel.
18. Should have knowledge about the care and maintenance of sophisticated medical equipment and should be able to supervise and train the posted staff.
19. Identify problems of research in the specialty particularly relevant to the disease pattern of the country and plan a rational approach to achieve its goal.
20. Organize CME in the specialty utilizing modern methods of teaching and evaluation.
21. Should develop a gentle and humanitarian approach towards the patient, should have good communication skills- to explain the procedure to patient, win his/her confidence & obtain informed consent.

### STUDENT ELIGIBILITY AND SELECTION METHOD

1. Medical Graduate with MBBS
2. Eligible candidates must take and pass an entrance examination
3. Students are selected on the basis of merit.

### CONCEPTUAL FRAMEWORK

#### DMRD COURSE

During the two year course the student will work in the following areas:

1.	Conventional- chest, abdomen, musculoskeletal including skull, spine, PNS and mammography etc.	5 months
2.	Contrast studies: GU, GIT, hepato-biliary, angiography etc including fluoroscopic guided interventions.	5 months
3.	USG, Doppler and USG guided interventions.	5 months
4.	CT and CT guided interventions	4 months
5.	Emergency radiology	2 months
6.	MRI	1 months
7.	Paediatric radiology	2 months
	TOTAL	24 months

## MD RADIODIAGNOSIS COURSE

During the three year course the student will work in the following areas:

1.	Conventional- chest, abdomen, musculoskeletal including skull, spine, PNS and mammography etc.	8 months
2.	Contrast studies: GU, GIT, hepato-biliary, angiography etc including fluoroscopic guided interventions.	8 months
3.	USG, Doppler and USG guided interventions.	8 months
4.	CT and CT guided interventions	6 months
5.	Emergency radiology	2 months
6.	MRI	2months
7.	Paediatric radiology	2 months
	TOTAL	36 months

- During each unit posting candidate should be able to conduct the procedures and interpret the findings
- Formative assessment at the completion of posting in each unit.

### THESIS FOR MD RADIODIAGNOSIS

Protocols submitted at the end of 5 months

Medical Education

Ethics

Research Methodology

Statistics

Epidemiology

orientation of these with in 6 months

Library

Manuscript

Computer

Medical Audit

Thesis submission at the end of 2 years

### OBJECTIVES

1. The student would be able to demonstrate capability in research by planning and conducting systematic scientific inquiry and data analysis and deriving conclusion.

### GUIDE FOR THESIS

As per faculty of medicine guidelines

### ASSESSMENT

As per faculty of medicine guidelines

## SUBJECT CONTENT

### Physics related to Radiodiagnosis

1. Introduction to general properties of radiation and matter. Fundamental of nuclear physics and radioactivity.
2. Production of x-ray
3. X-ray generating apparatus
4. Interaction of x-rays and gamma rays with matter and their effects on irradiated materials.
5. Measurement of x and gamma rays
6. Interaction of x-rays with the patients
7. Radiographic image
8. The image receptor
9. Contrast media.
10. Radiation protection
11. Image quality and quality assurance
12. Radionuclide imaging (gamma camera, spect. PET)
13. Computed tomography
14. Principles of diagnostic ultrasound and Doppler
15. Magnetic resonance imaging

### Radiography and Processing techniques.

1. Dark room technique
2. Radiography of the extremities
3. Radiography of the spine, abdomen, pelvic girdle and thorax
4. Radiography of the skull
5. Contrast techniques of GI tract, biliary tract, GU tract
6. Contrast techniques of C.N. system
7. Contrast techniques of the cardio vascular system including chest
8. Miniature radiography, macro radiography & magnification techniques
9. Pediatric Radiography
10. Dental , portable and emergency radiography
11. Contrast & contrast reactions

### Anatomy

- Gross and cross sectional anatomy of all the body systems.

### Pathology

- Gross morphology of pathologies condition of systemic disease.

## RADIODIAGNOSIS –COURSE CONTENTS

Various diseases involving the following systems-

1. Musculoskeletal System
2. Respiratory System
3. Cardio-vascular system
4. Gastro-intestinal tract including Hepatobiliary system
5. Urogenital tract.
6. C.N.S. including spine
7. Radiology of obstetric and Gynecology
8. E.N.T, EYES, Teeth, soft tissue, Breast.
9. Endocrinal Glands
10. Clinical applied radionuclide imaging.
11. PAC'S, digital radiography and other recent advances, molecular and functional imaging.
12. Emergency radiology and trauma
13. Interventional Radiology related to different system of the body.
14. Radiation Physics.

### **Contrast Agents:-**

Contrast media, their type, formulation, mechanisms of action, dose schedule, routes of administration, adverse reactions and their management and recent development.

## ASSESSMENT

As per faculty of Medicine guidelines

All the papers are to be set by 3 internal examiners and moderated by external examiner.

Theory - 50%

Paper-1 - Basic Sciences and radiation physics.

Paper-II - CVS, Resp.GIT (including Hepato biliary), Endocrine.

Paper-III - Genitourinary, Retroperitoneum, CNS, Musculoskeletal System, Obst and Gynecology ENT and Eye

Paper-IV - Recent advances and Nuclear Medicine

And Radiodiagnosis as related to clinical problem solving exercise.

All papers would consists of short answer questions covering all aspects of the course.

Practical - 50%

1. One long and two short cases- 50%
2. Film Quiz 50 spots -----25%
3. Radiation Physics - 5%
4. Equipment and Accessory related to Radiology - 5%
5. Radiological and Imaging Procedure - 10%
6. Goss Pathology - 5%

### **Diagnostic Techniques and General Conditions-**

Picture archiving and communication systems and digital radiology, intravascular iodinated contrast media, general principles of ultrasound, vascular ultrasound, recent developments in whole body Computed tomography, Basic principles of Magnetic Resonance Imaging, General Principles of Radionuclide imaging, dual energy X-ray absorptiometry, functional imaging, medico legal issues in diagnostic and interventional radiology, patient dosage and radiation protection in diagnostic imaging ,cost benefit.

### **THE RESPIRATORY SYSTEM**

The normal chest, methods of investigations, techniques, interpreting chest-radiograph and disease differential diagnosis.

The mediastinum, chest wall , pleura and diaphragm; Diseases of airways: collapse and consolidation; pulmonary infections ; pulmonary neoplasm's; Diffuse lung diseases; occupational lung disease; chest trauma, pulmonary thromboembolism; chest in critical care patients, interventional techniques ; chest in neonates, and pediatric chest radiology.

### **THE CARDIOVASCULAR SYSTEM:**

The normal heart: anatomy and techniques of examination. Acquired heart disease: the chest radiograph, non-invasive imaging- echocardiography, nuclear imaging, CT, MRI. Invasive imaging and interventional techniques  
Congenital heart disease, ischemic heart disease, radiology of pulmonary circulation, cardio my apathies and tumors, pericardial disease  
cardiac transplant surgery; role of Radiology in cardiac prostheses and pacemakers, Arteriography and interventional angiographic techniques, Phlebography, The lymphatic system.

## **THE ABDOMEN AND GASTROINTESTINAL TRACT**

The Abdomen : Normal appearance, abdominal calcification, acute abdomen, pneumoperitoneum, post operative abdomen, Intraperitoneal fluid, inflammatory conditions, intraabdominal abscesses, intramural gas ,other conditions.

The Esophagus-anatomy and normal appearances, radiological investigation like barium, usg, including endovascular, CT, MRI. diseases- hiatus hernia, oesophagitis, neoplasm, esophageal Varices, associated dermatological conditions, trauma, esophageal web, motility disorders,eosophageal diverticulum, extrinsic esophageal compression, post operative changes, scintigraphy.

The Stomach - anatomy and normal appearances, radiological and imaging investigations, inflammatory diseases, tumors, structural and functional abnormalities, extrinsic masses, post operative stomach- USG, CT, MRI, examination, radionuclide studies.

The Duodenum and small bowel-anatomy and normal appearances, radiological investigations ( Barium meal follow through, enteroclysis, CT,MRI, with CT/MRI enteroclysis, virtual endoscopy). diseases- neoplasms, infections, and infestations, radiation enteritis, mechanical small bowel intestinal obstruction, ischemia, intramural hemorrhage, diverticulitis, and blind loop, neuromuscular disorders, malabsorption syndromes, immunological disorders, radionuclide studies of small bowel.

Large Bowel-Anatomy, colonic function, investigations like (Barium, CT,MRI, Colonography, virtual colonoscopy), diseases- tumors, diverticular diseases, colitis, miscellaneous conditions, appendicitis, Scintigraphic detection of bleeding,

Abdominal imaging-

Liver: gross anatomy, plain film diagnosis, investigations like USG, CT, MRI, MRCP, PTC, ERCP, T-tube cholangiography, vascular studies, hepatobiliary interventions., portal hypertension, focal masses, diffuse liver disease, inflammatory disease of liver, gall bladder and biliary diseases, gall bladder masses, radiology in liver transplantation. Radiology of spleen ,pancreas, peritoneum and mesentery, Pancreas; embryology, radiological anatomy, techniques of examination, radiological diagnosis and interventional treatment.

GI manifestation of AIDS; Radiological evaluation, techniques, lesions, oesophagitis, lesions involving stomach, small bowel, colon, biliary tract, lymphadenopathy.

GI angiography – general considerations, celiac and hepatic, pancreatic, SMA & IMA angiography, GI bleeding, angiography in portal hypertension, PTA and mesenteric ischemia.

Newborn and young infant: lesions causing obstruction, atresia, gastric, antral or pyloric atresia, small bowel atresia, anal atresia and imperforate anus, anomalies of rotation and mid gut volvulus, enteric duplication, hypertrophic pyloric stenosis, gastro esophageal reflux and hiatus hernia, Hirschsprung's disease, colonic immaturity, neonatal small left colon syndrome, meconium plug syndrome, meconium ileus, intussusceptions, necrotizing enterocolitis.

**ENDOCRINE DISEASE:** introduction, Pathophysiology, radiological techniques, hypothalamus, pineal, pituitary, thyroid, para thyroid, thymus, pancreas, GI tumors, adrenal, female reproductive system, male reproductive system

**GENITO-URINARY SYSTEM** –methods of investigation – plain films, IVU, MCU, ultrasound, CT scanning, MRI, MR-angiography, antegrade pyelography, retrograde pyelography, cavernosography, radionuclide imaging. Nuclear medicine in genitourinary tract, clearance techniques, dynamic renal scan, static renal scan, V-U reflux, role of radionuclide scanning in renal infections, Urodynamics, lower urinary tract studies, applications in bladder instability, urinary incontinence, outflow obstruction, neurogenic bladder, & upper urinary tract, disease.

Renal parenchymal disease; anatomy, normal appearances, differential diagnosis, renal infections.

Renal masses: modalities available for diagnosis, non-neoplastic renal masses, neoplastic renal masses - benign and malignant, calculus disease and urothelial lesions, nephrocalcinosis, other lesions, staging of upper urinary tract tumors, staging of bladder tumors.

Urinary obstruction : Pathophysiology, diagnosis by different modalities, non obstructive dilatation, causes of obstruction, urinary bladder; normal anatomy, radiological evaluation, pathologies, prostate: Normal anatomy, radiological investigations, congenital processes, infection, calculi, tumors, BHP, carcinoma. Reno vascular hypertension, renal arteriography, Reno vascular disorders, Reno vascular HT - etiology, management, investigative strategy, identification of renal artery stenosis, significance of renal artery stenosis, radiological treatment of Reno vascular hypertension, PTA, embolization in



Reno vascular HT. Injuries to urinary tract-kidney, ureter, bladder and urethra classification of renal injuries, principles of management, evaluation, imaging, modalities, radiological findings, complications. Renal failure and transplantation; renal size and collecting system dilatation, diagnosis of causes of failure, transplant - investigation of donor, IVU, vascular studies, radionuclide imaging, evaluation of recipient, surgical techniques, transplant kidney – radionuclide imaging, ultrasound, angiography, CT, MR, complications of transplantation.

Paediatric uroradiology: introduction, techniques, embryology, congenital anomalies, neonatal conditions, infections and V-U reflux, hypertension in a child, renal tumors in childhood.

Interventional Uroradiology – Percutaneous nephrostomy, percutaneous nephrolithotomy, percutaneous resection of transitional cell tumors, renal cyst puncture, FNAC, pressure - flow studies, ureteric manipulations, therapeutic ureteric occlusion. urethral dilatation and stenting, endoscopy, extra corporeal shock wave lithotripsy, management of upper urinary tract calculi, ESWL;

The female reproductive system: ultrasound in obstetrics and gynecology, imaging in gynecology, MRI of female pelvis, radiological techniques in obstetrics and gynecology, congenital anomalies of female genital tract, inflammatory diseases, tumors of pelvis.  
Imaging in infertility with detailed knowledge of HSG.

## **MUSCULOSKELETAL SYSTEM**

Skeletal Trauma: General conditions, spine: cervical, thoracolumbar, pelvis and acetabulum, appendicular skeleton.

General classification of bone lesions, benign tumors & cysts of bone, giant cell tumors, tumors of fibrous origin, other tumors, tumor like conditions synovial tumors, malignant bone tumors, metastatic lesions, primary malignant tumors,– chondral origin, osteoid origin, fibrous origin, marrow origin, notochord origin, synovial origin, other tumors.

Myeloproliferative disorders: renal cell disorders, chronic hemolytic anemia's, other anemia's and bone marrow dyscrasias, white cell disorders, lymphoma, plasma cell disorders, reticulo- endothelial disorders, hemophilia and other bleeding disorders.

Bone and joint infections: periostitis and osteomyelitis, chronic osteomyelitis, bone and joint infections, in neonates, infections arthritis, granulomatous arthritis, parasitic and fungal infections, viral disorders, sarcoidosis, diabetic osteopathy, infected prostheses.

Metabolic and endocrine diseases of the skeleton, anatomy, and physiology; increase and decrease in the bone density, generalized or localized; quantitative bone mineral analysis. Skeletal dysplasia's; normal bone growth, disorders affecting growth plate, disorders affecting epiphysis and apophyses metaphyses, diaphyses, mucopolysaccharidoses, mucopolipidoses, miscellaneous conditions including neurofibromatosis and Paget's disease, chromosomal disorders; Cranio – vertebral instability, joint disorders, Patho physiological concept and diagnostic approach Inflammatory (synovial) arthropathies, connective tissue disorders, crystal deposition arthropathies, degenerative joint arthropathies, degenerative disease of spine, arthrography, radiology of soft tissues; imaging techniques, focal lesions, calcification and ossification. Gas in soft tissue, soft tissues tumors; musculo skeletal system in children-development and nutrition; Congenital anomalies and bone Dysplasia, inflammatory neoplastic, traumatic, endocrine, metabolic and systemic skeletal disorders in children; radiology of child abuse; Musculo Skeletal CT (computed tomography), techniques aspects of clinical applications; in trauma; musculo skeletal infections neoplasm's and low-back pain syndromes, quantitative bone mineral analysis, uses in joint diseases, CT-based interventional techniques; Musculo skeletal MR (Magnetic Resonance Imaging), normal signals, bone marrow-reconversion, infiltration or, replacement, bone marrow edema, myeloid depletion, bone ischemia, bone tumor imaging, joint imaging; Radio-nuclide bone imaging: Technique, normal bone scan, specific applications. Ultrasound in Musculoskeletal system for assessment of muscular, tendinous and ligamentous pathologies and joint.

**The Breast:** The mammographic technique, equipment and quality control, indications for mammography, normal anatomy, benign conditions, carcinoma, calcifications, breast screening, lesion localization, breast ultrasound. Role of MRI, PET, thermography, Elastography, CT, Image guided interventions for diagnosis and therapy of breast lesions.

**CENTRAL NERVOUS SYSTEM:** methods of examination and diagnostic approach; cranial and intracranial pathologies, intracranial tumors- supra and infratentorial, pituitary tumors, intracranial infections, degenerative disorders, demyelinating disorders, cerebro-vascular ischemia, intracranial vascular abnormalities, HIV infections- cerebral complications. Spine: methods and diagnostic approach. Plain Radiography, CT, MRI, Myelography, spinal angiography. Radionuclide imaging of CNS- Radiopharmaceutical and blood-brain barrier(BBB), scintigraphy, radionuclide arteriography, positron emission tomography(PET), receptor imaging, monoclonal body imaging, ultrasound of infant brain.

### **Orbits, ENT and face; maxillofacial and dental radiology.**

Orbits: anatomy and techniques, intraocular abnormalities, orbital pathology, orbital trauma, inflammatory disease, space occupying lesions;

Nose and Para nasal sinuses, Ear-Anomalies or development, methods of investigation, HRCT temporal, anatomy and diseases, MRI for inner ear, mouth, pharynx and larynx, Para pharyngeal spaces.

Maxillofacial pathology, fracture, benign lesions, malignant lesions, differential diagnosis of radiolucent and radio opaque lesions, abnormalities of growth and development, tempomandibular joint, salivary glands, soft tissue calcification, dental radiology, anatomy of teeth and supporting structure, developmental anomalies, eruption of teeth, dental carries, pulpitis and periapical infection, periodontal disease, fracture of teeth and alveolar bone, resorption of teeth, Neck anatomy on various modalities and diseases.

**Reticuloendothelial Disorders**= Lymphoma-pathology and imaging, spleen-Imaging, interventional techniques, Imaging in oncology-General methods in oncological diagnosis, staging and follow-up, ovarian tumors, nonseminomatous germ cell tumor, colorectal cancers, lung cancer, radiotherapy, treatment planning, interventional radiology-complication and treatment, radionuclide imaging in oncology, HIV infection and AIDS(Acquired immunodeficiency syndrome), background, epidemiology, treatment pathogenesis, natural history diagnosis complication ,treatment

**Angiography –intervention and other techniques** embolization, Percutaneous Tran luminal angioplasty, regional arteriography, head and neck, thorax, abdomen, upper and lower extremity angiography, angiography for endocrinal glands.

**Venography;** technique and complications ,regional venography of head and neck, thorax and abdomen-SVC venography,IVC venography, Azygos and ascending lumbar venography, Mesenteric and portal venography, gonadal venography, pelvic venography, venous sampling, interventional technique in venous system.

**Vascular Imaging**-Doppler Ultrasound, clinical applications, volumetric flow measurements, color- flow imaging, artifacts, error and pitfalls, power Doppler, endovascular ultrasound, Interventional radiology, informed consent, biopsy procedures, Percutaneous decompression, extraction and drainage, image guided therapy, interventional vascular techniques, Percutaneous techniques for vascular extractions, impact on medicine and radiology.

**RECENT ADVANCES IN THE FIELD OF ULTRASOUND, DOPPLER, CT AND MRI.**

