SYLLABUS FOR M.D. (RADIO-DIAGNOSIS & IMAGING SCIENCES).

GOAL:- The broad goal of the teaching & training of Post-graduate student in Radio-Diagnosis is to
make them understand & implement the knowledge regarding the role of various imaging modalities,
helpful in the management of different clinical conditions. At the end of his/her training, he/she should be
capable to take up a career in teaching institution or in diagnostic center or in research..

OBJECTIVES :-

a) Knowledge:- At the end of the course the student shall be able to:
1) Explain the interaction of tile X-rays with mater to produce an image.
2) Fromiliarize with the principles of various imaging modalities (e.g. .US/CT/MRI) & their applications
in medicine.
3) Explain the biological hazards of ionizing radiation & protective measures.
4) Explain the normal Anatomy, Physiology of various organs and their deviation from normal) & its
consequences.
5} Summarize the fundamental aspects of embryology & alteration in development with reference to
congenital anomalies.
6) Select appropriate imaging modality for- study of specific condition.
7) Explain .the role of imaging, pre-operative, intra-operative & post-operative Conditions.
8) Evaluate role of imaging modalities in various therapeutic applications (lnterventional Radiology)
9) Update information about recent advances in imaging sciences.
10) Effectively organize & supervise the diagnostic proceduces to ensure quality control/assurances

b) Skills:-

At the end of the course the student shall be able to :
1) Make use of conventional & other imaging sciences to achieve definitive diagnosis.
2) Analyse & interpret imaging data.
3) Demonstrate the skills of solving Scientific & clinical problems & decision making.
4) Develop skills as a self:-directed learner recognize cointinuing educational needs, select & use
appropriate learning resources.
5) Demonstrate Comperence in basic concepts of research methodology & be able to critically aualyse
relevant literature.

c) Integration-

Knowledge acquired in Radio diagnosis shall help the students to integrate imaging techniques
with structure & function of the human body in health & disease.

M.D. (RADIODIAGNOSIS)

PAPER –I

Radiation Physics. Protective measures & Radiological procedures,
TOPICS

1) Radiations and production of X-rays
2) X-ray generators
3] Basic interactions between X-Rays and matter
4] Attenuation.
5] Filters and grids.
6] Luminescent screens.
7] Physical and Photographic characteristics of X-ray film & film processing
8] Computed tomography.
9] Ultrasound.
10] Radiation's hazards and protection.
11] Digital Radiography.
12] Nuclear magnetic resonance.
13] Magnetic resonance imaging.
14] Wet processing of films -Chemistry of Developer, fixer etc,
15] Dry processing – chemistry of films & its processing.
16] Radiological procedures(IVU, barium procedures, antegrade pyelography , fistulography, sialography, DCG)

PAPER- II

Radiological Imaging in congenital & systemic diseases- I

a. Respiratory system: Congenital anomalies, Pediatric chest, Chest wall, pleura, diaphragm, Mediastinum, Pulmonary infections, Airway obstruction, Pulmonary neoplasms, Diffuse pulmonary diseases.
b. Cardio-vascular system: Congenital heart Disease's, left-to-right shunts Cyanotic heart diseases,Acquired valvular heart diseases, Ischemic heart disease, Pulmonary circulation, cardiomyopathy, cardiac tumors, Pericardium, thoracic aorta.
c. Gastro Intestinal Tract: Oesophagus, Stomach, Duodenum, Small intestine large bowel, mesentry & omentum, Pediatric abdomen.
d. Hepato-biliary: Liver, Biliary tract, Pancreas.

PAPER-III

Radiological Imaging in congenital & systemic diseases-II

a. Skeletal system: Skeletal trauma benign lesions, malignant lesions, Myeloproliferative & similar disorders, metabolic and endocrine diseases, skeletal dysplasias and malformation syndromes,joint disease, bone and joint infection, radiology of soft tissues, musculo-skeletal system inchildren.
b. Genito-urinary system: Renal parenchymal diseases, Renal masses. Calculus disease and urinaryobstruction, urinary bladder and prostate, Reno-vascular

disorders, injuries, Renal failure andtransplantation, pediatric uroradiology Imaging in obstretics and gynecology, imaging of breast.

c. CNS: Skull, Intra-cranial tumors, Intra-cranial infections, Cerebro-vascular disease, cranial and intracranial malformatins trauma, CSF disturbances, degenerative diseases of spine infections of spine, spinal tumours.

PAPE R – IV

Miscellaneous, Interventional Radiology & Recent advances and Newer imaging.

a) Orbit , ENT, dental
b) Reticuloendothelial system
c) Interventional radiology:
    I. HSG & FTR
    II. 4 vessel angiography
    III. Biliary intervention(PTBD,PTC)
    IV. PCN
    V. Laser ablation of varicose veins
    VI. RFA/ chemoembolisation of hepatic tumour and malformations.
    VII. Vertebroplasty.
    VIII. Hemangioma and AVM management.

Syllabus for MD

A. RADIOLOGICAL PHYSICS & X-RAY TECHNOLOGY:

1. Radiation
2. Production of X -Rays
3. X- Ray Generators :
4. Basic Interaction between X- Rays and Matter
5. Attenuation
6. Filters
7. X- Ray beam restrictors
8. Physical characteristics of x- Ray films & film Processing
9. Photographic characteristics of X- Ray films
10. Fluroscopic imaging and image intensifier
11. Viewing & recording of the Fluroscopic Image
12. The Radiographic Image
13. Geometry of the Radiographic Image
14. Computed Tomography
15. Ultrasound
16. Digital Radiography
17. Nuclear Magnetic Resonance
18. Magnetic Resonance Imaging
19. Radiation hazards & Protection
20 Electric & Protection
21. Cine Angiography:
22. Atomic structure, Radioactive Isotopes & Gamma Camera
23. Positron Emission Tomography
24. Digital Subtraction Angiography
25. Catheters, guides wires, dilators, balloons & stents
26. Pictorial Achieving & Communicating System (PACS)
27. DICOM

B. DARK ROOM TECHNIQUES:

1. Intensifying screens /construction, types and advantages :
2. Rare earth intensifying screens :
3. Intensification factor :
4. Cassette: .construction & care
5. Factors affecting image details :
6. Factors affecting image contrast & density :
7. Grids : construction & types
8. Cones & collimeter :
9. X Ray films -construction, types & storage :

C. BASIC RADIOLOGY

I. IMAGING TECHNIQUIES AND MODALITIES

a) Department Organization: Digital Imaging and PACS:
   i. Digital imaging and PACS: Picture Reliving and Communication System
   ii. Digital Imaging and PACS: what should a radiologist expect from PACS
   iii. Digital Imaging and PACS: Image processing in Computed Radiography
b. Intravascular Contrast Media
c. Whole body Computed Tomography: Recent Advances
d. Magnetic Resonance Imaging Basic Principles
e. Ultrasound : general Principles
f. Radionuclide imaging
   i. Radionuclide imaging: General Principles
   ii. Radionuclide imaging: Pediatric Nuclear Medicine
g. Dual Energy X-ray Absorptiometry
h. Functional and Physiological Imaging
i. Medicolegal issues in Diagnostic Radiology
j. Radiation Protection and patient doses in diagnostic radiology

II. RESPIRATORY SYSTEM :

1.1 Techniques of Investigations

1.11 Standard Techniques
1.1.2 Tomography: a) Conventional film Tomography
b) Computed Tomography
1.1.3 Digital Radiography
1.1.4 Magnetic Resonance Imaging
1.1.5 Radionuclide Imaging a) Ventilation
b) Other thoracic scanning techniques
1.1.6 Ultrasound
1.1.7 Angiography
1.1.8 Lung Biopsy & Other Interventional Techniques.

1.2 Normal Chest:

1.2.1 The Lungs (Radiological Anatomy} & CT Terminology)
1.2.2 The Central Airways
1.2.3 The Lungs beyond Hila
1.2.4 The Hila
1.2.5 The Mediastinum :
a) CT & MRI
b) Plain film appearances
   i. The junctional lines :
   ii. The right Mediastinum above azygous vein
   iii. The left Mediastinum above Aortic arch
   iv. vi) The supra aortic Mediastinum on lateral view
   v. v) The right Middle Mediastinum border below azygous arch.
   vi. vi) The left cardiac border below aortic arch
   vii. vii) The para spinal lines
   viii. viii) The retrosternal line
1.2.6 The Diaphragm

1.3 The Chest Wall, Pleura & Diphragm

1.3.1 Chest Wall :

i) Soft tissue /Breasts

ii) Ribs /Sternum/Clavicle, Spine

1.3.2 The Pleura :

i) Normal Pleura

ii) Pleural Pathologies

1.3.3 The Diaphragm :

i) Height/ Eventration/Movements/Paralysis

ii) Hernias/Trauma/Neoplasm

1.4 The Mediastinum :

1.4.1 Techniques. .

1.4.2 Mediastinal Masses: i) Thyroid/ Para Thyroid Messes/Thymic tumors/Tymic hyperplasia/Teratoma/ Cermcell Tumor.

ii) Mediastinal lymphadenopthy

iii) Neurogenic Tumors

iv) Extra medullar heamatopes/Mesenchymal Iumors/ Hernarationof / Mediastinal lipomatosis/ Aneusyrum

1.4.3 Differential Diagnosis:

1.4.4 Other Mediastinal Lesions: i) Acute/ fibrosing Medlastinitis

1.5 Pulmonary Infections in Adults .

1.5.1 Pneumonia

1.5.2 Associated features and complications of pneumonia

1.5.3 Pulmonary tuberculosis

1.5.4 HIV & AIDS

1.6 Large Airway Obstruction :

1.6.1 Collapse: General features /Collapse of individual lobes / entire lung/ segmental collapse/

Rounded /obstructive collapse

1.6.2 Obstructive Pneumonities/ Bronchoscope/Broncheietasis

1.7 Pulmonary lobar Collapse essential considerations :

1.8 Chronic inflow Obstruction :

1.8.1 Asthama:

1.8.2 Choronic Bronchitis and Emphysema

1.8.3 Bronchiolitis

1.9 Pulmonary Neoplasms :

1 Bronchial Carcinomas

2 Benign Pulmonary Tumors

3 Malignant Lymphoma

4 Metastases

5 The solitary Pulmonary Nodule

2.0 Diffuse Pulmonary. Disease / Industrial Lung Disease / HRCT :

1 Pulmonary Oedema :

2 Diffuse pulmonary Haemorrhage

3 Inhalation of particulate matter

4 Diffuse pulmonary Fibrosis

5 Sarcoidosis / Collagen Vascular Disease *I* Systemic Vasculitidis *I* Lymphoid Disorders of Lungs / Pulmonary Eosinophilia *I* Drug induced Lung Disease

2.1 Chest Trauma :

2.2 Pulmonary Thromboembolism :

Imaging Chest Radiograph/ Radionuclide Study *I* Pulmonary Arteriography/ CT / MRI

2.3 .Post Operative & Critically ill Patients :

1 Cardiopulmonary Disease
2 Post Thoracotomy Radiograph
3 Support and Monitoring apparatus
4 Radiation Therapy

2.4 Chest Radiography after Lung Transplantation :

2.5 Congenital Pulmonary Anamolies :

1 Abnormal Development of Lung Bud
2 Abnormalities of separation of the lung had from the foregut
3 Abnormalities of Pulmonary Vasculature
4 Ectopic of Hamartomatous Development

2.6 The Infant and Young Child :

1 Pathologies of Diaphragm
2 Pleural Abnormalities
3 Inflammation
4 Airway Obstruction
5 Diffuse Lung Disease .
6 Respiratory Distress in Newborn Baby

2.7 Interventional Techniques in Thoracs:

1 Biopsy Procedures
2 Thoracic Drainage Procedure
3 Thoracic Sympathectomy
4 Therapeutic Embolisation
5 Dilatation & Stenting Techniques
6 Extraction Techniques.

III. THE HEART AND GREAT VESSELS

3.1 Cardiac Anatomy and Enlargement- :

3.1.1 Plain Radiography
3.1.2 Enlargement of various chambers on Plain Radiography

3.2 Magnetic Resonance of Heart and Circulation .

3.3 Congenital Heart Disease :

1 General Principles
2 Left to right shunts .
3 Central Sinuses
4 Other Congenital Heart Disease

3.4 Aquired Heart Disease: i) Non Rheumatic/ Rheumatic Mitral VD
ii) Tricuspid VD
iii) Aortic VD

3.5 Ischaemic Heart Disese : i) Coronary Atreriography
ii) Left Ventriculography
iii) Angina Pectoris
iv) Myocardial Infarction
v) Mechanical Complication of MI

3.6 Pumlonary Circulation : i) Anatomy and Physiology
ii) Pulmonary Vascularity in Heart Disease
iii) Pulmonary Arterial hypertension/ Its Imaging
iv) MR in Pulmonary Vascular Abnormalities .

3.7 Cadiomyopathy, Cardio Tumors, Trauma
3.8 The Imaging of Prosthetic Cardiac .Valves
3.9 The pericardium
3.10 Thoracic Aorta

IV .THE GASTROINTESTINAL TRACT:

The Esophagus
1 Anatomy .and Functions
2 Methods of Examination
3 Pathologies of Esophagus
4 Motility Disorders
5 Extrinsic lesions/ miscellaneous conditions

The stomach
1 Radiological anatomy and methods of examination
2 Inflammatory Diseases
3 Neoplastic Conditions
4 Radionuclide Studies in Stomach

The Duodenum
1 Anatomy and Normal Appearances
2 Methods of Radiological Examination
3 Peptic ulceration
4 Gastro heterotopia /diverticula
5 Neoplasms benign and malignant

The Small Intestine
1 Anatomy and normal appearances
2 Methods of radiological examination
3 Crohns disease/Coeliac Disease/Neoplasms/various conditions

The Large Bowel
1 Anatomy and Normal Appearances
2 Methods of Radiological Examination
3 Tumors
4 Diverticular Disease
5 Colitis
6 Aids
7 Miscellaneous Conditions

Peritoneum, Mesentery and Omentum
1 Peritoneal spaces and reflections
2 Abnormalities of Peritoneum
3 Abnormalities of Mesentry
4 Abnormalities of greater Omentum

Gastrointestinal Angiography.
1 General Consideration
2 Gastro intestinal bleeding

Interventional Radiology in Gastrointestinal tract

1 Introduction
2 Esophagus
.3 Stomach and Duodenum
4 Small Intestine
5 Colon and Rectum

Pediatric Gastrointestinal Radiology

1 The Neonate
2 The Infant and Older Child

V. Liver, Biliary tract, Pancreas, Endocrine System and Lymphoma

Liver

1 Normal and variant Anatomy
2 Liver Imaging Techniques
3 Diffuse Disease
4 Focal Disease
5 Intervention

The Biliary Tract

1 Anatomic Consideration
2 Methods of investigation
3 Biliary Disorders

Interventional Techniques Hepatobiliary System

1 Liver Biopsy
2 Biliary Obstruction
3 Malignant Biliary Obstruction
4 Percutaneous Cholangiography and Biliary Drainage Procedures
5 Vascular Interventional Techniques in Hepatobiliry System

The Pancreas

1 Embryology and Anatomy
2 Congenital Anomalies
3 Multisystem Diseases with Pancreatic involvement
4 Pancreatitis
5 Pancreatic Neoplasms
6 Trauma
7 Interventional Radiology in Pancreas

Imaging of the Endocrine System :

1 Hypothalamic-Pituitary Axis
2 Pineal Gland
3 Thyroid Gland
4 Parathyroid Gland
5 Pancreatic & Gastrointestinal Endocrine Disorders
6 Carcinoid Tumors
7 Adrenal Glands
8 Female Reproductive System .
9 Male Reproductive System

Reticuloendothelial Disorders : Lymphoma

1 Epidermilogy
2 Histopathological Classification
3 Staging Investigation and Management
4 Extranodal Manifestation of Lymphoma
5 Monitoring response to therapy

Reticuloendothenial Disorders: The Spleen

1 Imaging Techniques
2 Normal Anatomy
3 Splenomegaly
4 Benign Mass Lesions
5 Malignant Mass Lesions
6 Splenic Trauma

VI Genito Urinary Tract :

6.1 Methods of Investigation :

6.2 Radionuclide Imaging in Genito Urinary Tract :

6.3 Urodynamics

6.4 Reno Vascular Disease:

6.4.1 Renal Arteriography
6.4.2 Vascular Abnormalities
6.4.3 Radiological Management of Reno Vascular Disease

6.5 Renal Parenchymal Disease

6.5.1 Normal Appearance
6.5.2 Renal Parenchymal Disease
6.5.3 Parasitic Infections

6.6 Renal Masses :

6.6.1 Methods of Analysis
6.6.2 Pathological Renal Masses
6.3 Neoplastic Renal Masses

6.7 Calculus Disease & Urothelial Lesions

6.7.1 Calculus Disease
6.7.2 Nephrocalcinosis
6.7.3 Urothelial Tumors

6.8 Urinary Obstruction:

6.8.1 Pathophysiology
6.8.2 Causes of Obstruction

6.9 Radiological Evaluation of Urinary Bladder, Prostrate & Urethra :

6.10 Injuries to the Genito Urinary Tract :

6.11 Renal Failure and Transplantation :

6.12 Interventional Uroradiology :

6.13 Imaging of the Kidneys & Urinary Tract in Children

6.13.1 Embryology
6.13.2 Techniques .
6.13.3 Interventional Procedure "

6.14 Imaging of Paediatric Pelvis :

6.14.1 Imaging Techniques ;
6.14.2 Normal Anatomy
6.14.3 Congenital Anomalies
6.14.4 Pelvis Masses
6.14.5 Scrotal Disease

VII Skeletal System :
7.1 Skeletal Trauma
7.2 Bone Tumors : Generals Characteristic & Benign Lesions
7.3 Bone Tumors : Malignant Lesions
7.4 Myelproliferative and Similar Disorders
7.4.1 Generalised/Localised Decreased in Bone Density
7.4.2 Generalised/Localised Increased in Bone Density
7.4.3 Delayed Skeletal Matuarity
7.5 Metabolic and Endocrine Disease of the Skeletal
7.6 Skeletal Dysplasias and Malformation Syndrome
7.7 Joints Diseases :
7.7.1 Rhumatiod Arthritis
7.7.2 Other Connective Tissue Disease
7.7.3 Crystal Deposition Arthropathy
7.7.4 Degenerative Joint Disorders/Degenerative spine
7.7.5 Arthrography/ HPOA/ Pachy Dermoperiostritis
7.8 Bone and Soft tissue Infection :
7.9 Imaging of Soft tissue :
7.10 Bone Tumors in Children :
7.10.1 Imaging approach
7.10.2 Benign Bone Tumors
7.10.3 Malignant Bone Tumors
7.11 The Radiology of Non Accidental Injry in Children :
7.12 Paediatric Musculo -Skeletal Trauma
7.13 Radiology of Arthritides in Children
7.14 Radiology of Soft tissue in Children
7.15 Bone and Soft tissue infection in Children.
VIII. The Reproductive System :
8.1 Ultrasound in Obstetrics and Gynaecology
8.1.1 Indication
8.1.2 Instrumentation in US Techniques
8.1.3 Gynecological infertility
8.1.4 Assesing Tubal Patency
8.2 Imaging in Gynaecology
8.3 Hysterosalpingography
8.4 The Breast & its Imaging
8.5 Breast Cancer
8.6 Male Reproductive System
IX Central Nerve System :
9.1 Skull and Brain : Methods of Examination and Anatomy
9.2 Cranial and Intracranial Pathology : Tumors in Adults
Cerebro Vascular Disease and Non Traumatic
Intracranial Haemorrhage
Infections, AIDS, Demyelinating and Metabolic
Disease
9.3 Spine: Method of Investigation
9.4 Imaging of Spinal Pathology
9.5 Scoliosis in Children
9.6 Neonatal Head and Spine Sonography
9.7 Neurology in Children

X. The Orbit; ENT; Face; Teeth:

10.1. The Orbit

10.1.1 Anatomy / Techniques
10.1.2 Intraoccular Abnormalities
10.1.3 Lacrimal Gland Tumors
10.1.4 Muscular Tumors
10.1.5 Intra/Extra Canal Tumors

10.2 Ear, Nose and Throat Radiology

10.2.1 The Ear
10.2.2 Nose and Paranasal Sinuses
10.2.3 Phrynx

10.3. Maxillofacial Radiology

10.3.1 Fractures of Maxilla
10.3.2 TM Joint
10.3.3 Salivary Glands

10.4. Dental Radiology

10.5. Pediatrics, Eye & Orbit :

10.5.1 Imaging Techniques
10.5.2 Child with Proptosis or an Orbital mass
10.5.3 Child with Orbital Infection
10.5.4 .Child with White Eye
10.5.5 Child with Development Abnormalities

10.6. Paediatric ENT Imaging

XI) Interventional radiology:

1. HSG & FTR
2. 4 vessel angiography
3. Biliary intervention(PTBD,PTC)
4. PCN
5. Laser ablation of varicose veins
6. RFA/ chemoembolisation of hepatic tumour and malformations.
7. Vertebroplasty.
8. Hemangioma and AVM management.