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CURRICULUM & SYLLABUS GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME, VALID FOR

MASTERS IN CLINCAL RADIOLOGY (MICR)

MICR IS A HONOUR AWARDED BY INDIAN COLLEGE OF RADIOLOGY (ICRI),

THE ACADEMIC WING OF INDIAN RADIOLOGICAL & IMAGING ASSOCIATION (IRIA)

CONTENTS

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1. PREABLE

The purpose of Post graduate education is to create specialists who would provide high quality health care and advance the cause of science through research & training. The Goal of ANY POST GRADUATE program is to impart training in conventional and modern radiology and imaging interpretation / interventional techniques so that the post graduate student becomes well versed and competent to practice, teach and conduct research in the discipline of radiology. The student should also acquire basic knowledge in the various sub-specialties of radiology. These Guidelines also would help to standardize Radiodiagnosis/Clinical Radiology teaching at post graduate Masters (MD/DNB) and diploma (DMRD) level throughout the country so that it will benefit in achieving competent radiologist with appropriate expertise.

During the process of this training, the post graduate student is allowed to take the parts of MICR examination as per the prevailing regulations. MICR is a high standard examination of international quality conducted by the ICRI (please refer to document labeled “MICR exam overview”)

The purpose of this document is to **provide illustrative guidelines to institutions, teachers and learners to achieve defined outcomes in Radiology, Imaging and Intervention training** through various aspects of learning and assessment. This document was prepared by various subject-content specialists. The team has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

This is a dynamic document, which may be constantly updated; please refer to the latest version.

2. SPECIFIC LEARNING OBJECTIVES

The objective of the MICR EXAMINATION PROCESS is to ensure the student is adequately skilled and competent radiologist to conduct and interpret various diagnostic/interventional imaging studies (conventional and advanced imaging and intervention), to organize and conduct research and teaching activities and be well versed with medical ethics and legal aspects of imaging/ intervention. The TRAINING PROCESS GUIDELINES AND SYLLABUS will reflect the same to ensure our students are prepared and trained at international level.

3. SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain

A post graduate student on completing post graduation (MD (Radiodiagnosis) /DNB/ DMRD plus one year of Senior residency) should acquire knowledge in the following areas, and be able to:

1.Acquire good basic knowledge in the various sub-specialties of radiology such as Chest radiology, Neuro-radiology, Head & Neck imaging, GI-radiology, Uro-radiology, Cardio-vascular- radiology, Musculoskeletal imaging, Interventional radiology, Emergency radiology, Nuclear medicine, Pediatric radiology and Women's (including Gynecology, breast, Obstetric) and Foetal imaging.

2. Independently conduct and interpret all routine and special radiologic and imaging investigations.

3. Provide radiological services in acute emergency and trauma including its medico-legal aspects.

4. Elicit indications, diagnostic features and limitation of applications of Conventional and Digital Xray, ultrasonography, Fluroscopy, all contrast related procedures, DSA, CT, PET CT and MRI and should be able to describe proper cost- effective algorithm of various imaging techniques in a given problem setting.

5. Decide on the various image-guided interventional procedures both non vascular and vascular, to be done for diagnosis and therapeutic management.

6. Able to decide on further specialization to be undertaken in any of the branches in Radiology, Imaging & Intervention related specialties.

7. Able to formulate basic research protocols and carry out research in the field of radiology- related clinical problems.

8. Acquire knowledge and teaching capabilities to work as a post graduate student /Consultant in Radiodiagnosis and conduct teaching programmes for undergraduates, post graduates as well as paramedical and technical personnel.

8. Iinteract with other specialists and super-specialists so that the maximum benefit accrues to the patient.

9. Should be able to organize CME activities in the specialty utilizing modern methods of teaching and evaluation.

10. Acquire knowledge to impart training in both conventional radiology and modern imaging techniques so that the post graduate student is fully competent to practice, teach and do research in the broad discipline of radiology including ultrasound, PET, Computed Tomography and Magnetic Resonance Imaging.

11. Acquire knowledge of interventional radiology both non vascular and vascular interventions

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.

2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.

3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.
4. Develop non- reporting skills including clinical and radiological audit

C. Psychomotor domain

Practical Training will include two major aspects:
a) Interpretation of images, and
b) Skill in performing a procedure.

a) Interpretation of images:

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, traumatic neoplastic degeneration metabolic and miscellaneous condition.

7. Imaging in Emergency Medicine.

8. Imaging in Obstetrics and Gynecology including Foetal imaging

9. Imaging of Breast and interventional procedures.

10. ENT, EYE, Neck and Dental Imaging.

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

12. Clinical applied radionuclide imaging and PET CT

13. Interventional Radiology including both vascular and non vascular interventions

b) Skills in performing a procedure

The student should be able to perform the following procedures:

1) GIT contrast studies: Barium studies (swallow, upper GI, Follow through, enema); fistulogram; sialogram; cologram/ileostogram/ other stomograms

2) GU: Excretory urography, MCU, RGU, nephrostogram, genitogram,

3) Ultrasound: Studies of whole body including neonatal transfontanelle studies, Doppler studies,

4) CT scan: should be able to position a patient, plan study as per the clinical indication, do reconstruction of images, perform triple phase study, perform & interpret advanced applications like CT enterography, CT cologram, CT venography, CT angiography, CT Dacryocystography etc.

5) Nuclear Medicine and PET CT : should be able to position a patient, plan study as per the clinical indication, do reconstruction of images, perform tracer injection ,able to handle radionuclides, perform management of adverse contrast injections & interpret anatomical and functional activity of a given disease

6) MRI: plan and perform MRI studies of whole body

7) DSA: should be able to describe the techniques, do (if available to student) transfemoral puncture and insert catheter, help and achieve independent skill in angiographic procedures both diagnostic and interventional.
8)Radiography: should be able to independently do radiography of common and some important uncommon views of different body parts. This includes positioning, centering of X ray beam, setting of exposure parameters, exposing and developing the films. The student should be familiar with not only conventional radiography but with CR and DR systems.
9) Interventional radiology: The student should be able to perform simple, common non- vascular procedures under ultrasound and fluoroscopy guidance e.g. abscess drainage, drainage catheter placement, nephrostomy, biliary drainage etc. The student should have knowledge of common vascular interventions e.g. stricture dilatation using balloon catheters, remobilization with gel foam and other agents, names of common catheters, handling of intravenous contrast reactions; techniques, indications and contraindications for various procedures;

4. SYLLABUS - summary

- **Anatomy**

Gross anatomy of all the body systems.
Embryology of all parts
Ultrasound Anatomy of all organ systems
Plain and Contrast radiography including Fluroscopic Anatomy
Cross sectional anatomy pertaining to radiology including CT, MRI
DSA anatomy of vascular system

- **Pathology**

Gross morphology of pathological conditions of systemic diseases affecting all organ systems. Histopathological Slides for various pathology

- **Radiologic pathology**

This would cover imaging and interventions of diseases affecting all the body systems:
-Chest
-Cardiovascular system
- Emergency Radiology including emergency interventions
-Musculoskeletal including soft tissue
-Gastrointestinal system
-Hepato-biliary-pancreatic system
-Urogenital (genito-urinary) system
-CNS including head and neck
-Obstetrics and gynaecology
-ENT, eye, Neck, dental, breast
-Endocrine and metabolic system
-Interventional Radiology (Both Vascular and Non Vascular Interventions)
-Clinically applied radionuclide (Nuclear medicine) and PET CT imaging

- **Radiological Physics –** all Radiation physics, Atomic/ Quantum physics, Sono physics, Magnet physics, principles related to imaging and intervention

- **Radiological procedures and protocols including Radiography and processing techniques**

- **Nuclear medicine physics and Handling of radionuclides**

5. Components of training (given by the respective University / national board accredited institution) and assessment process.

The training is spread over 3 years and includes following components:
Post graduate in MD/ DNB Radiodiagnosis/ Clinical radiology is a continuum of MBBS. The skills learnt in core clinical specialities like medicine, surgery, obstetrics

and gynaecology, paediatrics, ENT, ophthalmology, pathology , anatomy etc also apply here, Every patient should not only be seen from radiological perspective but also in clinical perspective

1. Physics related to imaging
2. Anatomy and pathology related to Imaging
3. Detailed Clinical Examination and History taking, review of lab reports
4. Management of Adverse Drug Reactions, providing Basic life support
5. Rotational posting in various sub-specialties.
6. Seminars, case discussion, journal club, interdepartmental meet, audit etc.
7. Research methodology, ethics and bio-statistics.
8. A log book should be maintained by the student and will be checked and signed regularly by the faculty-in-charge during the training program.
9. The postgraduate students shall be required to participate in the teaching and training program of undergraduate students and interns.
10. The postgraduate student would be required to present one poster presentation, to read one paper at a international/national/state conference and to submit one research paper which should be published or accepted for publication or sent for publication to a peer reviewed journal, during the period of his/her postgraduate studies so as to make him/her eligible to appear at the postgraduate degree examination.
11. Department should encourage e-learning activities.

SUGGESTED Rotations:

During the three-year course, suggested rotations are as follows:-

no	**postings**	**Duration**
1.	Conventional chest, abdomen, musculoskeletal including skull, spine, PNS and mammography etc Including exclusive posting for Mammography - 1 month	4 months
2	Contrast and special procedures studies: G.U., GIT, Hepato-biliary, angiography etc including	2 months

	fluoroscopic guided procedures (barium studies, MCU, AUG, RUG, IVU, fistulogram etc)	
3	Ultrasound (Includes Preventive Radiology OPD General Abdomen, Lung, Small Parts- Testis, Thyroid, Head and Neck, Neurosonogram, Spine, Swellings, MSK, Obstetrics and Gynaecology, ECHO, ocular, endoscopic USG, Intravascular and Intraoperative ultrasound, This includes exclusive 1 month posting for ECHO, 2-3 months for Obstetrics and Gynecology,2 months for Vascular Doppler studies)	12 Months
4	Nuclear Medicine including PET CT	2 Months
5	CT	6 Months
6	M.R.I	6 Months
7	Interventional Radiology(Including Intervention OPD, vascular and non Vascular Interventions , each 1.5 months)	3 Months
8	Paediatric Radiology	1 Month
Emergency Radiology is treated as concurrent postings e.g. Students shall learn along with regular and on call / stay duty days and with regular rotational postings, covers CT,PET CT, MRI, E- FAST, whole body ultrasound including obstetrics and gynaecology imaging ,emergency interventions etc -3 Months		

During each posting, post graduate student should be able to perform the procedures and interpret the findings.

PROPOSED SCHEDULE FOR ROTATION

1ST Year (1/6)	Conventional Chest, abdomen, skull, spine,	CT	USG	Contrast studies - GIT and G.U. tract& other fluoroscopic	USG	Doppler

	musculo-skeletal etc			investigations		
(2/6)	Obstetrics & Gynaecology Ultrasound	Interventional Radiology	CT	USG	ECHO	MRI
2nd Year (3/6)	CT	MRI	Interventional Radiology	USG	CT	MRI
(4/6)	USG	Mammography	Nuclear Medicine	Doppler	Contrast studies - GIT and G.U. tract& other fluoroscopic investigations	Paediatric Radiology

3rd year (5/6)	Obstetrics and gynaecology Ultrasound	USG& Doppler	Nuclear Medicine	Conventional Chest, abdomen, skull, spine, musculo-skeletal etc	CT	MRI
(6/6)	Interventional Radiology	Contrast studies - GIT and G.U. tract& other fluoroscopic investigations	CT	USG	MRI	MRI

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.

ASSESSMENT

FORMATIVE ASSESSMENT, during the training program (SUGGESTED PROCESS).

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. The Internal Assessment should be conducted in theory and practical/clinical examination.

The student to be assessed periodically as per categories listed in postgraduate student appraisal form.

Aggregate of quarterly and yearly performance of candidates shall be documented by the department. Refer to Annexure III for proposed quarterly assessment

SUMMATIVE ASSESSMENT, i.e., assessment at the end of training; *The summative examination would be carried out as per specific MICR guidelines for the award for MICR degree (see part 10 in this document; details in MICR basic document). This is completely separate and not connected to any university or national board degree (at present) which is otherwise required as per the training /PG course rules/regulation.*

1. Thesis (SUGGESTED GUIDELINES):

This part is required as per the MD/ DNB – University or National Board regulations and MICR accepts the same regulation and no separate thesis required. Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis (Dissertation). Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis shall be submitted at least six months before the Theory and Clinical /Practical examination. The thesis shall be examined by a minimum of two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners, as specified by respective University / National board

2. MICR Examination
Please see **MICR Basic document** for details about the MICR examination.

6. Suggested Reading:

Books (latest edition)

1. Grainger & Allison's Text book of Diagnostic Radiology (Churchill Livingstone)
2. Textbook of Gastrointestinal Radiology- Gore and Levine (Saunders)
3. MRI of Brain and Spine - Scott Atlas (LWW)
4. Diagnosis of Diseases of the Chest -Fraser
5. Diagnostic Imaging Series: (Amirsys, Elsevier)
Abdominal Imaging, Orthopedics, Head and Neck, Neuroradiology, Pediatric Radiology Chest, Obstetrics, Breast
6. MRI in Orthopedics and Sport Injuries - Stoller
7. Skeletal Radiology - Greenspan
8. Abdominal-Pelvic MRI - Semelka (lWW)
9. Caffey's Pediatric Radiology
10. CT and MRI of the whole body- John R. Haaga
11. Text Book of Radiology and imaging - David Sutton
12. Diagnostic ultrasound - Carol C. Rumack
13. AIIMS-MAMC-PGI's Comprehensive Textbook of Diagnostic Radiology, Volumes 1, 2, 3

14. Nuclear Medicine Textbook: Methodology and Clinical Applications by Duccio Volterrani, Paola Anna Erba, Ignasi Carrió H. William Strauss , Giuliano Mariani
15.Feigenbaum's Echocardiography

Journals (especially the Review articles)

1. Indian Journal of Radiology and Imaging
2. American Journal of Roentgenology
3. Seminars in Ultrasound, CT, MRI
4. Radiographics
5. Clinical Radiology
6. British Journal of Radiology
7. Radiological Clinics of North America
8. Pediatric Radiology
9. Australasian Radiology
10. Journal of Computerized Axial Tomography
12. MR Clinics of North America
13. Seminars in Roentgenology

7. SYLLABUS – DETAIL

a. Anatomy

b. Pathology

c. System based detailed information.

a. Anatomy

Gross anatomy of all the body systems.

Embryology of all parts

Ultrasound Anatomy of all organ systems

Plain and Contrast radiography anatomy including Fluroscopic Anatomy

Cross sectional anatomy pertaining to radiology including CT, PET CT and MRI

DSA anatomy of vascular system

Category 1 Critical anatomical structures Must recognize and interpret, must know and explain. These structures comprise core basic radiologic anatomy, and a deficiency of anatomical knowledge and skills for these structures will jeopardise a radiology trainee's ability to perform to a satisfactory level during radiology training. Projectional identification: identifies confidently on all common projectional modalities, recognises normal variants and knows range of normality, can identify and point out expected location, shape and size even if not visible, and the adjacent category 1 structures. Cross sectional identification: identifies confidently on all common cross-sectional modalities, in standard radiological planes and any dedicated planes (straight or curved) commonly used for that structure, recognises normal variants and knows range of normality, can trace structure from plane to plane in an interactive stack; can identify and point out expected location, shape and size even if not visible, and the adjacent category 1

Structures; can point out this expected location and size in an interactive scrolling stack. Knowledge base: can give a structured coherent verbal account (oral or written) of the anatomical structure in language applicable to radiology reporting and to interspecialty communication; this includes all common and important anatomical characteristics of the structure, for example course, parts, relations, distribution, etc. Knows and can concisely describe normal anatomical variants, particularly those that endanger the structure or other structures, and those that simulate disease. Can draw a basic diagram (artistic skills not required) to illustrate key morphology, internal composition and external relations of the structure in a way applicable to radiology image analysis and identification.

Category 2 Important anatomical structures Must recognise, must know. Anatomical structures in this category must be known for competent generalist radiologist

performance. For radiology trainees at the beginning of radiology training, anatomical knowledge of these structures is needed to permit the acquisition of skills and knowledge of imaging manifestations of disease. Projectional identification: identifies confidently on all common projectional modalities, recognises normal variants, can differentiate normal from abnormal appearance, can describe and point out the nearest category 1 structures to which it relates when not visible.

Cross sectional identification: identifies confidently on all common cross sectional modalities in key working standard planes (transverse and coronal), recognises normal variants, can differentiate normal from abnormal appearance, can describe and point out the nearest category 1 structures to which it relates when not visible. Knowledge base: can give a concise, coherent verbal account (oral or written) of the anatomical structure in language applicable to radiology reporting and to interspeciality communication; this includes all the clinically important anatomical characteristics of the structure, for example course, area of supply, location of vulnerability, functional anatomy. Knows and can concisely describe clinically important anatomical variants, particularly those that endanger the structure or those that simulate disease

Category 3 Useful radiologic anatomical structures Good to recognise, good to know. Anatomical structures in this category must be known to category 2 level for satisfactory sub-specialist radiology performance. A radiology trainee at the end of radiology training would not be expected to know these structures to category 2 level, but is aware of their existence. A radiology trainee at the beginning of radiology training is unlikely to know these structures. Projectional identification: with increasing training and experience able to identify on all common projectional modalities on which it is visible, and distinguish normal structure from abnormality of either this or other structures. Cross sectional identification: with increasing training and experience able to identify on all common cross-sectional modalities on which it is visible in key working standard planes (transverse and coronal), and distinguish normal structure from abnormality of either this or other structures. Knowledge base: with increasing training and experience aware of the structure’s existence, name, and functional anatomy

b. Pathology

Gross morphology of pathological conditions of systemic diseases affecting all organ systems.
Histopathological Slides for various pathology

c. System based details

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 thrombo embolism; chest in critical care patients, interventional techniques ; chest in neonates, and paediatric chest radiology.

THE CARDIOVASCULAR SYSTEM:

Goal is to provide experience in the role of imaging in cardiovascular diseases by different techniques including cardiac cathaterization and cardiac angiography, Digital subtraction angiography (DSA) and interventional procedures in non cardiac arterial and venous diseases

Diseases and disorders of cardiovascular system including congenital conditions and the role of imaging by conventional, ultrasound, Echo, colour-Doppler, CT, MRI, angiography (including DSA) and radionuclide studies. It also includes interventional procedures e.g.; balloon angioplasty, remobilization etc.

Understand the anatomy and common pathology of congenital and acquired cardiac conditions.

Correlate plain film findings of common congenital abnormalities with those shown by angiography and explain the pathophysiology including abnormal pressure measurements.

Correlate plain film findings and the echocardiographic studies of patients with acquired valvular diseases and other common pathologic conditions including pericardial pathology.

Understand the role of modalities like CT/MRI, in aortic diseases e.g., aorto-arteritis, aortic dissection and aortic aneurysm.

Should be able to perform fluoroscopy on patients before and after valve replacement and identify those with complications after valve replacement.

Understand the principle and logic behind various interventional procedures carried out in the cardiovascular labs e.g.; PTCA, balloon dilatation of valvular lesions etc.

To perform 2D Echo and to learn about RWMA, Ejection fraction, valvular disorders, pulmonary embolism etc

The normal heart: anatomy and techniques of examination.

Acquired heart disease
Techniques: 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 tumours, pericardial disease cardiac transplant surgery; role of Radiology in cardiac prostheses and pacemakers, Arteriography and interventional angiographic techniques, Phlebography (as appropriate)

Anatomy of the Thorax		
Category 1	**Category 2**	**Category 3**
1. BONE		
• Ribs • Sternum • Typical thoracic vertebral bodies • Scapula	• Clavicle • Costal cartilages	
2. JOINT		

	• Sternoclavicular joint • Manubriosternal joint	• Costochondral joint • Costocervical joint
3. LIGAMENT		
• Arcuate ligament • Ligamentum arteriosum	• Central tendon of the diaphragm	• Pulmonary ligament • Pericardial ligament
4. MUSCLE		
• Diaphragm • Intercostal muscles • Pectoral muscles • Serratus muscle, anterior	• Scapular muscles • Paravertebral muscles	• Serratus muscles, posterior
5. ARTERIAL STRUCTURE		
• Aorta • Brachiocephalic artery • Common carotid arteries • Subclavian arteries • Pulmonary arteries • Bronchial arteries • Right and left internal mammary arteries • Coronary arteries • Intercostal arteries, posterior and anterior	• Thyrocervical trunk • Costocervical trunk	• Lateral thoracic artery • Dorsal scapular artery • Thyroidea ima artery
6. VENOUS STRUCTURE		
• SVC and IVC • Brachiocephalic veins • Subclavian veins • Azygous vein • Hemiazygous vein • Pulmonary veins • Coronary veins	• Accessory hemiazygous vein • Superior and supreme intercostal veins • Lateral thoracic vein	• Internal mammary veins • Thebesian veins
7. LYMPHATICS		
• Thoracic duct • Intrathoracic nodal groups	• Cisterna chyli	
8. NERVES		
• Recurrent laryngeal	• Intercostal nerves •	• Cardiac plexus

nerve • Phrenic nerve • Spinal cord	Vagus nerves	
9. RADIOLOGICAL SPACES		
• Pleural spaces • Pericardial spaces		
10. HOLLOW VISCUS		
• Oesophagus • Trachea • Bronchial tree		
11. SOLID VISCUS		
• Lung • Heart • Thymus		
12. CROSS SECTION		
• Level of T5		
13. UNCLASSIFIABLE		
• Superior thoracic aperture (thoracic inlet)		

THE ABDOMEN AND GASTROINTESTINAL TRACT

- Basic anatomy and physiology in clinical practice relevant to imaging examinations of the gastrointestinal tract, hepatobiliary tract and pancreas

- Clinical significance of pathology associated with clinical presentation and link with likely diagnoses

- Construction of appropriate imaging pathway and protocol considering different pathologies and management options and according to available resource and case complexities, Common surgical procedures, expected post-operative imaging appearances and common complications.

- Understand indications, contraindications and limitations of relevant specialized barium/contrast imaging examinations of the gastrointestinal and hepatobiliary tract

- Role of plain films in modern era imaging of GIT

- Conventional examination of GIT using barium and water soluble contrast media- oesophagus, upper gastrointestinal study, follow through for small bowel (including small bowel enteroclysis)and enema (both conventional and double contrast) for colon.

- Other investigations done using fluoroscopic guidance - fistulogram, sinogram, t-tube cholangiography, sialography etc .

- Examination of liver, biliary system and pancreas using all the imaging modalities available to a radiologist including specialized investigations like ERCP, PTC and interventional procedures like abscess drainage, percutaneous trans hepatic biliary drainage (PTBD, internal and external), tumour remobilization, radiofrequency(RFA) ablation etc.

- Indications and limitations of ultrasound, CT and MR

- Understand indications, limitations and contraindications of various interventional radiology techniques

- Diseases and disorders of GIT, omentum, peritoneum and mesentery. Diseases and disorders of hepato-biliary-pancreatic system. Conventional and other imaging methods like US, CT, MRI, DSA and isotope studies pertaining to these systems.

<u>Conditions – outline is below but need not limited to the given list :</u>

Normal appearance, abdominal calcification, acute abdomen, pneumperitoneum, post operative abdomen, Intraperitoneal fluid, inflammatory conditions, intraabdominal abscesses, intramural gas and other conditions.

The Oesophagus-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, tumours, 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 haemorrhage, diverticulitis, and blind loop, neuromuscular disorders, malabsorbtion syndromes, immunological disorders, radionuclide studies of small bowel.

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

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, meconeum plug syndrome, meconium ileus, intussusceptions, necrotizing enterocolit**s**

Anatomy of the Abdomen		
Category 1	**Category 2**	**Category 3**
1. Arterial structure		
• Aorta • Parietal branches • Common iliacs	• Inferior phrenic • Lumbar arteries • Inferior and superior epigastric arteries	• Median sacral
2. Arterial structure: Visceral branches		
• Celiac • Common hepatic • SMA • IMA • Renals	• Adrenals • Gonadals • Splenic • Genital	• Duodenal • Pancreatic • Gastric • Gallbladder
3. Ligament		
	• Inguinal ligament and associated structures	
4. Radiological Spaces		
Retroperitoneal		
• Renal fasciae and spaces • Anterior pararenal spaces		
Intraperitoneal Spaces & Cavities		
• Greater sac • Lesser sac • Right mesenteric space • Left mesenteric space •		

Supramesocolic • Inframesocolic • Right and left paracolic • Inguinal canal • Scrotal sac		
5. Neural tract or nerve		
• Lumbar nerves and plexus	• Vagus nerves • Thoracoabdominal and subcostal nerves in abdominal wall • Sympathetic trunk and ganglia	• Greater, lesser, least splanchnics • Autonomic plexuses and ganglia
6. Hollow Viscus		
• Oesophagus (abdo) • Stomach • Duodenum • Jejunum • Ileum • Caecum • Appendix • Colon • Renal pelves and ureters • Gallbladder • Biliary tree		
7. Venous Structures		
• Common iliacs • IVC and tributaries • Portal system • Portosystemic anastomoses	• Gonadal veins • Ascending lumbar vein	
8. Cross Section		
Identifications at any level transverse or corona		
9. Bone		
	• Ribs	
10. Muscle/group		
• Rectus abdominis and	• Posterior abdominal	

fascias • Anterolateral abdominal muscles and aponeuroses • Psoas	muscles and fasciae	
11. Fascias		
	• Properitoneal and retroperitoneal	• Superficial abdominal fascia
12. Lymphatics		
• Common iliac nodes • Paraaortic nodes • Preaortic nodes • Portal, portocaval nodes • Peripancreatic nodes • External iliac nodes	• Cisterna chyli	
13. Solid viscus		
• Liver, specifically • Couinaud segments • Venous anatomy • Spleen • Suprarenal glands • Kidneys • Pancreas • Testis (note: ovary is classified in pelvis		
Anatomy of the Pelvis		
Category 1	**Category 2**	**Category 3**
1. BONE		
• Ilium • Ischium • Pubis • Sacrum		
2. JOINT		
• Sacroiliac joints • Pubic symphysis • Lumbosacral joint		
3. LIGAMENT		
		• Sacrotuberous ligament •

		Sacrospinous ligament • Sacroiliac ligaments
4. MUSCLE		
• Levator ani and coccygeus (pelvic floor)	• Piriformis • Obturator internus	
5. ARTERIAL STRUCTURE		
• Internal iliac artery • Superior, middle and inferior rectal arteries • Internal pudendal artery • Uterine artery • Median sacral artery	• Superior and inferior gluteal arteries • Obturator artery • Vaginal artery	• Umbilical artery • Superior and inferior vesical arteries • Ovarian artery • Iliolumbar artery and lateral sacral arteries
6. VENOUS STRUCTURE		
• Internal iliac vein • Internal pudendal vein	• Pelvic venous plexuses: prostate, bladder, uterus, vagina	
7. LYMPHATICS		
	• Internal iliac lymph nodes	
8. NERVES		
• Sacral plexus • Lumbosacral trunk • Sciatic nerve • Pudendal nerve • Obturator nerve • Cauda equina		• Superior & inferior gluteal nerves • Hypogastric nerves • Inferior hypogastric plexus • Pelvic splanchnic nerves (parasympathetic) • Sacral splanchnic nerves (sympathetic)
9. RADIOLOGICAL SPACES AND FORAMINA		
• Greater and lesser sciatic foramen • Rectouterine & rectovesical pouches	• Superficial and deep perineal pouches • Ischioanal fossae • Mesorectal fascia	• Presacral and rectovesical fascia

10. VISCERA		
• Rectum and anal canal • Bladder and urethra (male and female) • Uterus • Uterine tubes & broad ligament • Ovaries • Vagina • Pelvic ureters • Prostate • Ductus deferens and spermatic cord • External genitalia (male and female) • Testis and epididymis	• Seminal vesicles and ejaculatory ducts	
11. CROSS SECTION		
• Midline sagittal hemipelvis		
12. UNCLASSIFIABLE		
• Pelvic inlet and outlet		

Role of Imaging in Fatal Medicine

Acute abdomen - investigations and interpretations with abdominal trauma imaging
Radiology of Post-operative abdomen and organ transplantation(Liver, Pancreas,etc.)
Ischemic conditions of Bowel and Mesentery and role of arteriography and Doppler study
Upper and lower GI bleeding and GI radiological investigations including scintigraphy, GI manifestation of AIDS; Radiological evaluation, techniques, lesions, esophagitis, lesions involving stomach, small bowel, colon, biliary tract, lymphadenopathy

ENDOCRINE DISEASE

Introduction, Pathophysiology, radiological techniques, hypothalamus, pineal, pituitary, thyroid, parathyroid, thymus, pancreas, GI tumours, adrenal, female reproductive system, male reproductive system

GENITO-URINARY SYSTEM –

Applied anatomy to interpret uro-gynaecological imaging

Clinical significance of pathology associated with presentation and link with likely diagnoses

Knowledge of local/regional guidelines in relation to clinical presentation

Various diseases and disorders of genito-urinary system including congenital, inflammatory, infectious, traumatic, neoplastic, calculus disease and miscellaneous conditions.

Performance, direction and interpretation of the conventional radiological examinations of the urinary tract including: intravenous urography; cystograms, micturating cystourethrography (MCU), hysterosalpingography (HSG) and retrograde urethrography (RGU).

Diagnostic imaging modalities and procedures which are used to evaluate urinary tract pathology i.e. Ultrasound, CT, MRI, angiography, as well as various interventional procedures like percutaneous nephrostomy, radio frequency ablation (RFA), kidney biopsy, stent placement, antegrade pyelography, tumor embolization etc.

Emergency conditions involving the urinary tract including trauma, infection, vascular compromise and obstruction.

Evaluation of renal mass lesions and the evaluation of other urinary tract neoplasms, including the detection and staging of the tumor.

Recognition of the difference between the pattern of diseases affecting the genitourinary tract of adults and that of children and understand and identify the common conditions affecting the pediatric genito-urinary system on imaging.

Evaluation of renal failure & post-transplant kidney.

Miscellaneous including cystic disease of kidney, nephrocalcinosis, lower urinary tract obstruction/infection and post-operative problems, male infertility imaging and interventions and trauma of genito-urinarytract

Interventional Uroradiology – Percutaneous nephrostomy, renal cyst puncture, FNAC and ureteric stenting.

The female reproductive system: ultrasound in obstetrics and gynecology, antenatal ultrasound including TIFFA, NT/NB , obstetric Doppler evaluation, 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 ofHSG
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 balder 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 arteriogrpahy, 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, MRI and complications of transplantation.

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

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.

Bone and joint infections: periostetis 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, mucopolysacchariodoses, mucolipidoses, 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 arthropaties, degenerative disease of spine, arthography, radiology of soft tissues; imaging techniques, focal lesions, calcification and ossification. Gas in soft tissue, soft tissues tumours; 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 tumour 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.

Anatomy of the Upper Limb		
Category 1	**Category 2**	**Category 3**
1. BONE		
Clavicle, Scapula and Humerus		
• Bony features • Articular surfaces • Attachments of ligaments • Epiphyses – (sites, dates of appearance/fusion)	• Attachments of muscles • Joint capsular attachments	
Radius and Ulna		
• Bony features • Articular surfaces • Attachments of ligaments • Epiphyses (sites, dates of appearance/fusion)	• Attachments of muscles • Joint capsular attachments	
Carpal Bones		
• Names of all bones • Bony features • Ossification	• Articular surfaces	• Attachments of muscles
Metacarpals & Phalanges		
• Bony features • Articular	• Sesamoids • Joint	• Attachments of muscles

surfaces • Epiphyses (sites, dates of appearance/fusion)	capsular attachments	
2. JOINT		
Joints of the Shoulder Girdle		
• Acromioclavicular joint	• Sternoclavicular joint	
Shoulder Joint		
• Articular surfaces • Fibrous capsule & joint cavity • Labrum	• Tendon of long head of biceps • Subacromial bursa	• Glenohumeral ligaments
Elbow Joint		
• Articular surfaces • Fibrous capsule & joint cavity • Pads of fat	• Carrying angle	• Olecranon bursa
Radioulnar Joints		
• Proximal radioulnar joint • Distal radioulnar joint	• Articular disc	
Wrist Joint		
• Articular surfaces • Capsule & ligaments		
Joints of the Hand		
• Intercarpal joints • 1st carpometacarpal joint • Metacarpophalangeal joints • Interphalangeal joints	• Carpometacarpal joints • Intermetacarpal joints	
3. LIGAMENTS		
Clavicular		
• Coracoclavicular ligament	• Costoclavicular ligament	• Anterior & posterior sternoclavicular ligaments
Acromioclavicular		
		• Acromioclavicular ligament

Shoulder		
	• Coracoacromial ligament • Glenohumeral ligaments	• Coracohumeral ligament
Elbow		
• Collateral ligaments		
Radioulnar		
• Annular ligament		
Metacarpophalangeal		
		• Palmar ligaments (Plates) • Collateral ligaments
Interphalangeal		
		• Collateral ligaments • Palmar ligaments (Plates)
4. MUSCLE/GROUP		
Muscles of the Shoulder (Pectoral) Girdle and Upper Arm		
• Subscapularis • Supraspinatus • Infraspinatus • Teres minor • Biceps (brachii)	• Pectoralis major • Pectoralis minor • Serratus anterior • Deltoid • Teres major • Coracobrachialis • Brachialis • Triceps (brachii)	• Subclavius
Muscles of Forearm		
	• Flexor compartment superficial layer: ¡ Pronator teres ¡ Flexor carpi radialis ¡ Palmaris longus ¡ Flexor carpi ulnaris • Intermediate layer: ¡ Flexor digitorum superficialis • Deep layer: ¡ Flexor pollicis longus ¡ Flexor digitorum	• Flexor compartment very deep layer: • Pronator quadratus • Extensor compartment superficial layer posterior group: ¡ Anconeus

	profundus • Extensor compartment superficial layer lateral group: ¡ Brachioradialis ¡ Ext. carpi radialis longus ¡ Ext. carpi radialis brevis • Extensor compartment superficial layer posterior group: ¡ Extensor digitorum ¡ Ext. digiti minimi ¡ Extensor carpi ulnaris • Extensor compartment deep layer: ¡ Abductor pollicis longus ¡ Extensor pollicis brevis ¡ Extensor pollicis longus ¡ Extensor indicis ¡ Supinator	
Deep Fascia		
• Flexor Retinaculum	• Interosseus membrane • Extensor retinaculum • Palmar aponeurosis • Fibrous flexor sheaths of digits • Deep transverse metacarpal ligament	
Long Tendons and Synovial Sheaths		
	• Flexor tendons • Extensor tendons • Intrinsic muscles of palm 1st layer: ¡ Abductor pollicis brevis ¡ Flexor pollicis brevis ¡ Flexor digit minimi ¡ Abductor	• Intrinsic muscles of palm 4th layer: ¡ 3 Palmar interossei

	digit minimi • Intrinsic muscles of palm 2nd layer: ¡ 4 lumbricals (from long tendons) • Intrinsic muscles of palm 3rd layer: ¡ Opponens pollicis ¡ Adductor pollicis ¡ Opponens digit minimi • Intrinsic muscles of palm 4th layer	
5. ARTERIAL STRUCTURE		
Axillary (all Category 1 except as shown)		
	• Subscapular artery • Circumflex humeral arteries (anterior & posterior)	
Brachial		
	• Profunda brachii artery	
Radial & Ulnar		
	• Anterior & posterior interosseous • Superficial palmar arch • Deep palmar arch • Digital arteries	
6. VENOUS STRUCTURE		
Superficial Veins		
• Cephalic • Basilic • Communications: Medial cubital vein	• Dorsal venous arch	
Deep Veins		
	• Axillary vein	• Venae comitantes
7. LYMPHATICS		
Axillary Lymph Nodes (all Category 1 except as indicated)		
• Apical, central, lateral,	• Supratrochlear lymph	

posterior, subscapular groups	nodes	
8. NERVES		
Axillary		
• All category 1 except upper lateral cutaneous N. of arm		• Upper lateral cutaneous nerve of arm
Musculocutaneous		
		• Lateral cutaneous nerve of forearm
Median		
• Median nerve course, relations and innervation	• Recurrent (Thenar) branch • All other median branches except anterior interosseous	• Anterior interosseus nerve
Ulnar Nerve		
• Ulnar nerve course, relations and innervation	• Deep (terminal) branch • Superficial (terminal) branch	• Dorsal branch
Radial Nerve		
• Radial nerve course, relations and innervation	• Deep Branch (posterior interosseus nerve)	• Superficial (terminal) branch
Brachial Plexus (Infraclavicular Part) and Branches		
Lateral Cord (all Category 2 except as indicated):		
		• Lateral pectoral nerve
Medial Cord (all Category 2 except as indicated)		
		• Medial pectoral nerve • Medial cut. nerves of arm & forearm
Posterior Cord (all Category 2 except as indicated):		
		• Upper & lower subscapular • Thoracodorsal nerves

Branches from Supraclavicular Part of Brachial Plexus		
	• Long thoracic nerve	• Suprascapular nerve • Nerve to subclavius • Nerve to rhomboids
9. REGIONS ANTERIOR		
Pectoral Region		
• Breast	• Boundaries • Contents	• Others
Axilla		
• Boundaries • Contents		
Anterior Compartment of Arm		
	• Boundaries • Contents	
Cubital Fossa		
• Boundaries • Contents		
Anterior Compartment of Forearm		
	• Boundaries • Contents	
Carpal Tunnel		
• Boundaries • Contents		
Palm of Hand		
	• Boundaries • Contents	
Palmar Aspect of Digits		
	• Boundaries • Contents	
10. REGIONS POSTERIOR		
Scapular Region		
	• Boundaries • Contents	
Deltoid Region		
	• Boundaries • Contents	
Posterior Compartment of Arm		
	• Boundaries • Contents	
Posterior Compartment of Forearm		
	• Boundaries • Contents	
Anatomical Snuff Box		
• Boundaries • Contents		

Dorsum of Hand		
	• Boundaries • Contents	
Dorsal Aspect of Digits		
	• Boundaries • Contents	
11. COMMON VARIANTS (all Category 1 except as indicated)		
• Bony/ligamentous • Vascular • Nervous	• Muscular	
Anatomy of the Lower Limb		
Category 1	**Category 2**	**Category 3**
1. BONE		
Hip Bone, Femur and Patella		
• Parts • Bony features • Articular surfaces • Epiphyses (sites, dates of appearance)	• Attachments of muscles • Attachments of ligaments	
Tibia and Fibula		
•Parts • Bony features • Articular surfaces • Attachments of ligaments • Epiphyses (sites, dates of appearance)	• Attachments of muscles	
Bones of the Foot		
• Tarsal bones • Talus & calcaneus • Accessory bones and sesamoids	• Navicular & cuboid • Metatarsals • Phalanges	• Cuneiforms • Ossification • Epiphyses
2. JOINTS		
Hip Joint		• Bursae • Pad of fat
• Articular surfaces • Fibrous capsule and		

retinacular fibres • Acetabular labrum		
Knee Joint		
• Articular surfaces (patello-femoral & femoro-tibial) • Fibrous capsule & deficiencies • Menisci (medial & lateral)	• Synovial membrane • Bursae: suprapatellar, prepatellar, semimembranosus • Infapatellar pad of fat	• Intracapsular tendon of popliteus
Tibiofibular Joints		
• Distal tibiofibular joint (Syndesmosis)	• Proximal tibiofibular joint	
Ankle Joint		
• Articular surfaces • Fibrous capsule		
Joints of the Foot		
• Subtalar & talocalcaneonavicular joints	• Other intertarsal joints (including calcaneocuboid) • Tarsometatarsal & intermetatarsal joints • Metatarsophalangeal & interphalangeal joints	
3. LIGAMENTS		
Hip Bone		
• Inguinal ligament		
Hip Joint		
• Iliofemoral ligament	• Transverse acetabular ligament • Ligament of head of femur	• Pubofemoral ligament • Ischiofemoral ligament
Knee Joint		
• Ligamentum patellae • Collateral ligaments (medial & lateral) •	• Oblique popliteal • Intermeniscal ligaments • Patellar retinacula	• Arcuate popliteal, transverse • Coronary • Ligamentum mucosum

Cruciate ligaments (anterior & posterior)		
Deep Fascia		
	• Deep transverse metatarsal ligament	
Ankle Joint		
• Collateral ligaments (medial & lateral)		
Joints of Foot		
	• Interosseous talocalcaneal ligament • Spring ligament • Bifurcate ligament • Cervical ligament • Collateral ligaments	• Plantar plates
4. MUSCLE		
Muscles of Hip and Thigh		
	• From posterior abdominal wall • Psoas major (& minor) • Iliacus	
Muscles of the Gluteal Region		
• Piriformis	• Gluteus maximus • Gluteus medius • Gluteus minimus • Obturator internus • Quadratus femoris	• Tensor fascia lata • Superior gemellus • Inferior gemellus
Anterior Compartment of Thigh		
	• Sartorius • Rectus femoris • Vastus lateralis • Vastus medialis • Vastus intermedius • Pectineus	
Medial Compartment of Thigh		
	• Gracilis • Adductor	

	longus • Adductor brevis • Adductor magnus • Obturator externus	
Posterior Compartment of Thigh		
	• Semitendinosus • Semimembranosus • Biceps femoris	
Muscles of Leg		
	• Anterior compartment ¡ Tibialis anterior ¡ Extensor hallucis ¡ Extensor digitorum ¡ Peroneus tertius • Lateral compartment ¡ Peroneus longus ¡ Peroneus brevis	
Deep Fascia		
• Flexor Retinaculum	• Extensor retinacula • Plantar aponeurosis • Synovial sheaths	• Peroneal retinacula • Fibrous flexor sheaths of digits
Long Tendons		
	• Extensor tendons • Peroneal tendons • Flexor tendons	
Muscles of the Foot		
	• Intrinsic muscle(s) of dorsum ¡ Extensor digitorum (& hallucis) brevis • Intrinsic muscles of sole ¡ Flexor hallucis brevis ¡ Adductor hallucis ¡ Dorsal interossei	• Intrinsic muscles of sole ¡ Abductor hallucis ¡ Flexor digitorum brevis ¡ Abductor digiti minimi ¡ Flexor accessorius ¡ 4 lumbricals ¡ Flexor digiti ¡ Minimi brevis ¡ Plantar interossei
Arches of the Foot		

• Longitudinal arch • (Medial & lateral)	• Transverse arch	
5. ARTERIAL STRUCTURES		
Femoral		
• Profunda femoris artery • Dorsalis pedis	• Medial & lateral circumflex Femoral arteries • Popliteal • Posterior tibial • Anterior tibial • Peroneal	• Perforating arteries • Genicular arteries • Plantar vascular arches • Lateral & medial plantar arteries • Digital arteries
6. VENOUS STRUCTURES		
Superficial		
• Great saphenous	• Small saphenous	
Deep Veins		
• Femoral vein	• Popliteal vein	• Venae comitantes of arteries • Venous plexus (sinuses) in soleus
7. LYMPHATICS		
• Superficial inguinal (horizontal & vertical) • Deep inguinal		• Popliteal
8. NERVES		
Thigh		
• Saphenous nerve • Obturator nerve • Sciatic nerve		
Leg		
• Common peroneal nerve • Superficial peroneal nerve • Deep peroneal nerve	• Sural nerve • Medial plantar nerve • Lateral plantar nerve • Superficial & deep terminal branches	
9. REGIONS ANTERIOR		
Femoral Triangle & Subsartorial Canal		
• Boundaries & contents		

Anterior & Medial Compartments of Thigh		
	• Boundaries & contents	
Anterior & Lateral Compartments of Leg		
• Boundaries & contents		
Dorsum of Foot & Digits		
	• Boundaries & contents	
10. REGIONS POSTERIOR		
Gluteal Region		
• Boundaries & contents		
Posterior Compartment of Thigh & Popliteal Fossa		
• Boundaries	• Contents	
Posterior Compartment of Leg		
• Boundaries & contents		
Tarsal Tunnel & Sole of Foot		
• Boundaries & contents		
Plantar Aspect of Digits		
	• Boundaries & contents	
Anatomy of the Spine & Back		
Category 1	**Category 2**	**Category 3**
1. Bones		
• Cervical vertebra including atlas and axis • Thoracic vertebrae • Lumbar vertebrae • Sacrum • Coccyx • Features of vertebrae (body, pedicle, facets etc) • Intervertebral foramina		
2. Joints		
• Atlantoaxial joints (median and lateral) • Intervertebral discs •	• Atlantooccipital joints • Costovertebral and costotransverse joints •	

Zygapophyseal (facet) joints • Sacroiliac joints	Sacrococcygeal joint	
3. Ligaments		
• Ligamentum flavum • Transverse ligament of atlas	• Anterior and posterior longitudinal ligaments • Apical and alar ligaments • Cruciform ligament	• Interspinous and supraspinous ligaments • Intertransverse ligaments • Ligamentum nuchae (nuchal ligament) • Tectorial membrane • Anterior and posterior atlantooccipital membranes • Anterior and posterior atlantoaxial membranes
4. Muscles		
	• Extrinsic back muscles • Intrinsic back muscles • Splenius capitis and cervicis • Erector spinae group • Transversospinalis group • Multifidus • Suboccipital muscles	• Spinalis • Longissimus • Iliocostalis • Semispinalis muscles • Rotatores • Intertransversarii and interspinales muscles
5. Vertebral canal and contents		
• Spinal cord and nerve roots including cauda equina • Dura mater and dural sleeves • Subarachnoid space including lumbar cistern • Epidural space		
6. Arteries		
• Vertebral artery	• Spinal arteries • Artery of Adamkiewicz	

7. Veins		
	• Epidural venous plexus • Batson vertebral plexus	

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, radinuclide arteriography, positron emission tomography(PET), receptor imaging, monoclonal body imaging, ultrasound of infant brain.

Category 1	Category 2	Category 3
1.INTRACRANIAL CAVITY (EXTRAAXIAL)		
Anterior cranial fossa		
• Ethmoid bone • Frontal bone & sinus • Sphenoid: Lesser wing • Olfactory bulb and tract	• Meningeal coverings • Crista galli	
Middle cranial fossa		
Sphenoid body, greater wing & sinus • Temporal bone & apex • Middle meningeal artery • • Foramina of middle cranial fossa & contents ¡ Optic canal ¡ Superior orbital fissure ¡ Foramen	Meningeal coverings Vidian canal • Foramen spinosum • Foramen lacerum	

rotundum ¡ Foramen ovale ¡ Carotid canal		
Posterior cranial fossa		
Temporal bone • Occipital bone • • Foramina of posterior cranial fossa & contents ¡ Internal auditory meatus with CN VII & VIII ¡ Jugular foramen & contents ¡ Hypoglossal canal & CN XII ¡ Foramen magnum	Meningeal coverings	
2.Cranial vault		
Bones :		
• Layers of skull • Bones including prominences, foramina and key vascular markings: ¡ Frontal ¡ Parietal ¡ Sphenoid ¡ Temporal ¡ Occipital	• Dural coverings • Arachnoid granulations •	
Scalp :		
	• Galea • Blood supply to scalp	Frontalis muscle • Occipitalis muscle
Nerves :		
	Meningeal • Scalp	• Skull bones
3.Orbit		
Bony orbit		
• Boundaries & walls, including contributions from specific skull bones • Foramina & contents • Optic canal • Superior	• Lacrimal fossa/crest • Periorbita • Medial & lateral tubercles • Orbital septum	

orbital fissure • Inferior orbital fissure		
Preseptal Structures		
Lacrimal sac & duct	• Lids & tarsal plates • Blood supply & venous drainage • Levator palpebrae superioris & nerve supply • Conjunctival sac boundaries • Lacrimal canaliculi	Lateral and medial check ligaments of the globe
Extraocular Muscle Cone		
Intraconal fat • Extraocular muscles & their nerve supplies	Tendon annulus	
Extraconal Space		
Lacrimal gland	Nerve & blood supply to the lacrimal gland • Extraconal fat	
Globe & Contents		
Cornea & sclera • Choroid & retina • Iris & lens	• Canal of Schlemm • Macula position • Short ciliary arteries • Nerve supply ¡ Short and long ciliary nerves • Ciliary ganglion	
Optic Nerve Complex		
• Fovea • Optic nerve • Central artery of retina • Central retinal vein • Optic nerve sheath		
Arteries		

• Ophthalmic artery • Infraorbital artery • Central artery of retina	• Supraorbital • Supratrochlear • Lacrimal • Dorsal nasal • Anterior & posterior ethmoidal	• Anterior ciliary • Posterior ciliary • Zygomaticotemporal • Zygomaticofacial
Veins		
• Superior and inferior ophthalmic veins • Facial-cavernous anastomoses		• Ophthalmic vein tributaries
Nerves		
• Oculomotor nerve & divisions • Ciliary ganglion • Ophthalmic nerve • Maxillary nerve • Infraorbital nerve	• Branches of ophthalmic nerve • Zygomatic branches of maxillary nerve	
4. NASAL CAVITY & PARANASAL SINUSES		
Bones & Foramina/Canals		
• Key bones • Ethmoid bone • Palatine bone • Maxilla • Conchae & meati • Ostiomeatal complex & its components • Sphenoid sinus • Sphenoethmoidal recess	• Other bones ¡ Premaxilla (incisive bone) ¡ Pterygoid plates of sphenoid ¡ Nasal bone ¡ Lacrimal bone ¡ Nasal septum & vomer ¡ Ethmodial cell variants ¡ Haller cell ¡ Agger nasii cell • Foramina ¡ Sphenopalatine foramen ¡ Palatine canals ¡ Incisive foramen • Variations of pneumatisation	• Mucosa
Blood Supply		

	• Sphenopalatine artery • Anterior and posterior ethmoidal arteries • Venous drainage	
Nerve Supply		
		• Anterior ethmoidal • Nasopalatine • Branches of greater palatine nerve
Lymphatics		
• Lymphatic drainage & nodal pathways		
5. THE FACIAL BONES		
• Bones, processes, articulations, sinuses, foramina/canals & their contents ¡ Sphenoid ¡ Palatine ¡ Ethmoid ¡ Nasal ¡ Vomer ¡ Zygoma ¡ Maxilla ¡ Mandible		
6. THE TEMPORAL BONE		
External Ear & Petrous Temporal		
• External auditory meatus • Tympanic membrane • Mastoid air cells		• Auricle & its innervation • Tympanic ring
Middle Ear		
• Floor & roof features, windows & foramina • Ossicular Chain ¡ Malleus ¡ Incus ¡ Stapes • Nerves ¡ Facial nerve ¡ Chorda tympani	• Ossicular chain joints & ligaments • Muscles ¡ Tensor tympani ¡ Stapedius • Jacobson's nerve	

Inner Ear		
• Bony & membranous labyrinth • Facial nerve canal, course & parts • Stylomastoid foramen	• Dorello's canal, abducens n. • Cochlear aqueduct • Vestibular aqueduct	
7. TEMPOROMANDIBULAR JOINT		
• Condylar fossa & eminence • Articular disc & components • Condyle & articular cartilage • Fully open & closed positional anatomy	• Joint capsule • Normal motional variants	
8. MANDIBLE		
• Condyle, neck, ramus & body • Muscle attachments • Inferior alveolar artery & nerve • Canals & foramina ¡ Mandibular canal ¡ Lingula ¡ Inferior alveolar foramen ¡ Mental foramen	• Mental nerve • Dental nerves • Nerve to mylohyoid • Inferior alveolar vein	
9. THE TEETH		
	• Dental terminology ¡ Mesial-distal, buccal-lingual, crown-roots • Parts of tooth ¡ Crown, neck, root, root canal, enamel, dentine, pulp cavity, roots • Numbering and naming (FDI terminology)	
10. SUPERFICIAL FACE		
• Veins ¡ Facial vein ¡ Facial venous	Veins Supratrochlear &	• Muscles of facial expression

anastomoses	supraorbital	
Category 1	**Category 2**	**Category 3**
1. THE BRAIN		
White Matter		
• Corpus callosum • Fornix and forniceal commissure • Corticospinal tracts (and corticobulbar tract) • Optic tract, geniculocalcarine tract and optic radiation • Internal capsule & components	• Middle thalamic radiation • Spinothalamic tract and spinal lemniscus • Medial lemniscus system • Spinocerebellar tracts • Rubrospinal tract	• Anterior, posterior, habenular commissures • Posterior & inferior thalamic radiations • Auditory system ¡ Lateral lemniscus ¡ Inferior brachium ¡ Auditory radiation • Association tracts (subcortical WM) • Anterior thalamic radiation • Trigeminothalamic tract • Reticular formation • Reticulospinal tracts
Grey Matter Nuclei (Non-Cranial Nerve)		
• Caudate nucleus • Putamen • Globus pallidus • Amygdala		
Cerebral Cortex		
• Frontal, temporal & occipital poles • Frontal, temporal, parietal, & occipital lobes • Key gyri ¡ Precentral ¡ Postcentral ¡ Precuneus ¡ Calcarine ¡ Cingulate ¡ Operculum • Hippocampus & components	• Important gyri ¡ Frontal ¡ Orbital ¡ Superior parietal & paracentral lobules ¡ Gyrus rectus ¡ Supramarginal and angular ¡ Cuneus ¡ Lingual ¡ Occipitotemporal ¡ Temporal • Parahippocampal gyrus & subiculum	• Other gyri ¡ Pyriform cortex ¡ Insular gyr

Cerebral Sulci		
• Interhemispheric fissure • Lateral (Sylvian) fissure • Central (Rolandic) sulcus • Callosal sulcus • Cingulate sulcus • Parietooccipital fissure • Calcarine sulcus	• Circular sulcus • Collateral sulcus • Superior & inferior frontal • Superior & inferior temporal • Postcentral	• Temporooccipital notch • Occipitotemporal • Fimbriodentate • Intraparietal • Subparietal
Anatomic Basis of Functional Systems		
• Cortical motor system • Cortical sensory system • Auditory system • Visual System	• Olfactory system • Speech: Broca & Wernicke areas	
2. THE BRAINSTEM		
White Matter		
• Cerebral peduncle • Middle cerebellar peduncle • Inferior cerebellar peduncle • Pyramid and pyramidal decussation	• Superior cerebellar peduncle	
Grey Matter Nuclei (Non-Cranial Nerve)		
• Thalamus ¡ Lateral and medial genicular bodies • Pineal gland • Posterior pituitary (neurohypophysis) • Substantia nigra • Superior and inferior colliculi	• Subthalamic nucleus • Thalamic nuclei ¡ Ventral posterior nucleus • Red nucleus • Pontine nuclei • Olivary nucleus • Hypothalamus ¡ Infundibulum ¡ Mammillary body	• All other thalamic nuclei
3. VENTRICULAR SYSTEM		
• Lateral ventricles • Third ventricle & boundaries •	• Septum pellucidum, velum interpositum •	

Cerebral aqueduct • Fourth ventricle • Obex, median (Magendie) and lateral (Luschka) foramina • Choroid plexus	Choroid fissures of lateral ventricles • Superior medullary velum • Features of fourth ventricle floor	
4. BASAL CSF CISTERNS		
• Suprasellar cistern • Interpeduncular cistern • Ambient cistern • Quadrigeminal cistern • Prepontine cistern • Cerebellopontine cistern • Premedullary & perimedullary cisterns • Cisterna magna		
5. PITUITARY & RELATED STRUCTURES		
• Sella turcica • Cavernous sinus, walls and contents • Neurohypophysis & Stalk • Adenohypophysis • Pituitary blood supply & portal system • Planum sphenoidale	• Diaphragma sellae	• ICA dural rings
6. THE CRANIAL NERVES		
Cranial Nerve Systems		
• Olfactory bulb & tract • Retina, optic nerve & chiasm • Oculomotor nerve & nucleus, ciliary ganglion • Trochlear nucleus & n. • Trigeminal nuclei, ganglion & roots • Abducens nucleus & n. •		• Edinger-Westphal nucleus • Spinal trigeminal tract nucleus • Superior salivary nucleus, Lacrimal nucleus, Facial motor nucleus, facial sensory components • Vestibular nuclei, cochlear

Facial nucleus & n. • Vestibulocochlear nerve & spiral ganglion • Glossopharyngeal nerve & ganglia • Vagus nerve & ganglia • Accessory nucleus & n. • Hypoglossal nucleus & n.		nucleus • Inferior salivary nucleus • Motor & dorsal nuclei • Multi-nerve nuclei ¡ Spinal nucleus of trigeminal nerve ¡ Nucleus of tractus solitarius ¡ Nucleus ambiguus • Mesencephalic ganglion • Trigeminothalamic tract
Organisation of Cranial Nerve Nuclei		
• Somatic motor efferent ¡ Hypoglossal, abducens, trochlear, oculomotor • Brachiomotor efferent ¡ Motor nucleus of VII ¡ Motor nucleus of V • Somatic sensory ¡ Trigeminal sensory • Vestibular and cochlear nuclei		• Brachiomotor efferent ¡ Nucleus ambiguus • Somatic sensory ¡ Mesencephalic, spinal • Visceral sensory ¡ Nucleus of tractus solitarius • Visceral motor efferent ¡ Dorsal nucleus of vagus, salivary, lacrimal, Edinger Westphal
7. THE MENINGES		
• Pia mater (in general) • Arachnoid mater (in general) • Dura mater (in general) • Falx cerebri • Tentorium cerebelli • Falx cerebelli • Middle meningeal artery • Subarachnoid space (in general) • Subdural space (in general) • Extradural space (in general)	• Meningeal blood supply • Meningeal innervation	
8. THE CEREBELLUM		

• Neocerebellum • Vermis • Cerebellar tonsils • Dentate nuclei • Superior, middle and inferior peduncles	• Superior & inferior medullary velum	
9. VASCULAR SUPPLY TO THE BRAIN		
Arterial		
• Internal carotid arteries, branches & segments • Ophthalmic artery and branches • Circle of Willis configuration and common variations • Middle cerebral artery (MCA), segments & branches • Anterior cerebral artery (ACA), segments & branches • Anterior communicating artery (AComA) • Posterior cerebral artery (PCA), segments & branches • Vertebral & basilar artery • Anterior & posterior spinal arteries • Posterior communicating artery (PComA) • Cerebellar arteries (SCA, AICA, PICA) • Arterial territories on crosssectional imaging, variations	• Extradural ICA branches ¡ Inferolateral trunk ¡ Menigohypophyseal trunk ¡ Artery of Vidian canal	• Anterior choroidal artery • Anterolateral and anteromedial perforating arteries including artery of Heubner • Intracranial – extracranial anastomoses ¡ Ophthalmic/facial ¡ Inferolateral & maxillary • Posterolateral perforating arteries • Posteromedial perforating arteries • Basilar and vertebral perforators
Venous		

• Ophthalmic vein • Internal cerebral vein • Basal vein (of Rosenthal) • Great cerebral vein (of Galen) • Venous sinuses	• Venous territories and overlap • Thalamostriate vein • Septal veins • Anterior cerebral vein • Deep middle cerebral vein • Cortical veins • Superior anastomotic vein (of Trolard) • Inferior anastomotic vein (of Labbe) • Superficial middle cerebral vein	
10. THE SPINAL CORD		
Spinal Cord Structure		
• Craniocervical junction • Cervical enlargement • Cervical cord • Thoracic cord • Lumbar enlargement • Conus medullaris • Filum terminale • Cauda equina		
Spinal Grey Matter		
• Anterior horn and motor neurons • Posterior horn and sensory neurons • Dorsal root ganglion • Central canal	• Lateral horn and autonomic neurons	• Laminae of gray matter
Spinal White Matter Tracts		
• Anterolateral funiculi (columns) ¡ Corticospinal tract ¡ Medial longitudinal fasciculus ¡ Spinothalamic tract • Lateral funiculi (columns) ¡ Corticospinal	• Reticulospinal tract • Ventral white commissure	• All other tracts

tract ¡ Corticorubral tract ¡ Spinocerebellar tracts • Dorsal funiculi (columns) ¡ Fasciculus and nucleus gracilis ¡ Fasciculus and nucleus cuneatus		
Spinal CSF Spaces & Coverings		
• Ventral nerve roots • Dorsal nerve roots • Denticulate ligament • Pia mater • Arachnoid mater • Dura mater • Subarachnoid space • Subdural space • Epidural (extradural) space		
Functional Anatomical Systems of the Cord		
• Lumbar enlargement • Pain & temperature sensation • Vibration & proprioception sensation	• Thoracic autonomic outflow • Sacral autonomic outflow	
Spinal Vascular Supply		
• Anterior spinal artery • Posterior spinal artery • Spinal segmental reinforcing arteries (esp. Adamkiewicz) • Spinal venous plexus	• Spinal segmental veins	
Anatomy of the Neck (Non-Spinal)		
Category 1	**Category 2**	**Category 3**
1. MUSCLES OF THE NECK		
• Suprahyoid muscles (digastric, sternohyoid, mylohyoid) • Infrahyoid		

muscles (sternothyroid, thyrohyoid, sternohyoid, omohyoid)		
2. VISCERAL AXIS OF THE NECK		
• Hyoid bone and related muscles and ligaments		
Larynx		
• Laryngeal cartilages • Laryngeal divisions: supraglottic, glottic and subglottic • Vestibule, ventricle/sinus • Pyriform recess/sinus/fossa	• Fibromuscular structures & folds • Intrinsic muscles	• Saccule
Pharyngeal Muscles		
• Circular ¡ Superior constrictor & components ¡ Middle constrictor ¡ Inferior constrictor & components	• Longitudinal ¡ Stylopharyngeus ¡ Palatopharyngeus ¡ Salpingopharyngeus	
Nasopharynx		
• Palatine tonsil, its features and relations • Rosenmüller fossa	• Boundaries • Auditory/Eustachian tube	
Oropharynx		
• Palatine tonsil, its features and relations	• Boundaries • Palatine tonsil, blood supply	
Laryngopharynx (Hypopharynx)		
	• Boundaries	
Thyroid gland		
• Parts • Relations • Arteries and veins	• Location & Relations	
3. FASCIAE & SPACES OF THE NECK		
Superficial Layer of Deep Cervical Fascia (DCF)		

• Spaces & their contents ¡ Masticator space ¡ Parotid space ¡ Submandibular & sublingual spaces ¡ Suprasternal space (of Burns)		
Deep layer of DCF		
• Perivertebral space • "Danger space" and its significance		
Middle layer of DCF		
• Buccopharyngeal fascia • Pharyngobasilar fascia		• Cloison sagittale
Other spaces:		
• Parapharyngeal space • Retropharyngeal space • Visceral space	• Pre-styloid & retrostyloid parapharyngeal spaces	• Anterior, posterior cervical, suboccipital triangles
4. INFRATEMPORAL & TEMPORAL FOSSAE		
Temporal Fossa		
• Temporalis muscle • Masseter muscle • Zygomatic arch		
Infratemporal Fossa		
• Muscles ¡ Medial pterygoid ¡ Lateral pterygoid ¡ Pterygopalatine fossa ¡ Palatine plates ¡ Contents • Foramen ovale • Nerves ¡ Mandibular n. & branches ¡ Maxillary n. & branches ¡ Pterygopalatine ganglion • Vessels ¡ Maxillary		

artery & branches ¡ Deep maxillary vein ¡ Pterygoid venous plexus		
5. THE TONGUE		
• Muscles ¡ Genioglossus ¡ Mylohyoid ¡ Hyoglossus • Hyoid bone • Mylohyoid sling • Lingual artery, nerve and chorda tympani • Facial artery & vein • Hypoglossal & glossopharyngeal nerves • Lymphatic drainage	• Other Muscles ¡ Geniohyoid ¡ Intrinsic muscles ¡ Styloglossus ¡ Palatoglossus • Lingual vein	
6. BLOOD VESSELS AND NERVES OF THE NECK		
Common carotid artery, course, relations, vertebral level of bifurcation • Relations of common carotid artery • • All branches of external carotid artery and their relations • Vertebral artery in the neck • Thyrocervical trunk and its branches in the neck • Internal jugular vein and its relations • Anterior, external jugular veins, their course, origin and termination, relations Cervical plexus : Topography,relations with scaleni anterior and	• Relations of external carotid and Internal carotid arteries in the neck • Branches (especially cutaneous branches & phrenic nerve)	

medius ¡ Relations with sternomastoid		
Brachial plexus in the neck		
• Topography, relations	• Formation, roots and trunks and branches in the neck	
7. CAROTID SHEATH		
• Internal carotid artery • External carotid artery and its head branches • Internal jugular vein • Carotid body • Nerves ¡ Glossopharyngeal ¡ Vagus ¡ Accessory ¡ Hypoglossal	• Jugular tributaries • Carotid sympathetic plexus • Internal-external carotid anastomoses	
8. LYMPH NODES		
• Traditional divisions ¡ Superficial cervical chain ¡ Spinal accessory chain ¡ Deep cervical chain ¡ Jugulo-digastric and juguloomohyoid, Virchow nodes ¡ Retropharyngeal nodes ¡ Transverse cervical chain • Imaging-based classification ¡ Levels I – VI		
9. SECTIONAL ANATOMY		
• Cross sections (horizontal sections) of the neck at all vertebral levels • Median section (Mid-sagittal section) of the neck • Cross sections of		

the larynx and pharynx		

OPHTHALMOLOGY, 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.

Ocular ultrasound and its application sin detection of posterior segment diseases

Neck anatomy on various modalities and diseases and application of various imaging modalities like CT, MRI, and Isotope studies, PET, SPECT etc

Neck spaces anatomy in relevance to spread of various diseases across different spaces and compartments.

Diseases involving larynx - congenital, infectious, inflammatory and neoplastic

Malignant & benign neoplastic diseases of head and neck region

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

Dental radiology, anatomy of teeth and supporting structures ,Developmental anomalies, eruption of teeth, dental carries, pulpuitis and periapical infection, periodontal disease, fracture of teeth and alveolar bone, resorption of teeth, Neck anatomy on various modalities and diseases.

ReticuloendothelialDisorders

Lymphoma-pathology and imaging, spleen- Imaging, interventional techniques

Imaging in oncology-General methods in oncological diagnosis, staging and follow-up, ovarian tumours, nonseminomatous germ cell tumour, colorectal cancers, lung cancer and others

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 and treatment

Myeloproliferative disorders: red blood 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 bleedingdisorders

Angiography –intervention and other techniques

Embolization, Percutaneous Trans luminal angioplasty, regional arteriography, head and neck, thorax, abdomen, upper and lower extremity angiography, angiography for endocrinalglands.

Venography

Technique and complications ,regional venography of head and neck, thorax and abdomen-SVC venography, IVC venography, Azygos and ascending lumbar venography, Mesenteric and portalvenography, 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 and endovascular ultrasound

Interventional radiology:

Informed consent, biopsy procedures

Percutaneous decompression, extraction and drainage

Image guided therapy

Interventional vascular techniques and contrast reactions

Percutaneous techniques for vascular extractions impact on medicine and radiology

Emergency Management of acute contrast and other drugs hypersensitivity

The Breast:

Understand anatomy and physiology of breast, changes with ageand patterns of disease spread and principles of differentiation between normal breast, benign and malignant disease

Physics of image production and how it affects image quality with respect to mammography, ultrasound & breast MRI with indications for and determining optimal imaging examination

Clinical presentation, pathogenesis and basic principles of treatment of breast disease

Role of conventional and digital mammography in screening of breast cancer, benign and malignant lesions of the breast

Interpretation of mammograms

Understand basic principles underlying population screening and assessment of screen detected abnormalities

Breast ultrasound - discriminate cystic v solid mass; recognize typical features of benign and malignant masses; identify and discriminate between normal and abnormal axillary lymphnodes.

Image guided cyst aspiration, abscess drainage, fine needle aspiration and core biopsy under supervision, Vacuum assisted biopsy (VAB), stereotactic FNAC and biopsy, ductography.

BIRADS and New BIRADS system for lesion characterization and quality assurance MRI breast with emphasis on use of volume MR with newer sequences in breast imaging like DWI &PWI

Breast tomosynthesis

Role of breast cancer screening and guidelines
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

A Note on Normal Variants : Understanding and recognizing normal variants is a crucial part of being a radiologist, so as to avoid potentially damaging confusion with serious pathology. This is to be distinguished from congenital anomalies, although sometimes the distinction between these categories is somewhat blurred. In general however, normal variants are not the cause of significant disease but may mimic significant abnormalities such as fractures, tumours, dysplasias etc. As a result it is important for trainees to become very familiar with these variants early in their training.

Normal Variants		
1. Gastrointestinal System		
• Colonic interposition (Chilaiditi Syndrome) • Mobile caecum • Duodenal diverticulum • Primary colonic pneumatosis • Cathartic colon	• Phrenic ampulla • Intramural pseudodiverticulosis • Functional megacolon and ogilvie syndrome • Gastric diverticulum	• "Feline" oesophagus • Brunner gland hyperplasia • Ectopic pancreatic rest • Prominent lymphoid follicles
2. Hepatopancreatobiliary System		
• Reidel's lobe • Focal fatty infiltration •	• Milk of calcium bile • Agenesis of dorsal	• Congenital absence of hepatic segments • Variant

Replaced right hepatic artery • Variant left hepatic supply	pancreas • Annular pancreas • Pancreas divisum • Biliary hamartoma	hepatic venous drainage
3. Renal and Urinary Tract		
• Junctional zone • Dromedullary hump • Column of bertin • Persistent fetal lobulation • Renal ectopia • Horseshoe kidney • Ureteral duplication • Urachal remnant • Bladder diverticulum	• Accessory renal arteries • Retroaortic renal vein • Parapelvic cysts • Retrocaval ureter • Congenital megacalices • Ureteritis cystica	
4. Male Reproductive System		
• Ectasia of rete testis • Epidermoid cyst of testis		• Scrotal pearl • Congenital prostatic cyst
5. Spleen / Haematological / Bone Marrow		
• Spenuculi	Splenosis	• Wandering spleen
6. Retroperitoneum		
• Duplicated IVC	• Pelvic lipomatosis	
Chest Imaging – Normal Adult Variants		
• Technical limitations-Physics and Position (Inspiration, Rotation….) • Azygos lobe fissure • Cardiophrenic fat pads • Aberrant right subclavian artery • Eventration-partial / total • Pectus excavatum • Pectus carinatum • Rhomboid fossa • Normal thymus •	• Asymptomatic variations of aortic arch branching, including: • Right arch with aberrant left subclavian artery • Aortic diverticulum of Kommerell • Aortic nipple / left superior intercostal vein	• Superior accessory fissure • Inferior accessory fissure • Inferior pulmonary ligament • Tracheal cartilage calcification • Variations of segmental and subsegmental branches of bronchopulmonary tree • Absence of the left pericardium • Common

Tracheal buckling • Bifid rib • Cervical rib		origin of brachiocephalic and left common carotid arteries (“bovine arch”) • Separate origin of vertebral artery from arch • Congenital variations of coronary anatomy, including: • Independent ositum of MRC and conus branch • Circumflex from RCA • Circumflex from RC Sinus • LCA from RC Sinus • Poland’s syndrome
Neuro/ENT Imaging – Normal Variants		
1. Brain		
• Large Virchow-Robin spaces • Asymmetry of hemispheres and ventricles • Persistent cavum septum pellucidum • Cavum vergae • Basal ganglia calcification	• Normal appearance of brain at different ages in adulthood • Vermian pseudotumour • Calcarine pseudotumour • Choroid plexus pseudotumour • “Low hanging” cerebellar tonsils • Mega-cisterna magna • Dentate nucleus calcification • Empty sella	• Normal appearance of brain in paediatrics
2. Skull		
• Frontal hyperostosis	• Normal vault thinning • Parietal foramina • Arachnoid granulations • Large external occipital protruberance • Arachnoid granulations • Pseudofractures ¡	

	Accessory sutures ¡ Superficial temporal artery ¡ Occipitomastoid suture ¡ Spheno-occipital synchondrosis	
3. ENT		
• Neck and pharynx ¡ Asymmetry of internal jugular veins ¡ Persistent adenoids • Paranasal sinuses ¡ Low cribriform plate ¡ Dehiscent lamina papyracea ¡ Onodi cell ¡ Carotid dehiscence into sphenoid sinus • Temporal bone ¡ Dehiscent internal carotid artery ¡ Dehiscent internal jugular vein	• Neck and pharynx: ¡ Pyramidal lobe of thyroid ¡ Median thyroid vein ¡ Temporal bone: ¡ High jugular bulb ¡ Variation in mastoid development • Aberrant retropharyngeal course of carotid artery • Paranasal sinus developmental and pneumotisation variants and drainage patterns	• Calcified stylohyoid ligament
4. VASCULAR		
• Circle of Willis normal variants • Vertebral artery asymmetry & dominance • Common carotid artery origin variations • Asymmetric internal jugular veins • Jugular bulb variations	• Azygos anterior cerebral artery	• Duplicated cerebral arteries • Persistent fetal cerebral arteries ¡ Hypoglossal ¡ Trigeminal
Musculoskeletal Imaging - Normal Variants		
1. Extraneous to Musculoskeletal System		
• Superimposed hair braid • Superimposed soft tissue		
2. Technique / Artifact		
• Mach effect •		

Projectional variants (e.g. lucency greater tuberosity humerus, tuberosity radius simulating bone lesion, epiphysis proximal humerus simulating fracture)		
3. In relation to Musculoskeletal System		
• Accessory Ossicles that may simulate fracture • Sutural variants that may simulate fracture • Vascular channels • Nutrient foramina • Bone island • Anomalies of segmentation • Transitional spine • Variants of epiphyseal fusion • Variants of ossification (bone, epiphysis, apophysis, ossicles, sutures, synchondroses, ligaments) • Vacuum phenomenon • Growth arrest lines • Fusion of carpal / other bones • Variants in bone marrow fat content • Potentially symptomatic / painful normal variants (awareness required for patient care) • Awareness that some previous	• Hyperostosis frontalis interna • Variants of pneumatisation of paranasal sinuses • Intracranial calcifications • Pseudosubluxation of C2/3 • Accessory ribs • Variations in pedicle size • Notochordal remnants • Scoliosis of sacrum • Fibrous cortical defect • Coccygeal angulation • Physeal scar • Metaphyseal density • Bipartite patella / other bones • Especially with MRI, awareness of normal red and white marrow pattern in growth and ageing • Variants of glenoid labrum (e.g. Buford complex) • Variants of acetabular labrum • Eg. fusion: Tarsal coalition • Eg. Ossicles /	

"normal variants" have been further investigated and are pathologic eg. many "os acetabulum" are infact stress fractures related to FAI.	ossification centres: Os tibial externum	
Spinal Variants		
• Limbus vertebra • Conjoined nerve roots • Bone island • Lumbar segmentation & numbering anomalies	• Craniovertebral junction variants	• Filum terminale fibrolipoma • Ventriculus terminalis
Ankle & Foot Variants		
	• Tarsal coalition • Ossicles around the ankle & foot • Accessory muscles of the hindfoot • Low soleal musculotendinous junction • Accessory soleus	
Breast Imaging - Normal Variants		
• Extraneous to breast • Cassette artefacts • Deodorant artefact • Normal lymph nodes & lymphatic drainage • Skin lesions • Sternalis • Normal breast • Normal asymmetry • Accessory glandular tissue • Variation in appearance over time / hormonal state	• Accessory nipples • Variations of lymphatic drainage ¡ Sentinel node(s) ¡ Axillary ¡ Internal mammary ¡ Infraclavicular ¡ Contralateral	• Poland's syndrome

• Normal chest wall		
Obstetrics & Gynaecological Imaging – Normal Variants		
1. Gynaecology		
• Variations of uterine version • Physiological ovarian follicle • Arcuate uterus		
2. Obstetrics		
• Braxton-Hicks contraction • Placental lakes • Debris/vernix in amniotic fluid • Normal gut herniation before 12 weeks • Transient rotated foot position • Dolichocephaly • Corpus luteum with increased circumferential vascularity in first trimester (vs ectopic) • Succenturiate lobe	• Physiological pericardial fluid • Brachycephaly • Decreased end diastolic velocity in umbilical artery due to fetal respiration or movement • Placental shelf	• Circumvallate placenta
Vascular and Interventional Imaging – Normal Variants		
1. General and peripheral vascular		
	• Carotid tonsillar loops • Popliteal entrapments	• Persistent sciatic artery
2. Thoracic vascular		
• Aortic arch variants • Co arctation	• Double SVC • Thoracic outlet syndrome	• Left SVC • Azygous continuation IVC
3. Abdominal vascular		
• Double IVC • Accessory renal arteries	• Left IVC • Coeliac / mesenteric arterial variants	• Hepatic arterial variants • Renal vein variants
4. Urointervention		

• Horseshoe kidney • Pelvic kidney • Exrarenal pelvis • Parapelvic cysts	• Ureteric variants	• Urachal variants
5. Gastrointestinal and hepatobiliary		
• Chyladites	• Billiary tree variants	

Condition Categories – Definition Condition Categories are defined as follows:

Category 1 1.1) Common Conditions Those that would be encountered in a differential diagnosis several times a year in a clinical practice. Ignorance of these conditions would seriously affect the radiologist's status as a peer or useful member of a multidisciplinary team. 1.2) Conditions in which the radiology has a major impact on patient management These are conditions that either could be potentially fatal, or could have major clinical consequences if not diagnosed in timely fashion. They may not be as common as Category 1.2 conditions. 1.3) Less common conditions in which the radiological appearance has an important role in diagnosis These include rarer conditions with specific or characteristic appearances where the patient & clinician would be significantly assisted by their inclusion in a report. The vast majority of truly rare conditions are not included in this category, but a few rare pathologies (e.g., Osteogenic sarcoma) are included because of their clinical importance and characteristic imaging findings.

Category 2 Conditions which are clinically relevant but of lesser importance due to: • Less urgency in their diagnosis • Less frequency in their occurrence. The passing candidate should able to be to suggest the correct disease type and /or diagnosis, however a lesser level of knowledge is still acceptable. Findings should NOT be diagnosed incorrectly as other unrelated conditions.

Category 3 Conditions which are rare, but which should be known to prevent a more serious diagnosis being considered e.g. mesoblastic nephroma is the most common renal mass in a neonate (rather than Wilm's tumour). For most Category 3 conditions the candidate need to know a few facts. Conditions given in Category 3 should have clinical relevance in a practical setting, and it is fully accepted that many rare conditions will not be included.

Pathology :

Abdominal Imaging – Adult Clinical Conditions

1. Gastrointestinal System		
Oesophagus		
• Carcinoma • Trauma (tear and rupture) • Reflux esophagitis and hiatus hernia	• Pharyngeal pouch • Oesophageal web • Oesophageal varices • Cricopharyngeal spasm • Motility disorders • Achalasia • Other esophagitis (infective, corrosive, radiation and autoimmune) • Diverticula • Schatzki ring	• Leiomyoma • Spontaneous intramural haemorrhage • Scleroderma • Duplication cyst
Stomach		
• Carcinoma • Peptic ulcer • Lymphoma • Gastritis, acute and chronic • Hyperplastic and inflammatory polyps	• Acute gastric dilation • GIST tumours • Post surgical appearances and complications • Gastric volvulus colon Organoaxial colon Mesenteroaxial • Gastric outlet obstruction	• Gastric diverticulum • Leiomyoma / leiomyosarcoma • Menetrier's disease • Corrosive injury
Small Bowel		
• Crohn's disease • Small bowel obstruction • Ischaemia • Intussusception • Small bowel trauma • Haemorrhage	• Coeliac disease • Metastatic disease • Lymphoma • Primary small bowel tumour (adenocarcinoma and / or carcinoid) • Post surgical appearances and complications • Meckel's diverticulum • Gallstone ileus • Radiation enteritis • TB	• Small bowel infections / infestations • Whipple's disease / Amyloid and mastocytosis • Polyps & polyposis syndromes • Eosinophilic gastroenteritis • Yersinia • GIST

		tumours • Jejunal diverticulosis
Large Bowel		
• Carcinoma • Diverticular disease • Appendicitis • Inflammatory bowel disease • Obstruction and pseudoobstruction • Ischaemic colitis • Volvulus • Toxic megacolon • Haemorrhage	• Polyps • Angiodysplasia • Infective Colitis • Carcinoid tumour • Perianal sepsis • Pseudo-obstruction • Post surgical appearances and complications • Epiploic appendagitis • Mesenteric panniculiti	• Radiation Colitis • Metastases • Lymphoma • Pneumatosis intestinalis
Peritoneum / mesentery / abdominal wall		
• Ascites • Hernias • Peritonitis • Metastases • Pneumoperitoneum	• Rectus sheath haematoma • Pseudomyxoma peritonei • TB peritonitis	• Mesenteric cyst • Desmoid tumour • Mesothelioma, other tumours • Sclerosing peritonitis
2. Hepatopancreatobiliary system		
Diffuse Liver Disease		
• Fatty infiltration and fatty sparing • Cirrhosis • Portal hypertension	• Acute & chronic hepatitis • Sclerosing cholangitis	• Primary biliary cirrhosis • Wilson disease • Haemochromatosis • a1 anti-trypsin deficiency • Glycogen storage disorder • Post transplant appearances and complications • Caroli's disease
Focal Liver Disease		
• Cyst • Cavernous haemangioma • Metastatic	• Hydatid disease • Cholangiocarcinoma •	• Biliary hamartomas • Biliary cystadenoma

disease • Hepatocellular carcinoma • Focal nodular hyperplasia • Hepatocellular adenoma	Abscess	
Trauma / Vascular		
• Trauma • Portal vein thrombosis	• Budd-Chiari syndrome	• Liver infarction • Peliosis hepatis • Veno-occlusive disease
Biliary		
• Cholelithiasis • Acute Cholecystitis • Obstruction	• Adenomyosis • Gallbladder polyps • Gallbladder carcinoma • Cholangiocarcinoma • Cholangitis • Chronic cholecystitis / Porcelain gallbladder	• Biliary infestation (including oriental cholangiohepatitis) • Choledochal cyst
Pancreas		
• Acute pancreatitis • Pancreatic carcinoma • Trauma	• Chronic pancreatitis • Pseudocyst • Ampullary tumour • Islet tumours • Intraductal neoplasia • Cystic pancreatic tumours	• Annular pancreas • Ectopic pancreas • Pancreas divisum
3. Renal and urinary tract		
Renal Congenital / Developmental		
• Congenital / Developmental:- • Horseshoe / Pancake / duplex kidney • Crossed fused ectopia • Vesicoureteric reflux	• Medullary sponge kidney • Adult polycystic kidney disease	• Calyceal diverticulum
Renal Neoplasia		
• Renal cell carcinoma • Transitional cell carcinoma • Angiomyolipoma	• Oncocytoma	• Multilocular cystic nephroma

Renal Inflammation / Infection		
• Renal abscess / carbuncle • Acute pyelonephritis	• Tuberculosis	• Schistosomiasis • Xanthogranulomatous pyleonephritis
Renal Vascular Conditions		
• Renal infarction • Renal artery stenosis • Fibromuscular dysplasia • Renal vein thrombosis • Renal artery aneurysm	• Renal AV fistula	• Polyarteritis nodosa
Miscellaneous Renal Conditions		
• Obstruction (including PUJ) • Renal trauma • Renal calculi • Simple renal cysts • Contrast media nephrotoxicity	• Acute tubular necrosis • Papillary necrosis • Analgesic nephropathy • Renal atrophy • Renal transplant complications • Nephrocalcinosis • Glomerulonephritis (acute and chronic but not specific subtypes excepting Goodpastures) • Acute and chronic renal failure	• Acute cortical necrosis • Acquired cystic disease of the kidney • Amyloidosis • Diabetic nephropathy • Sickle cell nephropathy • Gouty nephropathy • SLE
Bladder, prostate, ureters and urethra		
• Cystitis (acute and chronic) • Transitional cell carcinoma • Trauma • Urethral strictures • Ureterocoele	• Neurogenic bladder • Diverticula	• Other tumours • Ureteropyelitis cystica • Schistosomiasis • Tuberculosis • Malacoplakia • Urachal remnants
Adrenals		
• Adrenal metastasis • Adrenal adenoma (functioning and non	• Cushings syndrome • Multiple endocrine	• Addison’s disease and syndrome •

functioning) • Phaeochromocytoma • Adrenal carcinoma	neoplasia • Paragangliomas • Spontaneous adrenal haemorrhage	Adrenal hyperplasia • Myelolipoma
4. Male reproductive system		
• Benign prostatic hyperplasia • Prostatic carcinoma • Epididymo-orchitis • Testicular torsion • Testicular tumours including lymphoma / leukemia • Urethral trauma	• Epididymal cysts • Spermatocoele • Varicocele • Spermatic granuloma • Testicular microlithiasis • Testicular trauma	• Testicular cysts • Prostatitis (acute and chronic) • Other epididimal / paraepididymal abnormalities: TB / adenomatoid tumor
5. Splenunculi / Haematological / Bone Marrow		
• Lymphoma • Trauma • Spontaneous and delayed rupture • Infarction • Metastases • Abscess	• Myeloma / plasmacytoma • Myeloproliferative / myelodysplastic disorders • Leukemia • Haemoglobinopathies (e.g. thalassemia) • Splenic cyst • Haemangioma • Langerhans cell histiocytosis • ITP • DIC • Splenic Infection (e.g. mononucleosis) • Immunosuppression & Opportunistic infection	• Sickle cell anaemia • Spherocytosis • Thorotrast
6. Retroperitoneum		
• Lymphoma • Lymph node enlargement, metastases • Sarcoma • Aortic aneurysm	• Retroperitoneal fibrosis	• Inflammatory aortitis

Chest Imaging – Adult Clinical Conditions		
1. Air Space/Ground-glass		
• Diffuse alveolar damage / ARDS • Diffuse alveolar haemorrhage • Aspiration pneumonia • Atelectasis & patterns of collapse • Adenocarcinoma in lepidic originPulmonary oedema (cardiogenic and other) • Pneumonia (viral, bacterial & fungal) & complications (e.g. abscess) • Mycobacterial infection • AIDS & other forms of Immunocompromised host infection	• Eosinophilic lung disease • Pulmonary alveolar proteinosis • Toxic inhalation • Pulmonary sequestration • Cryptogenic organizing pneumonitis • Acute hypersensitivity pneumonitis • Adenocarcinoma in-situ/minimally invasive adenocarcinoma	• Alveolar microlithiasis • Amyloidosis • Lymphoma • Hydatid disease
2. Airways		
• Bronchiectasis • Cystic Fibrosis • Chronic Obstructive Airways Disease • Allergic bronchopulmonary aspergillosis	• Tracheal Stenosis • Bronchiolar Disease • Tracheobronchomalacia	• Tracheobronchomegaly • Kartageners syndrome • Tracheopathia osteoplastica • Relapsing polychondritis
3. Interstitial		
• Sarcoidosis • Asbestosis • Lymphangitis carcinomatosa • Pulmonary fibrosis • Connective tissue disorders (lung manifestations) • Smoking related interstitial lung diseases	• Diffuse interstitial pneumonias • Langerhan's Cell Histiocytosis • Hypersensitivity pneumonitis • Drug	

	reactions • Pneumoconiosis, coal, silica • Lymphangiomyomatosis	
4. Mediastinum		
• Lymphoma • Superior Vena Cava Obstruction • Pneumomediastinum • Diaphragmatic hernias • Goitre • Metastatic lymph node involvement • Oesophageal cancer & other diseases	• Thymoma • Ectopic parathyroid • Ectopic thyroid • Germ cell tumours • Bronchogenic cyst • Extramedullary haematopoiesis • Nerve sheath tumours	• Sympathetic ganglion tumours • Fibrosing mediastinitis • Neurenteric cyst
5. Carcinoma & Nodules		
• Bronchogenic carcinoma and staging • Lung (tumour) Biopsy and complications • Solitary pulmonary nodule: ¡ causes and management (solid vs ground-glass nodule) • Metastasis (lung) • Radiation changes	• Wegener's Granulomatosis • Pulmonary hamartoma • Pulmonary carcinoid • Rheumatoid nodule	
6. Pleura		
• Pleural effusion • Asbestos related pleural disease • Malignant mesothelioma • Pneumothorax • Haemothorax • Pleural metastasis • Pleural thickening • Empyema	Actinomycosis	• Fibrous tumour of pleura
7. Hyperinflation & Cysts		
• Emphysema	• Alpha 1 antitrypsin deficiency • Lymphangioleiomyomatosis • Langerhans cell histiocytosis •	

	Neurofibromatosis • Tuberous sclerosis	
8. Heart & Pericardium		
• Cardiac size & contour • Pericardial effusion / haemopericardium / pneumopericardium • Valvular heart disease • Pericardial calcifications • Valvular heart disease • Left to right shunt (septal defects and patent ductus arteriosus)	• Cardiac mass • Pacemaker & defibrillator placement and artificial valves • Coronary artery atheromatous disease • Cardiac aneurysm • Cardiomyopathy	• Pericardial tumours, • Coronary AV fistula • Right ventricular dysplasia • Takotsubo cardiomyopathy • Valsalva sinus aneurysm
9. Vessels		
• Pulmonary embolism & venous thromboembolism • Embolism (septic, air, fat & other) • Aneurysm • Dissection • Cor pulmonale • Atheromatous disease, including coronary arteries	• Pulmonary arterial hypertension • AV malformation / angioma • Congenital variants of arteries and veins in chest, including transposition of arteries, anomalous venous drainage • Marfan's / Ehlers-Danlos • Coarctation / pseudocoarctation • Anomalous origin of coronary arteries • Management of acute hemoptysis	• Marfan's / Ehlers-Danlos • Scimitar syndrome • Pulmonary varix
10. Chest Wall		
• Pectus and Kyphoscoliosis • Rib lesions • Rib notching • Rib expansion • Multiple myeloma	• Haematopoietic disease (e.g. Sickle cell disease, Thalassaemia)	• Poland's Syndrome
11. Trauma & ICU		

• Diaphragmatic rupture • Chest wall trauma • Tracheobronchial rupture • Rib/sterna/clavicular/thoracic spine fractures & Complications • Median sternotomy • Endotracheal, intercostal tube, chest drainage tube and catheter assessment • Thoracotomy and complications • Pacemaker wire position • Central line malpositioning • Oesophageal rupture/Boerhaave's syndrome • Inhaled and swallowed foreign bodies		
Extracranial Head & Neck Imaging – Clinical Conditions		
Nose and sinuses; facial bones		
Congenital / Developmental		
	• Frontoethmoidal / anterior skull base encephalocoele	• Choanal atresia • Anterior neuropore abnormalities
Trauma / Fractures		
• Zygomaticomaxillary fractures ¡ Isolated fracture of the zygoma and zygomatic arch ¡ Tripod fracture • Maxillary fractures ¡ Isolated antral fractures ¡ Alveolar ridge fractures • Mid-face fractures ¡ LeFort types I To III ¡ Bilateral mid-face fractures	• Nasal fractures ¡ Nasal bone fractures ¡ Fractures of the nasal septum ¡ Fractures of the nasal spine ¡ Nasoorbitalethmoidal fractures	
Inflammatory / Infection		
• RhinoSinusitis, acute •	• Sinonasal polyposis •	• Invasive fungal

RhinoSinusitis, chronic • Planning CT for functional endoscopic sinus surgery	Fungal sinusitis • Mucocoele • Wegener's granulomatosis	infection
Benign Tumours & Tumour-like Conditions		
• Sinus osteoma • Fibrous dysplasia	• Juvenile angiofibroma • Inverting papilloma	• Mandibular and Maxillary Tori • Ossifying Fibroma • Stafne Cyst
Malignant Tumours		
• Metastases	• Adenocarcinoma • Squamous cell carcinoma • Lymphoma • Chrondo-Sarcoma • Osteo-Sarcoma • Rhabdomyosarcoma	• Melanoma • Esthesioneuroblastoma
3. Orbit		
Congenital / Developmental		
• Dermoid, epidermoid • High myopia changes in globe	• Vascular malformation (Cavernous haemangioma) • Neurofibromatosis type 1	• Coloboma • Lymphangioma
Trauma / Fractures		
• Orbital fractures ¡ Orbital rim fractures ¡ Blow-out fractures ¡ Blow-in fractures ¡ Orbital emphysema • Foreign body	• Ocular Injuries ¡ Ruptured globe ¡ Dislocated lens ¡ Retinal detachment ¡ Phthisis bulbi	
Inflammatory / Infection		
• Idiopathic orbital inflammatory disease (pseudotumour) • Subperiosteal abscess • Orbital cellulitis	• Optic neuritis • Phthisis bulbi	• Dacroadenitis • Sjogren Syndrome
Benign Tumours & Tumour-like Conditions		
• Capillary haemangioma • Optic	• Benign mixed lacrimal	

nerve sheath meningioma	tumour	
Malignant Tumours		
• Retinoblastoma • Ocular melanoma • Optic pathway glioma	• Lymphoma • Rhabdomyosarcoma	• Lacrimal gland malignantcies
Other Conditions		
• Thyroid orbitopathy (Graves)	• Venous varix of orbit (primary and secondary) • Carotid-cavernous fistula	
4. Temporal Bone and Cerebellopontine angle; Skull base		
External auditory canal		
	• Atresia • Exostoses	• Necrotising external otitis • EAC cholesteatoma • Keratosis obturans • Squamous cell carcinoma
Middle ear, mastoid		
• Acute mastoiditis + abscess • Aberrant internal carotid artery • Cholesteatoma, acquired	• Dehiscent jugular bulb • Cholesteatoma, congenital • Chronic mastoiditis • Glomus tympanicum paraganglioma	• Cholesterol granuloma • Rhabdomyosarcoma • Post-operative ear
Inner ear; petrous apex		
• Apical petrositis	• Labyrinthitis ossificans • Cochlear implants • Otosclerosis • Cholesterol granuloma petrous apex • Large endolympatic sac (LEDS) • Otosclerosis • Petrous apex pseudolesion	• Congenital labyrinthine abnormalities • Cochlear dysplasia • Chondrosarcoma petrous apex • Labyrinthitis ossificans

Cerebellopontine angle and internal auditory canal		
• Acoustic schwannoma • Meningioma • Viral labyrinthitis	• Epidermoid cyst • Arachnoid cyst • Neurofibromatosis 2	• Aneurysm • Metastases • Ramsay-Hunt syndrome • Superficial siderosis
General temporal bone lesions		
• Temporal bone fractures • CSF leak	• Fibrous dysplasia • Paget's disease	
Skull base		
• Glomus jugulare paraganglioma • Dural sinus thrombosis	• Chordoma of clivus • Skull base meningioma • Metastasis	• Jugular foramen schwannoma • Chondroid series tumour • Post radiation treatment appearances and complications
5. Larynx, hypopharynx, trachea		
• SCC hypopharynx • SCC larynx • Epiglottitis • Tracheal and Laryngeal infection/ inflammation • Inhaled foreign bodies	• Vocal cord paresis • Laryngeal trauma	• Laryngocele • Chondroid lesions
6. Oral cavity, Pharyngeal mucosal Space		
Congenital		
• Thornwaldt's cyst		• Lingual thyroid • Dermoid of floor of mouth
Inflammatory / Infective		
• Tonsillar abscess • Ludwig's angina: infection extending into sublingual and submandibular spaces	• Simple ranula • Plunging ranula • Sialocoele • Retention cyst of pharynx	
Benign Tumours		
	• Benign mixed tumour of	

	submandibular gland	
Malignant Tumours		
• SCC of oral cavity • SCC of oropharynx / tonsil • SCC of nasopharynx / NPC • Lymphoma		• Adenoid cystic carcinoma, minor salivary glands
Miscellaneous		
• Zenker's diverticulum		
7. Submandibular Space		
Congenital / Developmental		
	• Dermoid/Epidermoid cyst • Lymphatic malformation	
Infection / Inflammatory		
• Obstruction / calculus • Acute infection • Chronic infection		
Benign Tumours		
• Pleomorphic adenoma • Reactive lymphadenopathy		
Malignant Tumours		
• Salivary gland origin • Metastatic lymphadenopathy • Lymphoma		
8. Parotid Space		
Congenital / Developmental		
		• 1st branchial cleft cyst, sinus or fistula
Infection / Inflammatory		
	• Acute parotitis • Sjogren's syndrome • Lymphoepithelial cysts of HIV	
Benign Tumours		
• Benign mixed tumour	• Warthin's tumour	• Haemangioma

(pleomorphic adenoma)		(children)
Malignant Tumours		
• Mucoepidermoid carcinoma • Lymphoma	• Intraparotid node metastases	• Adenoid cystic carcinoma
Miscellaneous		
• Perineural spread via CN 5	• Benign masticator muscle hypertrophy	• Denervation atrophy of trigeminal nerve territories
9. Carotid Space		
Congenital / Developmental		
Infective / Inflammatory		
• Lymphadenopathy • Node abscess		• Caseating necrosis due to granulomatosis infection
Vascular Lesions		
• Internal jugular vein thrombosis • Carotid arterial dissection • Carotid artery pseudoaneurysm		
Benign Tumours		
• Paraganglioma (e.g. carotid body tumour and glomus vagale) • Reactive lymphadenopathy	• Nerve Sheath Tumours	• Castleman's disease
Malignant Tumours		
• Metastatic lymphadenopathy • Lymphoma		
10. Masticator Space		
Infective / Inflammatory		
• Masticator space abscess / cellulitis		
Malignant Tumours		

• Spread of SCC • Perineural spread via trigeminal nerve • Sarcoma • Lymphoma		
Miscellaneous		
• Benign masseteric hypertrophy		• Schwannoma of trigeminal nerve
11. Retropharyngeal Space (RPS) and Prevertebral Spaces		
Infective / Inflammatory		
• Suppurative adenopathy or RPS abscess • Prevertebral space infection		• Longus colli tendonitis (calcific HADD)
Malignant Tumours		
• Nodal metastases in RPS	• Lymphoma in RPS nodes	
Degenerative		
• Osteophytes and calcification in the anterior longitudinal ligament		
12. Visceral Space Organs		
Thyroid		
• Multinodular goitre • Grave's Disease • Thyroid adenoma • Papillary carcinoma • Assessment of solitary nodule (e.g. colloid nodule, follicular lesion) • Sonographic Assessment of thyroid nodules	• Hashimoto's Thyroiditis	• Follicular carcinoma • Anaplastic carcinoma
Parathyroids		
• Imaging in hyperparathyroidism		• Developmental cysts – parathyroid or thymic origin
13. Neck – general		
Congenital lesions		

• 2nd branchial cleft cyst • Thyroglossal duct cyst	• Slow Flow Malformations: Venous, Lymphatic, Mixed VenousLymphatic • High Flow Vascular malformations: AVM or AVF • Infantile Hemangiomas (true neoplasms)	• Dermoid cyst • Thyroglossal duct fistula • 1st, 3rd and 4th Branchial Anomalies
Lymph nodes of the neck		
• Knowledge of common patterns of lymph node and lymphatic spread • Lymph node groups in the Head and Neck, their nomenclature and definition • Metastases in neck nodes (especially SCC and papillary thyroid Ca) • Lymphoma	• Reactive lymphadenopathy • Suppurative lympadenitis	• Castleman's disease
14. Maxillofacial / Dental		
Basic Dental Disease		
• Caries • Periodontal disease • Periapical sepsis	• Impacted teeth • Know common dental nomenclature for teeth	• In maxilla, associated with antral disease
Odontogenic Lesions		
• Periapical granuloma • Periapical cyst • Periapical abscess	• Dentigerous cyst	• Common / important odontogenic cysts and tumours • Ameloblastoma • Odontogenic Keratocyst (OKC)
Trauma		
• Mandibular fractures ¡ Body	• TMJ dysfunction • TMJ	

and angle ¡ Symphyseal and parasymphyseal ¡ Condylar ¡ Ramus and coronoid process	dislocation	
Neuro Imaging - Adult Clinical Conditions		
1. Brain and intracranial structures		
Congenital malformations (see Paeds Syllabus)		
• Chiari malformations 1 & 2 • Agenesis of corpus callosum	• Dandy Walker spectrum • Holoprosencephaly • Heterotopic grey matter • Lissencephaly • Schizencephaly • Pachygyria-polymicrogyria	• Septo-optic dysplasia • Hemimegalencephaly • Microcephaly • Chiari malformation 3
Infection		
• Meningitis • Cerebral abscess • Empyema • Herpes encephalitis • HIV / AIDS and the CNS • Ventriculitis	• Neurocysticercosis • Tuberculosis • Fungal infections	• Rickettsial infections • Lyme disease
Tumours		
• Intra-axial metastases • Leptomeningeal metastases • Meningioma • Astrocytoma • Glioblastoma multiforme • Brainstem glioma • Teratoma • Primary CNS lymphoma	• Other brain tumours • Ependymoma • Choroid plexus papilloma • Choroid plexus carcinoma • Medulloblastoma • Haemangioblastoma • Germinoma • DNET • Supratentorial PNET • Pilocytic astrocytoma • Oligodendroglioma • Subependymal giant cell astrocytoma • Pleomorphic xanthoastrocytoma • Gliomatosis cerebri •	• Even More Brain Tumours ¡ Central neurocytoma ¡ Ganglioglioma ¡ Gliosarcoma ¡ Pineoblastoma ¡ Pineocytoma ¡ Subependymoma ¡ Astroblastoma ¡ Dysplastic cerebellar gangliocytoma ¡ Desmoplastic infantile ganglioglioma ¡ Atypical teratoid-rhabdoid tumour

	Atypical meningioma • Leukemia	¡ Angiocentric lymphoma ¡ Embryonal carcinoma ¡ Haemangiopericytoma ¡ Malignant meningioma
Non-neoplastic cysts		
• Arachnoid cyst • Colloid cyst	• Dermoid cyst • Epidermoid cyst • Pineal cyst • Choroid plexus cyst • Ependymal cyst • Porencephalic cyst	• Neuroglial cyst
Trauma		
• Extradural haematoma • Subdural haematoma • Traumatic subarachnoid haemorrhage • Cerebral contusion • Diffuse axonal injury • Non-accidental injury • Intracranial herniation syndromes	• Carotico-cavernous fistula • Traumatic subdural CSF hygroma	
Demyelination; dementias		
• Multiple sclerosis • Tumefactive demyelination • Multi-infarct dementia	• Alzheimer's disease • Parkinson's disease • ADEM	• Subacute sclerosing panencephalitis
Vascular lesions		
• Thromboembolic infarction • Carotid and vertebral dissection • Subarachnoid haemorrhage, aneurysmal • Subarachnoid haemorrhage, perimesencephalic (venous) • Aneurysm • Spontaneous intracerebral haemorrhage • Hypotensive infarction • Diffuse hypoxic injury • Venous infarction • Intracranial venous thrombosis	• Fibromuscular hyperplasia of the carotids • Cavernous malformation • Arteriovenous malformation • Pseudoaneurysm • Cerebral amyloid disease • Vasculitis • Cranial dural AV fistula • Vascular loop compression (e.g. trigeminal neuralgia, hemifacial spasm) • Developmental venous anomaly	• Superficial siderosis • CADASIL • Capillary telangiectasia
Toxic, metabolic, or degenerative disorders		
• Acute hypertensive	• Osmotic demyelination	• Effects of drug abuse •

encephalopathy (PRES) • Mesial temporal sclerosis	syndrome • Status epilepticus • Carbon monoxide poisoning • Alcoholic encephalopathy • Hepatic encephalopathyEffects of therapeutic radiation • Effects of chemotherapeutic drugs	Fahr's disease • Idiopathic (benign) intracranial hypertension
Miscellaneous		
• Brain death • Obstructive hydrocephalus – communicating and noncommunicating • Aqueduct stenosis • Complications of CSF shunts	• Normal pressure hydrocephalus • Neurosarcoidosis • Intracranial hypotension	• Hypertrophic pachymeningitis
Pituitary and parasellar region		
• Pituitary microadenoma • Pituitary macroadenoma • Pituitary apoplexy • Craniopharyngioma	• Pituitary stalk anomalies • Rathke's cleft cyst • Lymphocytic hypophysitis • Empty sella	• Hamartoma of tuber cinereum • Pituicytoma
Skull		
• Skull fractures & complications • Haemangioma • Myeloma • Metastases • Fibrous dysplasia • Paget's disease • Frontal hyperostosis		
Spinal cord and related structures; peripheral nerves		
• Ependymoma • Astrocytoma • Meningioma • Epidural haemorrhage • Epidural abscess • Spinal / epidural metastases • Intrathecal metastases • Traumatic cord injury • Spinal cord infarction • Disc prolapse • Neurofibroma • Transverse myelitis • Arachnoiditis	• Syringomyelia • Transverse myelitis • Cord demyelination • Arachnoid cyst • Dorsal / ventral dural defect • Spinal vascular malformations • Spinal dural AV fistula • Meningitis	

• Postoperative epidural fibrosis / scarring		
5. Neurocutaneous syndromes		
• Neurofibromatosis 1 • Neurofibromatosis 2	• Von Hippel Lindau • Tuberous Sclerosis	• Basal cell naevus syndrome • Cowden syndrome
6. Cranial Nerve		
• Optic neuritis • Schwannoma • Vascular compression syndrome (trigeminal neuralgia)	• Vestibular neuritis • Bell palsy • Perineural spread	
Musculoskeletal Imaging – Clinical Conditions		
1. Shoulder and Clavicle		
Bony Trauma		
• Common fractures (Greater tuberosity, Humeral neck, Neck and body of scapula, Acromion) • Clavicular fractures & related complications • Sternoclavicular joint dislocation and subluxation	• Less common fractures (Coracoid process, scapular spine)	
Joint Trauma		
• Loss of alignment and congruity at the GHJ (dislocation and subluxation) • Hill-Sachs defects • Posterior glenoid rim fracture • AC joint subluxation	• Glenoid hypoplasia • Bony Bankart lesion • Reverse Hill-Sachs defect	
Arthritis and Bursitis		
• Osteoarthritis • Rheumatoid arthritis • Septic arthritis, bacterial • Osteomyelitis	• Atypical infective arthritis • Psoriatic arthritis • Osteochondromatosis • Calcium pyrophosphate arthropathy (CPPD)	• Other arthritides (Gout, amyloid) • Other bursitis • Sternoclavicular hyperostosis
Glenohumeral Capsule & Ligament Injuries		
• Bankart injuries	• Adhesive capsulitis, including treatment options •	• TUBS (Traumatic Unilateral with Bankart

	SLAP injuries in general	lesion, usually requiring surgery) • AMBRI (Atraumatic, Multidirectional, Bilateral, Rehabilitation, rarely needs an Inferior capsular shift) • SLAP lesions – types I to IV • GLAD lesion • HAGL lesion • Inferior instability • IGL lesion • Microinstability (superior instability) • Perthes and ALPSA lesions • Labral cysts • Rotator interval injuries and synovitis
Tendon Injuries and Degeneration		
• Calcific tendinopathy (HADD) • Rotator cuff tendinopathy / tears • Long head of biceps tendinopathy / tears • Subscapularis tear / avulsion • Infraspinatus tear / avulsion	• Pectoralis major tears / avulsion • Long head of biceps dislocation	• Long head of biceps instability • Other tendon injuries or avulsions (e.g., coracobrachialis, short head of biceps, etc.)
Miscellaneous Disorders		
•AVN & bone infarcts	• Traumatic osteolysis of the outer clavicle • Suprascapular nerve palsy • Post-op changes & complications in humeral head prosthesis	• Osteochondral lesion OCD • Acromial apophysitis • Scapulothoracic bursitis • Axillary nerve palsy • Quadrilateral space syndrome • Parsonage-Turner Syndrome
2. Elbow and Forearm		
Bony Trauma		

• Common elbow fractures (Epicondylar, lateral condylar, capitellar, radial head & neck, ulnar) • Supracondylar fractures & related complications • Fracture-Dislocations (Monteggia, Galeazzi) • Nightstick fracture • Greenstick fractures	• Less common elbow fractures (Coronoid, olecranon) • Coronoid process fracture • Plastic bowing of the forearm bones	• Stress fracture of olecranon • Essex-Lopesti fracture/subluxation
Joint Injuries & Overuse syndromes		
• Soft tissue signs of intra-articular fracture ¡ Supinator sign ¡ Fat fad displacement	• Loose bodies and os supratrochleare • Synovial osteochondromatosis	• Radiocapitellar overload syndrome • Capitellar OCD • Valgus extension overload
Infection & Inflammation		
• Osteoarthritis • Rheumatoid arthritis • Gout • Septic arthritis • Osteomyelitis • Olecranon bursitis	• Psoriatic arthritis • CPPD	• Bicipital radial bursitis • Other arthritides (Amyloid)
Tendinopathy & Tendon Injuries		
	• Posterior dislocation of elbow • Collateral ligament injuries • Lateral epicondylitis • Medial epicondylitis • Biceps tendinopathy and rupture • Triceps tendinopathy and rupture	• Brachialis injuries • Hyperextension injuries
Neuropathies & Nerve Injuries		
	• Ulnar neuropathy • Median neuropathy	• Radial (posterior interosseus) neuropathy • Anconeus epitrochlearis • Synovial fringe syndrome
3. Hand and Wrist		
Bony Trauma		

• Common carpal fractures ¡ Scaphoid ¡ Triquetral ¡ Scaphoid AVN ¡ Thumb ¡ MCP joint (UCL and RCL) • Fractures at base MC1 • Volar plate injuries • MCP fracture/dislocations • CMC joint injuries, esp. 5th	• Phalangeal fractures • Stress views for thumb MCPJ, & indications • Lunatomalacia • Nonunion & repair of scaphoid fractures • Stress fracture • Hook of hamate • Pisiform • Distal radial growth plate	• AVN/OCD of capitate • Less common carpal fractures • Anterior ridge of the trapezium • Pisiform • Capitate
Joint Injuries, Carpal Instability		
• Scapholunate dissociation • Soft tissue signs of intra-articular fracture ¡ Pronator quadratus fat plane displacement ¡ Scaphoid fat pad displacement	• SLAC & SNAC wrist • DISI & VISI • Lunate & perilunate dislocations • TFCC Injuries • DRUJ instability	
Arthritis & Inflammation		
• Osteoarthritis • Rheumatoid arthritis • Psoriatic arthritis • CPPD • Septic arthritis and osteomyelitis	• Soft tissue abscess • Septic tenosynovitis • Gout • Haemochromatosis • Reflex sympathetic dystrophy	• Ulnar impingement syndrome • Hamato-lunate impingement • Scleroderma • SLE • Acromegaly • Other arthritides (e.g. amyloid)
Tendons		
• Extensor tendinopathies (de Quervain's and ECU) • Flexor tendinopathies	• Tendon injuries ¡ FDP rupture – 3 types ¡ Bowstringing ¡ Extensor tendon injuries ¡ Extensor hood injuries	• Proximal and distal intersection syndrome
Miscellaneous		
• Ganglia	• Carpal boss syndrome • Carpal tunnel syndrome • Guyon's canal syndrome	• Hypothenar hammer syndrome
4. Pelvis, Hip and Thigh		
Bony Trauma		
• Disruption of the pelvic ring • Anterior and posterior column	• Apophyseal avulsions ¡ ASIS, PSIS ¡ Ischial	• Stress reaction and fractures ¡ Apophysitis ¡

injury • Pubic rami fractures • Sacral stress fracture	tuberosity ¡ Lesser trochanter ¡ Tensor fascia lata ¡ Iliac crest	Femoral shaft ¡ Thigh splints ¡ Groin strain – osteitis pubis
Joint / Articular Injuries		
• Dislocations of the hip • Loose hip fragment • Acetabular fractures • Femoral neck fractures ¡ Subcapital ¡ Stress / incomplete ¡ Intertrochanteric including classification ¡ Complications e.g, avascular necrosis (AVN)	• Transient osteoporosis • Regional migratory osteoporosis • Nontraumatic avascular necrosis	
Arthritis and Inflammation		
• Osteoarthritis • Rheumatoid arthritis • Septic arthritis • Sacroilitis	• Synovial chondromatosis • Other hip conditions ¡ Labral tears / cysts ¡ Transient osteoporosis ¡ Idiopathic chondrolysis ¡ AVN of the femoral head ¡ Snapping hip syndromes • Iliopsoas bursitis, infection • Other septic bursitis	• Ankylosing spondylitis • Acromegaly • DISH-related (diffuse idiopathic skeletal hyperostosis) • Ankylosis, joint changes in paraplegia & quadriplegia
Nerve & Muscle Pathology		
• Muscle and tendon tears ¡ Adductor ¡ Quadriceps ¡ Hamstrings ¡ Gluteus • Muscle wasting • Myositis ossificans (Heterotopic ossification) • Cellulitis	• Intramuscular and intermuscular hematoma • Peripheral nerve sheath tumours • Course & injuries to femoral nerve • Necrotising fasciitis • Intramuscular abscess • Diabetic myonecrosis	• Inflammatory myopathies ¡ Polymyositis ¡ Dermatomyositis • Nerve entrapments ¡ Obturator neuropathy ¡ Sciatic nerve entrapment ¡ Meralgia paraesthetica ¡ Pudental nerve entrapment ¡ Groin hernias (“sports hernia”)
Post-Treatment Changes		
• Hip joint prosthesis &	• Arthrodesis of hip • Pelvic	• Femoral rods, nails,

complications • Radiation necrosis	fracture fixation	plates & complications
5. Knee and Leg		
Bony Trauma		
• Fracture healing • Long bone fractures • Growth plate fractures • Patellar fractures • Bone bruising (MR) • Salter-Harris type I fractures • Stress fractures of femur, patella, tibia and fibula • Osteochrondritis dissecans	• Bone scan findings in fractures • Fibular head fracture • Stress fractures of the growth plates • Evaluation of orthopaedic prostheses and fixation • Spontaneous osteonecrosis of the knee (SONK)	• Plastic bowing of the fibula • Transient osteoporosis of the knee
Knee Injuries		
• Common avulsion injuries ¡ ACL, PCL, MCL, LCL • Osteochondral fractures ¡ Tibial condyle ¡ Femoral condyle ¡ Patella ¡ Tibial plateau fracture • Soft tissue abnormalities on plain films ¡ Joint effusion ¡ Lipohaemarthrosis ¡ Chondrocalcinosis ¡ MCL soft tissue swelling ¡ Osteochondral loose bodies • Dislocations & related complications ¡ Internal derangement ¡ Meniscal tears (all types) ¡ Ligament tears ¡ Posterolateral corner injury • Patellar tendinopathy and rupture • Patellar conditions	• Less common avulsions ¡ Segond and reverse Segond fracture ¡ Medial retinacular avulsion from patella ¡ Apophysis of tibial tuberosity ¡ Quadriceps avulsion ¡ Patellar sleeve fractures • Abnormal ossicles around the knee • Less common meniscal conditions ¡ Discoid meniscus ¡ Meniscal cyst ¡ Post-operative meniscal change ¡ Less common tendon pathologies ¡ Popliteus tendon injury ¡ Iliotibial band tendinopathy and rupture ¡ Quadriceps tendinopathy and rupture • Ganglia – periarticular, intraosseous and cruciate ligament	• Uncommon avulsions ¡ Gerdy's tubercle avulsion ¡ Capsular avulsion ¡ Arcuate avulsion ¡ Biceps femoris avulsion • Vertical patellar fractures • Uncommon meniscal findings ¡ Meniscal ossicle ¡ Parameniscal cyst ¡ Meniscocapsular separation • Thickening of ligamentum mucosum • Other patellar conditions ¡ Fong's syndrome ¡ Excessive lateral pressure syndrome (ELPS) ¡ Hoffa's disease ¡ Patellar position & tracking abnormalities ¡ Plica syndrome

Leg Trauma		
• Ruptured popliteal cyst • Gastrocnemius tear (tennis leg) • Other muscle tears	• Proximal tibiofibular joint ¡ Fractures and dislocations	• Proximal tibiofibular joint ¡ Instability due to hypoplastic facets
Arthritis / Synovitis / Bursitis		
• Osteoarthritis • Rheumatoid arthritis • Chondrocalcinosis, including CPPD • Popliteal (Baker) cysts	• Pigmented villonodular synovitis • Synovial osteochondromatosis • Bursal pathology ¡ Prepatellar bursitis ¡ Infrapatellar bursitis ¡ Pes anserine bursitis	• Lipoma arborescens, knee • Reflex sympathetic dystrophy, knee • Haemophillia • Gout
Neurovascular		
	• Proximal tibiofibular joint ganglion causing peroneal nerve entrapment	
6. Ankle and Foot		
Ankle Injuries		
• Common Ankle Fractures ¡ Weber classification ¡ Dupuytrens fracture ¡ Maissoneuve fracture ¡ Posterior lip of distal tibia ¡ Medial malleolus • Commonly missed hindfoot fractures ¡ Talar dome ¡ Tibial plafond ¡ Anterior process of calcaneum ¡ Posterior process of talus ¡ Lateral process of talus ¡ Talar neck • Calcaneal fracture classification & analysis • Subtalar dislocation • Avulsion fractures & ligament injuries ¡ LCL complex ¡ Deltoid ligament ¡ Distal tibiofibular syndesmosis	• Midfoot injuries • Lisfranc fracture-dislocation • Osteochondritis dissecans OCD talar dome • AVN of the talus • Stress Fractures ¡ Distal fibula ¡ Distal tibia ¡ Talar neck and lateral process ¡ Distal tibial growth plate ¡ Other ankle ligament injuries ¡ Anterior talofibular ligament (ATFL)	• Ankle impingement ¡ Anterolateral ¡ Anteromedial • Posterolateral Ankle arthrofibrosis • Classification of talar dome fractures • Lauge-Hansen classification of ankle injuries
Foot & Ankle Tendon Injuries & Tendinopathies		

• Achilles tendinosis & tear	• Haglund syndrome (retrocalcaneal bursitis) • Tibialis posterior tendon injuries & tenosynovitis • Plantar fasciitis • Other heel conditions ¡ Plantar fibromatosis • Painful os tibiale externum • Other tendinopathy & tenosynovitis ¡ FDL ¡ FHL ¡ Peroneal ¡ Tibialis anterior	
Foot Injuries		
• Forefoot fractures & dislocations ¡ Base of fifth metatarsal ¡ Fractures of tarsal bones ¡ Midtarsal fractures & dislocations ¡ Metatarsal fractures (acute & stress) • Fractures & dislocations of toes	• Other Hindfoot conditions ¡ Tarsal coalition ¡ Sinus tarsi syndrome ¡ Tarsal tunnel syndrome ¡ Other tarsal stress fractures ¡ 2nd MT base stress fracture ¡ Special 5th MT fractures ¡ Spiral distal shaft ¡ Jones fracture ¡ Fracture of the tubercle • Other forefoot injuries ¡ Turf toe ¡ Plantar plate rupture ¡ Toe deformities ¡ Sesamoid stress fractures, sesamoiditis ¡ Hallux valgus and metatarsus primus varus ¡ Hallux rigidus ¡ Freiberg's infraction	• Mueller-Weiss syndrome (spontaneous atraumatic osteonecrosis of the tarsal navicular) • Other conditions of the forefoot ¡ Bunionette formation ¡ Painful os intermetatarseum ¡ Morton's neuroma
Arthropathy and Infection		
• Osteoarthritis • Post-traumatic arthritis • Rheumatoid arthritis • Septic arthritis and osteomyelitis	• Midfoot ganglia • Neuropathic (Charcot) foot • Diabetic foot • Reiter's syndrome • Reflex sympathetic dystrophy	• Acromegaly • Hemochromatosi

7. The Spine (For Spinal Cord & Nerves, See Neuro Syllabus)		
Congenital and Developmental Disorders		
• Chiari I malformation • Neurofibromatosis Type 1 • Neurofibromatosis Type 2 • Idiopathic scoliosis • Congenital scoliosis and kyphosis • Schmorl node • Scheuermann Disease • Tethered cord • Diastematomyelia	• Failure of vertebral formation • Partial vertebral duplication • Vertebral segmentation failure • Klippel-Feil spectrum • Congenital spinal stenosis • Neuromuscular scoliosis • Idiopathic kyphosis • Connective tissue disorders • Achondroplasia • Posterior element incomplete fusion • Sacrococcygeal teratoma	• Meningocoeles • Dural dysplasia • Mucopolysaccharidoses • Sickle cell disease • Osteopetrosis • Ochronosis • Caudal Regression Syndrome • Neurenteric cyst • Osteogenesis imperfecta
Spinal Infections and Inflammatory Disorders		
• Discitis (pyogenic, TB) • Epidural abscess • Subdural abscess • Paraspinal abscess • Osteomyelitis	• Granulomatous osteomyelitis • HIV • Spinal meningitis • Septic facet joint arthritis • Pseudoinflammatory: pseudoarthrosis of ankylosing spondylitis	• Echinococcus • Schistosomiasis • Cysticercosis
Spine Post-procedural Imaging		
• Recurrent vertebral disc herniation • Post-operative infection • Peridural fibrosis • Hardware failure	• Pseudomeningocoele • Bone graft complications	
Cervical Spine		
• Routine Non-trauma Views ¡ Neutral lateral ¡ AP from C3 toT1 ¡ AP atlantoaxial region ¡ AP obliques ¡ Acute trauma Views ¡ Cross-table lateral ¡ With clinical neuropathy – CT or MRI ¡ AP views	• Additional non-trauma views ¡ Flexion and extension ¡ Additional trauma views ¡ “Swimmer’s view” ¡ Other Injuries ¡ Rotary atlantoaxial	

after lateral view cleared ¡ Flexion and extension with patient UNAIDED!! ¡ Spinal alignment signs ¡ Prevertebral soft tissue swelling • Hyperflexion injuries ¡ Wedge compression fracture ¡ "Clay shoveler's" fracture ¡ Flexion teardrop fracture ¡ Unilateral or bilateral facet dislocation / fracture dislocation ¡ Acute disc protrusion • Hyperextension injuries ¡ Fracture of the posterior arch of the atlas ¡ Extension sprain injuries ¡ Extension teardrop fracture ¡ Hangman's fractures • Odontoid process fracture • Jefferson fracture	subluxation ¡ Radicular symptoms following cervical spine injury • Neurocentral joint degeneration • Rheumatoid arthritis, esp. atlantoaxial subluxation	
Thoracic Spine		
• Routine views • AP ± weight bearing • Lateral (long exposure) • Acute trauma • Wedge compression fractures • Age of fractures • Burst fractures • Fractures and dislocations	• Additional views • Lateral centred on the thoracolumbar junction • Cross-table lateral if unable to stand • Other injuries • Thoracic disc protrusion	
Lumbar Spine		
• Routine views ¡ AP ¡ Lateral ¡ Coned lumbosacral junction ¡ 30° angled sacroiliac joints ¡ Additional views ¡ Oblique views ¡ Acute trauma ¡ Wedge compression ¡ Burst fracture ¡ Transverse process ¡ Chance injuries ¡ Injury to ring apophysis • Vertebral osteonecrosis • Bone stress and stress fractures of the pars • Sacroiliitis • Discitis & vertebral osteomyelitis	• Bone scan, including SPECT • Stress fractures of the spinous process • Interspinous bursopathy • Other conditions ¡ Limbus vertebra ¡ Schmorl's nodes ¡ Scheuermann's disease ¡ Lumbosacral pseudarthrosis	

Degenerative Spinal Conditions & Arthritides		
• Degenerative disc disease nomenclature • Degenerative disc disease ¡ Bulge ¡ Disc annular tear ¡ Disc herniation, cervical ¡ Foraminal disc extrusion ¡ Degenerative endplate changes • Spondylolisthesis • Instability • Spondylosis • Acquired spinal stenosis • DISH • Facet arthropathy • Rheumatoid arthritis • Epidural lipomatosis	• OPLL • Degenerative scoliosis • Facet joint synovial cyst • Ankylosing spondylitis • GIT-related spondylitides • Septic arthritis sacroiliac joint	• Neurogenic (Charcot) arthropathy • Septic arthritis facet joint • Ossification of ligamentum flavum
8. Bone Dysplasias (also see Paediatric Syllabus)		
• Multiple Hereditary Osteochondromas (diaphyseal aclasis) • Neurofibromatosis	• Ollier disease • Maffucci syndrome • Achondroplasia • Osteogenesis imperfecta • Meleorrhostosis • Osteopoikilosis • Trevors disease	• Mucopolysaccharidoses • Spondyloepiphyseal dysplasias
9. Bone Marrow & Metabolic Diseases		
• Osteoporosis • Osteomalacia • Renal osteodystrophy • Patchy red marrow • Leukemia • Radiation changes	• Hemochromatosis • Hemosiderosis • Myelofibrosis • Extramedullary hemopoiesis • Hyperparathyroidism • Immune suppression states • Treatment-related benign reactive changes	• Osteopenia / osteoporosis related to primary bone tumour • Gaucher's Disease
10. Peripheral Nerve Conditions		
• Muscle denervation • Thoracic Outlet Syndrome • Common nerve entrapments – Median nerve	• Brachial plexus pathology ¡ Trauma ¡ Traumatic neuroma ¡ Radiation plexopathy ¡ Superior sulcus syndrome ¡ Other entrapment neuropathies ¡	• Idiopathic brachial plexus neuritis • Hypertrophic neuropathy • Peripheral neurolymphomatosis • Leprosy

	Supracapsular n. ¡ Posterior interosseus n. ¡ Radial n. ¡ Ulnar n. ¡ Femoral n. ¡ Posterior tibial n. ¡ Common peroneal n.	
11. Bone Tumours		
Secondary Malignancy		
• Metastases, lytic • Metastases, blastic • Multiple myeloma		
Primary Osteoblastic		
• Osteoma • Osteoid osteoma • Osteosarcoma	• Osteoblastoma	
Primary Cartilaginous		
• Enchondroma • Osteochondroma • Chondroblastoma • Chondrosarcoma	• Chondromyxoid fibroma	
Primary Fibrous		
• Fibrous dysplasia • Nonossifying Fibroma • Fibrous cortical defect • Malignant fibrous histiocytoma	• Fibrosarcoma	• Fibroxanthoma
Miscellaneous		
• Giant cell tumour • Intraosseous haemangioma • Aneurysmal bone cyst • Multiple myeloma	• Ewing sarcoma • Lymphoma • Plasmacytoma • Chordoma	• Adamantinoma
Tumour-Like Lesions		
• Unicameral bone cyst • Intraosseous lipoma • Heterotopic ossification • Paget disease	• Brown tumour • Bone infarct	• Thoracic elastofibroma
12. Soft Tissue Tumours		
Secondary Malignancy		
• Lymph node metastases		• Metastases, muscle • Metastases, fat
Primary Fatty		

• Lipoma • Liposarcoma		
Primary Fibrous		
• Fibromatosis / desmoid • Malignant fibrous histiocytoma	• Fibrosarcoma, soft tissue	
Other Primary Soft Tissue Tumours		
• Synovial sarcoma	• Soft tissue chondroma • Soft tissue chondrosarcoma • Leiomyosarcoma • Rhabdomyosarcoma	
Peripheral Nerve Tumours		
• Benign peripheral nerve sheath tumour • Neurofibroma, solitary	• Malignant peripheral nerve sheath tumour • Neurofibroma, plexiform	
Primary Vascular		
• Capillary haemangioma • Lymphangioma • Capillary malformation (e.g. Sturge Weber syndrome) • Venous malformation • Arteriovenous malformation		• Angiosarcoma
Miscellaneous Tumours and Tumour-Like Lesions		
• Pigmented villonodular synovitis • Synovial osteochondromatosis • Myositis ossificans • Tumoral calcinosis • Soft tissue ganglion	• Giant cell tumour of the tendon sheath • Aneurysm • Venous varix • Unrecognised muscle tear • Apophyseal avulsions	• Elastofibroma of the chest
Paediatric Imaging – Clinical Conditions		
NEONATES & FIRST 3 MONTHS		
1. Head and spine		
• Aqueduct Stenosis • Arachnoid cyst • Callosal dysgenesis • Chiari malformations • Choanal atresia •	• Common Orbital lesions • Dandy Walker spectrum • EncephalocoeleHoloprosenc	• Hydranencephaly • Septo-optic dysplasia • Hemimeganencephaly

Hydrocephalus • Infections – meningitis and encephalitis • Intracranial haemorrhage • Neonatal encephalopathy (Hypoxic Ischemic Injury) • Neoplasms – supra and infra tentorial tumours • Abusive Head Trauma • Periventricular Leukomalacia • Trauma	ephaly spectrum • Neuronal migrational abnormalities • Porencephaly • TORCH Infections • Vein of Galen Aneurysm	
2. Neck		
• Congenital abnormalities e.g. ¡ Branchial abnormalities ¡ Thyroglossal duct cyst • Fibromatosis colli • Lymphadenitis • Neoplasm's – e.g. haemangioma, neuroblastoma, rhabdomyosarcoma • Prevertebral abscess • Trauma e.g. Cervical spine fractures and normal variants simulating fractures	• Lingual thyroid / / Thyroid agenesis • Torticollis • Vascular Malformations e.g. lymphangioma	
3. Chest		
• Assessment of Intravascular lines and ET tubes • Chronic Lung Disease of Prematurity • Diaphragmatic Hernia • Hyaline membrane disease • Infections including bronchiolitis, pneumonia, abscesses and aspiration • Meconium Aspiration • Neonatal mediastinal masses (Normal thymus / masses benign and malignant) • Neonatal Pneumonia and Aspiration • Oesophageal atresia and tracheooesophageal fistula • Patent Ductus Arteriosis • Pulmonary Interstitial Emphysema • Pneumothorax/	• Aortic Co-arctation • Bronchopulmonary foregut malformations e.g. Bronchial Atresia, Congenital lobar overinflation, CPAM, Pulmonary Sequestration • Dextrocardia and anomalies of situs • Persistent Pulmonary Hypertension • Tetralogy of Fallot • Transposition of the Great vessels • Variants of aortic arch and major branch anomalies • Vascular rings/slings	• Ebstein's anomaly • Neonatal VSD /ASD / TAPVD • Pericardial defects • Pleuropericardial cyst • Pulmonary Haemorrhage • Pulmonary Hypoplasia/congenital venolobar syndrome • Truncus Arteriosus

Pneumomediastinum • Transient tachypnoea of the Newborn		
4. Abdomen & Pelvis		
Stomach & Duodenum, Spleen		
• Duodenal Atresia and Web • Gastroesophageal reflux • Malrotation with or without small bowel volvulus • Pyloric Stenosis	• Duplication Cysts • Gastroschisis • Omphalocoele • Trauma	
Small and Large Bowel		
• Hirschsprung's disease • Ileal Atresia & Stenosis • Meconium Ileus • Meconium peritonitis • Meconium Plug Syndrome/small left colon • Microcolon • Necrotising Enterocolitis	• Anal atresia	• Colonic atresia • Colonic Duplication
Pancreas & Retroperitoneum		
• Adrenal haemorrhage • Neuroblastoma	• Annular pancreas • Pancreatitis	
Hepatobiliary		
• Neonatal hepatitis / Biliary atresia • Hepatoblastomas • Haemangioma/ haemangioendothelioma	• Choledochal cyst • Liver tumours – non hepatoblastoma	• Bile plug syndrome • Liver Transplantation • Spontaneous bile duct perforation • Vascular Malformations
Kidneys & Urinary Tract		
• Nephroblastomatosis • Non-obstructive/non-refluxing (primary) megaureter • Posterior urethral valves • PUJ/ VUJ obstruction • Pyelonephritis • Urachal anomalies • Ureterocoele • Vesicoureteric Reflux • Wilms Tumour	• Anomalies of renal / position and fusion: Including Horseshoe/ Ectopia/ Duplex/ Crossed Fused Ectopia • Autosomal dominant and recessive Polycystic Kidney Disease • Mesoblastic Nephroma • Multicystic dysplastic Kidney • Nephrocalcinosis	• HUS • Neurogenic bladder • Renal vascular accident • Sacrococcygeal teratoma

Genital System		
• Hernias	• Abnormalities of uterine fusion / development and uterine obstruction • Cryptorchidism • Epididymitis • Hydrocoele • Testicular/ovarian neoplasm • Testicular trauma • Torsion of the testicular appendix • Torsion testis/ovary • Varicocoele	• Foreign bodies
Vascular		
• Haemangiomas • Vascular malformation e.g. Lymphatic Malformation/ Venous Malformation	• AVM	• Vascular tumours (other than haemangioma)
THE BABY, TODDLER, CHILD AND ADOLESCENT		
Developmental		
• Benign macrocrania of infancy (increased subarachnoid fluid space of infancy) • Craniosynostosis • Dermoid, epidermoid cyst	• Arachnoid cyst • Branchial cleft cyst • Colloid cyst • Malformations of cortical development ¡ Heterotopic grey matter ¡ Lissencephaly ¡ Schizencephaly ¡ Pachygyria - polymicrogyria	• Fibrous dysplasia • Rathke's cleft cyst
Neurocutaneous / Phakomatoses		
• Neurofibromatosis 1 • Neurofibromatosis 2	• Tuberous sclerosis • Von Hippel Lindau	
Neoplastic and Hamartomatous		
• Choroid Plexus Papilloma/ carcinoma • Craniopharyngioma • Ependymoma • Gliomas (including brain stem and optic nerve) • Medulloblastoma • Pilocytic Astrocytoma • Pineal tumours •	• Haemangioblastoma • Langerhans cell histiocytosis • Oligodendroglioma • Rhabdomyosarcoma	• Hamartoma of the tuber cinereum

Pituitary tumours • Retinoblastoma		
Vascular		
• Vascular malformations • Venous thrombosis	• Moya moya • Sturge-Weber Syndrome	
Infective		
• Meningitis / Cerebral abscess • Retropharyngeal abscess • Sinusitis, tonsillitis and enlarged adenoids	• ADEM • Transverse myelitis	
Trauma		
• Intra cranial haemorrhage • NAI – abusive head trauma • Skull fractures and complications	• Shearing injuries	
Miscellaneous		
		• Dysmyelination syndromes MELAS • Leigh's disease
Spine		
• Scheuermann's condition • Scoliosis – idiopathic/ congenital • Spinal dysraphism • Spinal Cord Tumours • Tethered cord	• Inflammatory Spinal diseases • Sacrococcygeal Teratomas • Spinal Bone Tumours	
2. Chest		
Developmental		
• Bronchogenic cyst • Dextrocardia/Situs inversus • Diaphragmatic Hernia • Laryngomalacia • Tracheomalacia	• Agenesis/aplasia • Kartagener and immotile cilia syndrome • Neurogenic and oesophageal duplication cysts • Swyer-James syndrome	
Traumatic		
	• Pneumatocoele	
Neoplastic and hamartomatous		
• Mediastinal lymphoma	• Dermoids • Mediastinal	

	germ cell tumour • Lymphangioma • Thoracic neuroblastoma	
Infective		
• Bronchiolitis • Croup • Epiglottitis • Non-resolving pneumonia including tuberculosis / chronic aspiration / bronchiectasis/ foreign body/ abscess & empyema • Typical and atypical pneumonias		
Miscellaneous		
• Foreign body • Asthma • Cystic fibrosis	• Histiocytosis • Tuberous sclerosis	
Vascular		
• ASD/ VSD/ PDA and left to right shunts • Acute pulmonary oedema/ fluid overload	• Partial anomalous Pulmonary Venous drainage • Reduced pulmonary vasculature • Tetralogy of Fallot	
3. Musculoskeletal		
Developmental & Nutritional		
• DDH • Fibrous dysplasia • Osgood-Schlatter's • Perthes Disease • Slipped capital femoral epiphysis • Thalassemia • VACTERL Deformity	• Osteochondroses • Rickets • Talipes Equinovarus • Tarsal Coalition • Vertebral Segmentation anomaly, including Klippel-Feil Syndrome • Discoid meniscus	• Congenital Pseudarthrosis of the tibia • Heavy metal Poisoning • Scurvy • Vertical Talus
Inherited		
	• Achondroplasia • Haemophilia • Osteogenesis Imperfecta	• Cleidocranial dysostosis • MPS • Osteopetrosis • Osteopoikilosis • Sickle cell disease

Traumatic		
• Fractures ¡ Greenstick ¡ Plastic bowing ¡ Salter harris ¡ Torus • Fracture – Dislocation – monteggia • Epiphyseal/apophyseal avulsion • Injury to the physis • Non-Accidental injury • Stress and toddler's fractures • Bone Infarction / osteonecrosis		
Infective & Inflammatory		
• Brodies abscess • Juvenile inflammatory arthritis • Osteomyelitis / Discitis • Septic Arthritis • Transient Synovitis		
Neoplastic, hamartomatous and related conditions		
• Aneurysmal Bone Cyst • Ewing's Sarcoma • Cartilage tumours ¡ Enchondroma ¡ Olliers • Fibrous dysplasia • Langerhans Cell Histiocytosis • Osteosarcoma • Osteochondroma • Non-Ossifying Fibroma/ Fibrous cortical defect • Osteoid Osteoma/ Osteoblastoma • Unicameral Bone Cyst • Vascular tumours	• Chondroblastoma • Fibromatoses • Metastases	• Adamantinoma • Chondromyxoid fibroma
4. Abdomen & Pelvis		
Developmental		
• Duplex kidney and complications • Multicystic dysplastic kidney • PUJ obstruction	Biliary atresia • Meckel's diverticulum	• Mesenteric cyst • Urachal rest • Choledochal cyst
Traumatic		
• Assessment of major blunt trauma and visceral perforation • Torsion testis/ovarian	• Testicular trauma	

Neoplastic and hamartomatous		
• Liver Haemangioma • Nephroblastomatosis • Neuroblastoma and ganglioneuroma • Ovarian teratoma • Wilm's tumour	• Hepatoblastoma • Fibrolamellar hepatoma • Multilocular cystic nephroma	
Infective / inflammatory		
• Appendicitis & mesenteric adenitis • Bladder and upper tract urinary infection including: Pyelonephritis and renal abscess • Inflammatory bowel disease • Hydronephrosis • Reflux nephropathy	• Epididymitis	• Cholecystitis and cholelithiasis
Vascular		
	• Henoch-Schonlein Purpura • Kawasaki's disease	• Liver transplant • Renal transplant
Miscellaneous		
• Intussusception • Reflux oesophagitis and hiatus hernia	• Coeliac disease • Hydrometrocolpos	• Ingested foreign bodies and bezoar • Caroli disease
5. Other Systemic Conditions		
Chromosomal		
• Down's syndrome • Turner's syndrome	• Marfan syndrome	• Noonan syndrome
Other		
• Leukaemia and Lymphoma		• Mastocytosis
Breast Imaging Clinical Conditions		
Malignant Disease		
• Invasive breast cancer • Ductal • Lobular • Subtypes (medullary, tubular, mucinous) • DCIS	• Inflammatory carcinoma • Papillary carcinoma • Intracystic carcinoma •	• Sarcomas of the breast • Metastatic disease to the breast • Lymphoma

	Atypical ductal hyperplasia • Columnar cell change • Phylloides tumour • Investigation of axillary lymphadenopathy	of the breast • Male breast cancer • Paget's disease of the breast
Benign Disease		
• Fibroadenoma • Breast cysts • Simple • Complex • Breast abscess • Hamartoma and lipoma • Benign breast calcifications • Breast hematoma • Fat necrosis • Sclerosing adenosis and fibrocystic change • Breast abscess and mastitis	• Post operative appearances e.g. seroma, scarring, breast reconstruction, reduction mammoplasty • Giant fibroadenoma • LCIS • Radial scar • Ductal papilloma • Usual ductal hyperplasia • Lymphoedema of the breast • Gynaecomastia ¡ Breast implants – Types & Complications	• Management of breast pain • Cosmetic oil and gel injections • Diabetic mastopathy • Multiple papillomatosis • Granulomatous mastitis • Chronic breast abscess
Vascular and Interventional Radiology – Clinical Condition		
1. General Vascular – combine with peripheral vascular		
• Aneurysms • Atherosclerosis • Fibromuscular hyperplasia • Arteriovenous malformation • Embolism • Patterns of vascular trauma / injury	• Fibromuscular hyperplasia	• Granulomatosis with polyangitis (Wegener's Granulomatosis) • Takayasu's Arteritis • Giant Cell Arteritis • Vasculitis – other • Polyarteritis Nodosa • Hereditary Haemorrhagic Telangectasia
2. Peripheral Vascular – combine with general vascular		
• Vascular grafts and complications • Deep venous thrombosis	• Iatrogenic femoral Pseudoaneurysm and AV fistula	• Buerger disease (Thromboangitis obliterans) • Raynaud

		phenomenon • Popliteal artery entrapment syndrome • Adventitial cystic disease of popliteal artery • Klippel-Trenauny-Weber Syndrome • May Turner syndrome
3. Chest and Neck Vascular		
• Common congenital variants of thoracic aorta • Spontaneous aortic dissection • Traumatic aortic injuries • Carotid artery stenosis • Carotid artery dissection • Pulmonary embolism	• Subclavian steal syndrome • Superior vena cava syndrome • Aortitis • Haemoptysis • Pulmonary AVM	• Thoracic outlet syndrome • Paget-Schroetter (effort) syndrome
4. Cardiac		
• Principles of cardiac CT • Principles of echocardiography • Coronary artery anatomy and variations • Coronary artery ischemic disease	• Principles of cardiac MRI • Indications for coronary angiography • Principles of cardiac nuclear imaging	• Cardiac catheterisation • Transoesophageal echocardiography
5. Abdominal Vascular		
• Abdominal aortic aneurysm • Mesenteric ischemia • GI haemorhage • Blunt abdominal and pelvic trauma • Retroperitoneal and rectus sheath haematoma	• Splenic and other visceral artery aneuryms • Aortic endoleak • Vascular complications of pancreatitis • Portal hypertension / varicies • Renal artery stenosis	• Coeliac artery compression syndrome • Budd Chiari syndrome • Aortoenteric fistula • Mesenteric vein thrombosis
VASCULAR & NONVASCULAR INTERVENTIONS		
Vascular Intervention		
• Diagnostic arteriography • Dialysis fistulography • Percutaneous venous access • Central and PICC line insertion	• Percutaneous angioplasty • Vascular stent insertion • Embolisation • IVC filter insertion • Lumbar	• Complex arterial and venous access • IVC filter retrieval • Foreign body retrieval •

	sympathectomy	Thrombolysis / thrombectomy • Aortic stent grafts
Uroradiology Intervention		
• Nephrostomy • Renal biopsy	• Antegrade stent insertion / ureteric dilatation • Transrectal prostate biopsy	• Varicocele / ovarian vein embolisation • Uterine fibroid embolisation • Fallopian tube recanalisation
. Gastrointestinal & Hepatobiliary Intervention		
• GI tract dilatations and stenting • Liver biopsy principles and techniques • Other abdominal organ biopsy • Percutaneous abscess drainage	• Transjugular liver biopsy • Percutaneous transhepatic cholangiogram and drainage • Biliary stenting • Percutaneous gastrostomy	• Hepatic chemoembolisation • Hepatic radioembolisation • Percutaneous local ablative therapies (principles) • Transjugular intrahepatic portosystemic shunt (principles

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 absorptionetry, functional imaging, medico legal issues in diagnostic and interventiona radiology,patientdosageandradiationprotectionindiagnosticimaging ,cost benefit.

Radiology Emergency Medicine

The student should be able to evaluate emergency radiographic examinations with accuracy and have clear understanding of the protocol of imaging in emergency situations of different organ systems.

Diagnostic Techniques

Applied Imaging Technology Category Definitions

Category 1 1.1 Physical principles of image acquisition, processing and display. These relate to artefacts, image acquisition parameters and methods and their impact upon patient safety and image quality. E.g. Influence of kVp and mAs upon the image, effect of grid upon scatter and dose, effect of ultrasound transducer frequency upon resolution and penetration. Knowledge of this type is important to patient care and the radiologist role as expert and collaborator. Ignorance in this regard would seriously affect patient safety, the radiologist's status as a competent individual or a useful member of a multi-disciplinary team. Knowledge in this category will facilitate the radiologist in deciding the appropriateness of referrals for radiology examinations. This knowledge would be utilised in clinical practice several time a year. It is accepted that in some settings the radiologist will not need / have the detailed knowledge necessary for image acquisition but should understand factors that impact on that image. E.g. Artefacts: Beam Hardening/ Motion/ Esp. on 3D recon. Algorithms with edge enhancement/ SPECT recon with poor counting stats. 1.2 Special knowledge relevant to radiologist's status as expert in the arena of: Patient and Staff Safety. E.g. management of radiation exposure to minimise risk of carcinogenesis, an understanding of MRI safety issues (missile effect, heating) relating to patient implants or devices.

Category 2 2.1 Expected knowledge for an expert but where a lesser depth or degree of knowledge is required. This includes information which is not essential for image interpretation but is necessary to understand possible limitations of equipment, technique and the imaging setting. An in principle understanding of these concepts is required to interact effectively with other disciplines in the patient's interest. E.g. Effect of pixel size on image resolution, parameters that influence appropriate image viewing conditions (luminance, monitor resolution, ambient light),major principles of image generation and an understanding of the principles of dose estimation and quality assurance.

Category 3 3.1 Rarely used knowledge: but with implications for patient care and radiologist activities. E.g. electrical micro/macro-shock, minor artefacts (ultrasound : diaphragmatic mis-registration behind a hepatic lipoma), and quality control equipment tests. 3.2 Those where the radiologist will rarely be the prime (or even the preferred source) of information, particularly if this information is unlikely to be used by a candidate in the 5 years of training. It is felt that if the knowledge has not been used in this time period, it will have limited retention and uncertain relevance when finally needed. E.g. X-ray generator design, film screen combinations. The AIT Syllabus subjects within each topic have been assigned to one of the categories defined above. Note that not every category is used for each topic. For example all the subjects in Topic 1 have been assigned to Category 1. Learning objectives have been developed for the majority of subjects and are listed directly below the subject. A very small number of Category 3 subjects do not have learning objectives as the AIT reviewers felt trainees only need to be aware of these subjects and not actively learn them.

Topic 1: BASIC CONCEPTS OF ELECTROMAGNETIC RADIATION (BCER) BCER: Category 1 Subjects (a) Electromagnetic waves (b) Relationship between frequency & wavelength (c) The electromagnetic spectrum (d) Sources of electromagnetic radiation (e) Wave-particle duality - photons (f) Energy of photons BCER: Category 1 Learning Objectives • Describe the electromagnetic radiation spectrum. • Distinguish between the various components of that spectrum. • Explain the relationship between wavelength, frequency and energy. • Demonstrate knowledge of the wave-particle duality of photons.

Topic 2: PRODUCTION OF X-RAYS Production of X-Rays: Category 1 Subjects (a) Continuous Radiation or Bremsstrahlung (b) Characteristic Radiation (c) Effect of variation of: • kV • mA • Filtration • Voltage • Waveform Production of X-Rays: Category 1 Learning Objectives • Discuss the production of X-rays and the distinction between Bremsstrahlung and Characteristic radiation. • Describe and illustrate the spectrum of X-ray energies produced by an X-ray tube. • Discuss the impact of changes in kVp, anode material, mA and filtration on the X-ray spectrum, patient dose and image quality. Production of X-Rays: Category 2 Subjects (a) X-ray tubes: • Basic design • Line focus principle • Heel effect Production of X-Rays: Category 2 Learning Objectives • Describe and illustrate the basic components of X-ray tube construction. • Describe and illustrate the line focus principle. • Describe and

illustrate the heel effect and its implication for image quality. Production of X-Rays: Category 3 Subjects (a) X-ray tubes: • Tube ratings Production of X-Rays: Category 3 Learning Objectives • Explain the information on a tube rating chart

Topic 3: X-RAY GENERATORS X-Ray Generators: Category 1 Subjects (a) Generator Waveforms: • Effect of waveform on image quality • Automatic Exposure Control (AEC) X-Ray Generators: Category 1 Learning Objectives • Explain the impact that generator waveform has on image quality and patient dose. • Describe how an AEC system operates in generic terms. X-Ray Generators: Category 2 Subjects (a) Generator Waveforms: • Effect of waveform on radiation output X-Ray Generators: Category 2 Learning Objectives • Explain the impact that generator waveform has on radiation output.

Topic 4: INTERACTIONS BETWEEN X-RAYS AND MATTER OF RELEVANCE TO MEDICAL IMAGING X-Rays & Matter: Category 1 Subjects (a) Ionisation and excitation: • Photostimulable phosphors (b) Photoelectric effect & characteristic radiation (c) Compton scattering (d) Scattered radiation - impact of, field size, thickness & kVp X-Rays & Matter: Category 1 Learning Objectives • Distinguish between atomic ionisation and excitation. • Describe relevant luminescence processes in the context of photostimuable phosphors. • Describe the interaction processes of photoelectric effect & Compton scattering. • Discuss the impact of field size, kVp and patient thickness on scatter production. X-Rays & Matter: Category 2 Subjects (a) Ionisation and excitation: • Thermoluminescent Dosimeters (TLD) (b) Coherent scattering (c) Attenuation: • Linear attenuation coefficient and equation • Mass attenuation coefficient • Half-value layer (HVL) • Factors affecting attenuation • Polychromatic radiation attenuation
X-Rays & Matter: Category 2 Learning Objectives • Distinguish between atomic ionisation and excitation. • Describe the coherent scattering interaction process. • Demonstrate knowledge of the process described by attenuation. • Describe the attenuation of monoenergetic and polychromatic radiation in terms of linear and mass attenuation coefficients and HVLs. • Demonstrate knowledge of the factors that impact on attenuation. X-Rays & Matter: Category 3 Subjects (a) Ionisation and excitation: • Luminescent screens X-Rays & Matter: Category 3 Learning Objectives • Describe very simply how luminescent screens work.

Topic 5: FILTERS, COLLIMATORS & GRIDS Filters, Collimators & Grids: Category 1 Subjects (a) Filtration • Traditional (Al, Cu) • K-edge • Combination

filters (b) Scatter reduction techniques: • Collimation • Compression • Grids (types, properties, implication for patient dose & image quality) • Air gaps Filters, Collimators & Grids: Category 1 Learning Objectives • Explain what is meant by filtration in its various guises. • Describe the impact of filtration on the spectrum from an X-ray tube. • Describe how and why the scatter reduction techniques work. • Demonstrate knowledge of the implication of these techniques on image quality and dose.

Topic 6: BASIC DIGITAL IMAGING CONCEPTS Basic Digital Imaging Concepts: Category 1 Subjects (a) General Terminology: • Pixels & voxels • Image matrix • Grey scale display levels [bits per pixel] Basic Digital Imaging Concepts: Category 1 Learning Objectives • Define what is meant by pixels, voxels and the grey scale. Basic Digital Imaging Concepts: Category 2 Subjects (a) Image compression (lossy and lossless) (b) Picture Archiving & Communication Systems (PACS) and (c) Teleradiology

Basic Digital Imaging Concepts: Category 2 Learning Objectives • Distinguish between lossless and lossy images. • Describe the key elements of PACS. Basic Digital Imaging Concepts: Category 3 Subjects (a) General Terminology: • Storage requirements

Topic 7: RADIOGRAPIC IMAGE ACQUISITION Radiographic Image Acquisition: Category 1 Subjects (a) Computed Radiography (CR) • Basics • Image processing • Image quality (b) Flat Panel Detectors (DR): • Indirect (a-Si) • Direct (a-Se) • Image quality • Detector elements (dels) Radiographic Image Acquisition: Category 1 Learning Objectives • Describe the key elements of the CR system that lead to image formation. • Discuss the impact of image processing on image quality. • Describe the key elements of the DR system that lead to image formation. • Differentiate between types of DR system. • Discuss the impact of image processing on image quality. Radiographic Image Acquisition: Category 2 Subjects (a) Image display and recording devices: • X-ray or laser film (optical density (OD) , Base+fog, contrast and Dmax) • Display monitors (resolution, brightness) Radiographic Image Acquisition: Category 2 Learning Objectives • Describe the key factors that contribute to image quality for both film and softcopy reporting. Radiographic Image Acquisition: Category 3 Subjects (a) Dual Energy Radiography: • Basic physics • DEXA Radiographic Image Acquisition: Category 3 Learning Objectives • Describe in very basic terms the concept of dual energy radiography.

Topic 8: FLUOROSCOPIC IMAGE ACQUISITION Fluoroscopic Image Acquisition: Category 1 Subjects (a) Image Intensification • Performance characteristics: – Pulsed fluoroscopy – Field size dependence – Automatic brightness control (ABC) modes: (control of kV, mA, pulse length, video voltage) (b) Flat Panel Detectors (c) Digital Fluoroscopy & Fluorography (d) Digital Subtraction Techniques: • The digitised image: – Logarithmic processing – Image noise – Effect of scatter – Mask subtraction (e) Digital image processing • Motion artefact reduction [remasking, pixel shifting] Fluoroscopic Image Acquisition: Category 1 Learning Objectives • Describe with illustrations the key components of image intensifiers. • Compare and contrast image intensifiers and flat panel detectors. • Explain the implications of field size, pulsed fluoroscopy on image quality and patient dose. • Describe the purpose of ABC and describe in general terms how it operates. • Describe the physical principles of DSA including why logarithmic processing is undertaken. • Describe the process of mask subtraction and understand the impact that the subtraction process has on image noise. • Describe what is meant by image processing operations such as pixel shifting and remasking and explain why they are important in minimising impact of motion artifact. Fluoroscopic Image Acquisition: Category 2 Subjects (a) Image Intensification • Basic principles • Performance characteristics: – Limiting resolution – Veiling glare (b) Digital image processing • Noise reduction including frame integration • Edge enhancement • Landmarking Fluoroscopic Image Acquisition: Category 2 Learning Objectives • In the context of image intensifiers, describe what is meant by veiling glare and define limiting spatial resolution. • In DSA, describe the image processing operations such as edge enhancement and landmarking and processes that may be used to reduce image noise such as frame integration.

Fluoroscopic Image Acquisition: Category 3 Subjects (a) Image Intensification • Performance characteristics: – Contrast ratio – Distortion (b) Cone Beam CT with fluoroscopy equipment (c) Digital image processing • Road mapping Fluoroscopic Image Acquisition: Category 3 Learning Objectives • Define what is meant by the term contrast ratio in the context of image intensification. • Describe types of image distortion. • In DSA, explain what is meant by road mapping.

Topic 9: MEASURES OF RADIOGRAPHIC & FLUOROSCOPIC IMAGE QUALITY Measures of Radiographic & Fluoroscopic Image Quality: Category 1 Subjects (a) Contrast: • Subject contrast • Image contrast • Scatter (b) Spatial

Resolution: • Blur • Limiting resolution (c) Noise • Random noise (quantum mottle) • Signal-to-noise ratio (d) Geometrical considerations: • Magnification • Focal spot size Measures of Radiographic & Fluoroscopic Image Quality: Category 1 Learning Objectives • Discuss in detail the key image descriptors, contrast, spatial resolution and noise. • Explain the impact of magnification and focal spot size on image quality. • Explain the impact of noise on image quality. • Explain what is meant by quantum mottle (random noise) and the SNR. Measures of Radiographic & Fluoroscopic Image Quality : Category 2 Subjects (a) Spatial Resolution: • Line-spread function (LSF) • Modulation transfer function (MTF) (b) Noise • Systematic (structured) noise (c) Geometrical considerations: • Distortion

Measures of Radiographic & Fluoroscopic Image Quality: Category 2 Learning Objectives • Define the LSF and MTF. • Distinguish between quantum noise and other types of noise. • Explain the origin of image distortion arising from geometric effects.

Topic 10: MAMMOGRAPHY Mammography: Category 1 Subjects (a) Basic principles of soft-tissue imaging: • Contrast improvement at low kVp • Contrast versus radiation absorbed dose (b) Analogue and Digital detectors • Film/screen Systems • Computed Radiography Systems • Digital Radiography Systems • Scanning systems Effect of detector design on spatial resolution (c) Magnification technique Mammography: Category 1 Learning Objectives • Describe the construction and operational principles of X-ray mammography equipment. • Discuss the advantages and disadvantages of magnification versus contact mammography. • Discuss the impact of kVp, filtration, glandular content and breast thickness on the Mean Glandular Dose. • Contrast various digital methods which have been applied to mammography. • Discuss the advantages and disadvantages of digital techniques when compared with film/screen. Mammography: Category 2 Subjects (a) Differential features of Mammographic X-ray units (b) Geometric considerations (magnification, focal spot size) as a limiting factor (c) Image Processing Mammography: Category 2 Learning Objectives • Discuss the performance characteristics of X-ray mammography equipment. • Explain the impact of system geometry on spatial resolution. • Describe the effect of image processing on image quality. Mammography: Category 3 Subjects (a) Stereotactic Techniques (b) Computer aided diagnostics (c) Tomosynthesis Mammography: Category 3 Learning Objectives • Describe the stereotactic imaging process

Topic 11: COMPUTED TOMOGRAPHY Computed Tomography: Category 1 Subjects (a) Principles of CT scanning (b) Scanner Geometry: • Helical single slice scanning • Multi-detector CT scanning • Collimation (c) Image reconstruction and display: • Filtered back projection • Voxels and pixels • CT-numbers • Window width and level (d) Image quality: • Spatial [high-contrast] resolution • Contrast discrimination [low-contrast detectability] • Noise • Impact of pixel size, imaged slice thickness, mAs, algorithm, sampling frequency, number of projections & field of view on image quality and patient dose (e) Artefacts • Partial volume • Motion • Aliasing • Streak • Beam hardening • Ring artefact • Helical scanning • Multi planar reconstruction (f) CT dose considerations • Tube current modulation (g) CT Fluoroscopy: • Basic technical and radiation dose considerations Computed Tomography: Category 1 Learning Objectives • Describe various methods of reconstruction from projections with emphasis on filtered back projection. • Describe and contrast the various geometries used for CT scanning. • Discuss differences between single slice and multi slice CT, sequential vs helical. • Define the CT-numbers. • Discuss the quality of CT images in terms of resolution and noise, highlighting factors that affect each. • Describe the origin and appearance of common artifacts in CT images. • Discuss radiation dose features unique to CT scanning. • Explain in generic terms how tube current modulation works and its impact on patient dose. • Explain the impact of multi detector CT vs. single slice CT on patient dose. • Distinguish between collimated X-Ray beam width and imaged sliced width. Computed Tomography: Category 2 Subjects (a) Scanner Geometry: 3rd generation • Cone beam CT (b) Image reconstruction and display: • Other types of reconstruction algorithms [no mathematics] • Multi planar reconstruction (c) Image Quality • Line spread function • MTF (d) CT Fluoroscopy: • Image reconstruction Computed Tomography: Category 2 Learning Objectives • Describe key features of image reconstruction in CT Fluoroscopy. • Describe the principle and relevance of Scanned Projection Radiography (SPR). • Describe key features of the concept of CT Fluoroscopy. Computed Tomography: Category 3 Subjects (a) Data acquisition equipment: • X-ray tube Computed Tomography: Category 3 Learning Objectives • Describe the unique features of the X-ray tube used in CT.

Topic 12: MAGNETIC RESONANCE IMAGING (MRI) Magnetic Resonance Imaging (MRI): Category 1 Subjects (a) Basic Nuclear Magnetic Resonance (NMR): • Magnetic susceptibility • Nuclear magnetic moments • Effect of external magnetic

field • Nuclear precession • Equilibrium magnetization • Significance of Radio Frequency (RF) pulse • Resonance & Larmor frequency • Free Induction Decay (FID) • Chemical shift (b) Relaxation: • longitudinal (T1) relaxation time • Transverse (T2) relaxation time • Effect of field inhomogeneities, T2* (c) Pulse sequences: • Inversion recovery and STIR • Spin-echo • Characteristic features of Gradient Echo, Fast Spin Echo, Echo Planar Imaging (EPI) and other fast imaging techniques (d) Production of the Image: • Gradient fields • Slice thickness and RF bandwidth • Phase-encoding gradient • Frequency-encoding (readout) gradient • Determinants of image acquisition time (e) Image Quality • Signal-to-noise ratios • Spatial resolution • Common artefacts (f) Hazards and bio-effects: • Static magnetic field • Time varying magnetic field • RF field • Contraindications for MRI • Environmental problems
Magnetic Resonance Imaging (MRI): Category 1 Learning Objectives • Describe the Nuclear Magnetic Resonance (NMR) phenomenon from both classical physics and quantum mechanics perspectives. • Discuss the significance and the uniqueness of the Larmor frequency for a nuclear species. • Describe the origin of the Free Induction Decay and discuss the key factors which determine its strength. • Describe the origin of the T1 and T2 relaxation mechanisms. • Describe the behaviour of T1 and T2 as the strength of the static field is changed. • Describe the spin-echo and inversion recovery pulse sequences – including multiple spin echo and STIR. • Outline the advantages and characteristic features of Gradient Echo, Fast Spin Echo, Echo Planar Imaging (EPI) and other fast imaging techniques. • Discuss the physics behind the chemical shift phenomenon. • Describe how gradients may be applied to spatially encode the NMR signal. • Describe interleaved multislice imaging and indicate why it is utilised. • Discuss quality features of MR images including artifacts. • Discuss safety issues (patient and environmental) and contra-indications in the use of MRI. Magnetic Resonance Imaging (MRI): Category 2 Subjects (a) Production of the Image: • 2D Fourier transformation technique • 3D Fourier transformation technique (b) Fat suppression and fat imaging (c) Magnetic resonance spectroscopy (MRS) (d) Contrast imaging Magnetic Resonance Imaging (MRI): Category 2 Learning Objectives • Discuss the role of the Fourier Transform (FT) in MR image reconstruction. • Describe 2D-FT reconstruction methods in terms of the three time intervals (slice selection, phase encoding and frequency encoding). • Compare the 3D-FT reconstruction technique with the 2D-FT method. • Discuss the advantages of the Gradient Echo, Fast Spin Echo, Echo Planar Imaging (EPI) and other fast imaging

techniques. • Explain the effects of preparatory inversion pulse on image contrast. • Compare and contrast fat suppression obtained by spectral, IR GRE and subtraction methods. • Identify the biomolecular species which may be analysed in clinical MRS. Magnetic Resonance Imaging (MRI): Category 3 Subjects (a) Instrumentation • Magnets • Gradient coils • RF coils and electronics • Functional MRI (b) Hybrid MR-PET (c) Intra operative (d) Flow effects: • Flow-void effect • Paradoxical enhancement • Magnetic Resonance Angiography (MRA) • Diffusion imaging Magnetic Resonance Imaging (MRI): Category 3 Learning Objectives • Describe the general construction and mode of operation of MRI scanners. • Describe in simple terms the effects of blood flow on MR image data.

Topic 13: NUCLEAR MEDICINE Nuclear Medicine: Category 1 Subjects (a) Basic atomic structure and radioactivity: • Atomic structure • Isotopes • Radioactivity: – Alpha – Beta – Gamma – Radioactive decay law – Half-life & decay constant – Activity & specific activity (b) Measurement of radiation and radioactivity: • Scintillation systems (c) Imaging systems • Gamma camera - general principles • Performance parameters: – Efficiency / sensitivity – Uniformity – Spatial linearity – Resolution [intrinsic & extrinsic] • Single photon emission computed tomography (SPECT) - general principles • Positron emission tomography (PET) - general principles (d) Radiopharmaceuticals: • Desirable characteristics • Physiological clearance • Biological & effective half-life • Standardised uptake value (SUV) Nuclear Medicine: Category 1 Learning Objectives • Distinguish between the major forms of radioactive decay. • Express the radioactive decay law in mathematical terms. • Perform simple calculations using the concepts of physical, biological and effective half-lives. • Describe the construction and mode of operation of scintillation detectors. • Describe the main features and mode of operation of a gamma camera. • Describe the main features and mode of operation of a SPECT camera. • Discuss the performance characteristics of SPECT & gamma cameras. • Describe the physical, biological and chemical characteristics of radionuclides which are suitable for nuclear imaging. • Discuss major indicators of the physical quality of SPECT images. • Describe the main features and mode of operation of a PET scanner. • Discuss issues that limit the performance of PET scanners.

Nuclear Medicine: Category 2 Subjects (a) Measurement of radiation and radioactivity: • Detector types: – Gas-filled detectors (ionisation, Geiger) • Pulse-height analysis & energy spectra (b) Imaging systems • Collimators • Pulse height

analysers • Data analysis and display • PET/CT systems • SPECT/CT (c) Statistics and mathematics of nuclear decay: (d) Radiopharmaceuticals: • Radionuclide production Nuclear Medicine: Category 2 Learning Objectives • Describe the construction and mode of operation of gas-filled detectors. • Discuss the concept of pulse height analysis. • Explain the significance of the Poisson distribution in the characterisation of image noise. • Describe the manufacturing processes used for the production of medical radioisotopes. Nuclear Medicine: Category 3 Subjects (a) Measurement of radiation and radioactivity: • Solid-state detectors (b) Statistics and mathematics of nuclear decay: • Poison and normal distribution • Summation of errors **Topic 14: ULTRASOUND IMAGING Ultrasound Imaging:** Category 1 Subjects (a) Fundamental physics of ultrasound and interaction with tissues: • Interference, diffraction, resonance • Reflection, refraction • Attenuation, absorption, scattering (b) Transducers and the ultrasonic field: • Piezoelectric effect • Linear & convex arrays • Phased arrays c) Pulse-echo imaging and instrumentation: • Grey-scale imaging • Receiver functions: – Time-gain compensation (TGC) • Digital processing: – Pre- & post-processing • Spatial resolution (d) Real-time systems • Basic principles (e) Doppler systems: • Doppler effect & Doppler shift equation: – Basic principles – Limitations on velocity measurement (f) Ultrasound artefacts: • Multiple reflections – reverberation • Attenuation: – Shadowing – Enhancement (g) Biological effects: • Mechanisms of interaction with tissues • Thermal and mechanical incices • Safety recommendations • Australasian Society for Ultrasound Medicine (ASUM) Safety Statements Ultrasound Imaging: Category 1 Learning Objectives • Demonstrate knowledge of the basic physical nature of ultrasound waves and the interactions that occur as it traverses through tissues and other media. • Demonstrate knowledge of the various types of ultrasound transducers which are available, and to be able to choose a transducer on the basis of its physical characteristics and suitability for a given application. • Demonstrate knowledge of the basic principles of ultrasound imaging and how various technical factors affect image quality. • Describe how real-time systems work, and be aware of the interplay between temporal resolution, spatial resolution and depth of penetration. • Describe the basic physical principles underlying the use of the Doppler effect in ultrasound imaging. Explain how choice of frequency affects attenuation, spatial resolution, and the maximum flow rate that can be detected. Describe the operation of a simple duplex transducer. • Recognise simple ultrasound artefacts and explain how they are formed. • Discuss the main mechanisms

by which ultrasound could damage tissue. Have a knowledge of safe levels of exposure for imaging and safety recommendations

Ultrasound Imaging: Category 2 Subjects (a) Fundamental physics of ultrasound and interaction with tissues: • Wave motion and types of waves • Wave length, frequency, phase • Intensity, pressure, amplitude • Decibel notation - intensity and amplitude • Velocity in liquids and biological media • Acoustic impedance (b) Transducers and the ultrasonic field: • Beam pattern - near & far field • Focused transducers - types & techniques • Broad bandwidth transducers c) Pulse-echo imaging and instrumentation: • B-mode (d) Doppler systems: • Doppler effect & Doppler shift equation: – Direction detection – Spectral analysis • Colour and power Doppler (e) Compound imaging (f) Panoramic imaging (g) Ultrasound artefacts: • Beam width - side lobes • Instrumentation artefacts (colour Doppler aliasing) Ultrasound Imaging: Category 2 Learning Objectives • Demonstrate knowledge of some of the basic parameters which characterise a sound wave. Conduct simple calculations relating to frequency, wavelength and relative intensity in decibels. Demonstrate working knowledge of the relative magnitudes of sound velocity, acoustic impedance and attenuation in various biological media, and their implications for imaging. • Describe details of the main physical parameters that characterise transducers, and their effect on the image. • Describe the basic principles of B-mode pulse-echo imaging. Understand parameters such as pulse length, frequency, pulse repetition frequency and TGC affect the image. • Perform simple calculations using the Doppler shift equation and understand the concepts underlying spectral analysis colour Doppler and power Doppler. • Describe the basic principles of compound imaging. • Describe the basic principles of panoramic imaging. • Explain the factors which produce more complex artefacts such as aliasing and side lobes. Ultrasound Imaging: Category 3 Subjects (a) Transducers and the ultrasonic field: • Special types of transducer: – Intracavity probes – Biopsy and surgical probes • A-mode (b) New techniques: • Harmonic imaging • Contrast agents • 3D/4D imaging with ultrasound (c) Ultrasound artefacts: • Refraction - sound speed errors

Ultrasound Imaging: Category 3 Learning Objectives • Demonstrate a working (although not necessarily detailed) knowledge of more complex technology involving: • Special transducers • Harmonic imaging, 3D imaging and ultrasound contrast agents. **Topic 15: ELECTRICAL SAFETY IN MEDICINE Electrical Safety in Medicine:** Category 3 Subjects (a) Basic electrical safety issues. (b) Macroshock and

microshock (c) Classification of areas and equipment. Electrical Safety in Medicine: Category 3 Learning Objectives • Identify basic electrical hazards and safety issues relating to imaging equipment and areas. • Distinguish between macroshock and microshock hazards. • Interpret electrical classification of equipment and areas.

Topic 16: DOSIMETRY AND RADIATION BIOLOGY Dosimetry and Radiation Biology: Category 1 Subjects (a) Radiation quantities and units • Exposure; Coulomb/kg • Air kerma; Gray • Absorbed dose; Gray • Equivalent dose; Sievert • Effective dose; Sievert (b) Basic dosimetry parameters • Skin dose • Organ dose • Effective dose • Genetically significant dose (GSD) • Natural background dose (c) Interaction mechanisms • Ionisation • Excitation • Free radicals • Introduction to concept of linear energy transfer (LET) (d) Mutation • Spontaneous • Radiation induced • Dose rate dependence • Relation to germ cell maturation • Chromosome damage (brief overview) (e) Radiation carcinogenesis & other stochastic effects • Mechanisms • Latent period • Effect of dose and dose rate • Organ sensitivity • Risk of carcinogenesis • Hereditary effects (f) Deterministic effects • Skin damage (including late effects) • Sterility • Cataract induction (g) Effects on embryonic and foetal development • Relation to stage of development • Implantation failure • Embryonic death and malformations • Growth retardation • Mental retardation • Therapeutic abortion • Carcinogenesis

Dosimetry and Radiation Biology: Category 1 Learning Objectives • Define the main radiation quantities and units used in diagnostic radiology and nuclear medicine, and to understand the parameters they measure. • Demonstrate knowledge of the function and interpret the values of specific dose measurement methods used for radiological procedures. Explain the implications of measured dose parameters, both in terms of overall risk and the risk to specific tissues and organs. Be aware of the relative radiation doses from different radiological procedures, and how they compare to natural background radiation doses. • Examine the mechanism of how radiation interacts with tissue to cause biological damage, and the parameters used to quantify this damage. • Demonstrate knowledge of the hereditary and genetic implications of radiation exposure. • Demonstrate knowledge of the stochastic effects of radiation and the factors which influence it. Assess the approximate risk from a radiation exposure and explain how to convey this risk in a simple manner to patients and other staff. • Demonstrate knowledge of the deterministic effects of radiation and the factors which influence it. • Identify the procedures that may deliver large doses of radiation. •

Demonstrate knowledge of the effects of radiation on the developing embryo and foetus at various stages of gestation. To be aware of which procedures may deliver large doses to the embryo/foetus, and the actions to be taken in considering dose to a pregnant patient, prospectively or retrospectively. Dosimetry and Radiation Biology: Category 2 Subjects (a) Additional derived dosimetry parameters and indices • Dose-area product (DAP) • CT Dose Index (CTDI) • Dose length product (DLP) Dosimetry and Radiation Biology: Category 2 Learning Objectives •Explain the importance and application of the dose descriptors: • DAPS • CTDI • DLP

Topic 17: RADIATION PROTECTION Radiation Protection: Category 1 Subjects (a) Objectives (b) Biological aspects: • Radiation weighting factors (c) Measures of detriment • Nominal probability coefficients • Tissue weighting factors (d) ICRP framework of radiological protection practices • Justification • Optimisation (ALARA) • Limitation (see dose limits below) • Medical radiation including medical research (e) Dose limits • Occupational exposure • Risks from occupational exposure • Public • Occupational exposure of pregnant women • Diagnostic Reference Levels (DRLs) (f) Practical methods of reducing dose to • Occupationally exposed personnel • Public from Diagnostic X-ray equipment: • Distance & time • Protective clothing [aprons, gloves, thyroid shields] • Barriers [calculations not required] • Radioactive material (nuclear medicine) • Monitoring and surveillance • Personal hygiene • Transport, storage and management of sources • Simple decontamination procedures • Distance, time & shielding (g) Practical methods of reducing dose to patients • Radiography and fluoroscopy • CT optimisation • Guidelines for potentially pregnant and pregnant patients • Examination of children • Interventional procedures Quality Assurance programmes [see details below] (h) Methods of assessing radiation dose • Film badge dosimeters • Thermoluminescent dosimeters • Optically stimulated luminescent dosimeters • Direct reading ionisation chamber dosimeters • Electronic dosimeters

(i) Computational methods of assissing radiation dose • Patient radiation doses (skin and organ absorbed doses, effective dose) in diagnostic radiology • Typical doses to patients and foetus if applicable: – Chest X-ray – Abdomen X-ray – Lumbosacral spine X-ray – Mammography – Fluoroscopy procedures – CT (j) Patient radiation doses and foetal dose if applicable (organ absorbed dose and effective dose) in nuclear medicine scans. (k) Specific issues associated with therapeutic administration of radioisotopes. Radiation Protection: Category 1 Learning Objectives • Articulate

the objective of radiation protection. • Define radiation weighting factors and understand the various factor values. • Describe detriment, probability coefficients and tissue weighting factors, and differentiate between the factors for various tissues. • Describe, compare and contrast the various radiation dose quantities, and how they relate to each other. • Describe the ICRP radiological protection principles, and how they relate to medical exposure, and to research uses of radiation. • State and compare the ICRP dose limits for various groups. • Describe the concept of DRLs and explain how they are derived. • Describe, compare and contrast methods of occupational and public radiation dose reduction in both diagnostic radiology and nuclear medicine environments. • Describe the principle of dose optimisation, and how it is applied to diagnostic and interventional radiology. • Describe, compare and contrast the various technologies used for personal measurement and assessment of radiation dose in medical imaging. • Describe the various methods for calculation of patient radiation dose in radiology. • State approximate doses for common x-ray imaging examinations. • Describe the factors influencing patient dose in CT scanning. • Describe the methods of calculating patient and foetal radiation dose in nuclear medicine. State approximate doses for common examinations. • Discuss the safety issues associated with therapeutic administration of radioisotopes in relation to: • Thyroid • Breast • Foetus as appropriate Radiation Protection: Category 3 Subjects (a) ICRP Framework of Radiological Protection (b) Interventions

Topic 18: QUALITY ASSURANCE FOR DIAGNOSTIC IMAGING EQUIPMENT Quality Assurance for Diagnostic Imaging Equipment: Category 2 Subjects (a) Overview, benefits and rationale for Quality Assurance in Imaging Quality Assurance for Diagnostic Imaging Equipment: Category 2 Learning Objectives • Describe the principles and benefits of quality assurance in imaging. (ii) Quality Assurance for Diagnostic Imaging Equipment: Category 3 Subjects (a) Quality Control (QC) tests on Radiographic equipment • X-ray generator & tube • Fluoroscopic imaging equipment • Computed Tomography • DSA equipment • Image receptor and associated equipment (b) QC tests in Nuclear Medicine • Radiopharmaceutical Integrity • Dose calibrator • Gamma camera • Computer image • Processing • Artefacts • SPECT • PET (c) QC tests on ultrasound imaging equipment • AIUM target and tests • Tissue-equivalent phantoms • Test phantoms (d) QC tests on MRI scanners

Topic 19: CONTRAST AGENTS Contrast Agents: Category 2 Subjects (a) Basic physical properties (b) Types of contrast studies • Iodine • Barium (c) Contrast in MRI studies (d) Ultrasound contrast agents (e) Safety in contrast agent use Contrast Agents: Category 2 Learning Objectives • Describe the physical principles of contrast agents used in radiology. Articulate in general terms how they improve subject contrast. • Differentiate and contrast the use of iodine and barium agents in radiology examinations. • Describe the fundamental properties of MRI contrast agents. Articulate in general terms how they improve contrast. • Describe the nature, function, and use of ultrasound contrast agents. • Articulate in general terms the safety issues involved in contrast agent use

20. OTHER TOPICS:

General Radiology

The student should be able to evaluate conventional radiographs including radiographs on chest abdomen, pelvis, skull (including PNS+Orbit), spine, musculoskeleton and soft tissues. Student should be able to perform radiography of different body parts.

Ultrasound

The student should be able to perform and interpret all ultrasound studies. These studies include: abdomen, pelvis, small parts, neonatal head, breast, color duplex imaging (arterial and venous studies), obstetric/gynecology and intervention procedures using ultrasoundguidance.

CT

Select CT protocol according to the clinicaldiagnosis.
Demonstrate knowledge of the CT finding of the common pathological conditions.
Interpret conventional and modified body CT examinations like HRCT, dual/triple phase, Vertical CTetc.

Know limitations of CT in the diagnosis of certain diseases.
Perform CT guided simple interventions (undersupervision)

Angiography

Should be able to perform (under supervision and independent) and interpret routine angiographic procedures and vascular interventions.

MRI

Select MRI protocol according to the clinical diagnosis
Knowledge of conventional and modified MRI examinations, including MRA, MRV, MRCP, MRS.
Demonstrate knowledge of the MRI of the common pathological conditions.
Mammography and BreastIntervention InterventionalRadiology

The student should be able to perform (under supervision) simple interventional procedures of all the organ systems.

Vascular interventional radiologic procedures such as Percutaneous transluminal angioplasty, stenting, embolization using variousembolic material and arterial & venousthrombolysis both in emergency(eg. Percutaneous ballon valvuloplasty for mycocardial infarction, venous bleeding in case of pelvic trauma)and elective basis(cardiac angiogram, glue embolisation of reticular veins for varicose venous disease)
Various non-vascular interventional procedures such as percutaneous nephrostomy, stenting, abscess drainage, PTC/PTBD, biliary stenting percutaneous US/CT guided biopsy, balloon dilatation of the esophagus etc
Regional arteriography of head and neck, thorax, abdomen, upperand lowerextremities.
Venography: technique and complications , regional venography of head and neck, thorax and abdomen-SVC venography, IVC venography, Portal venography, gonadal venography, pelvic venography, venous sampling, interventional technique in venoussystem

Trans arterial chemoembolization & Trans arterial radio embolization– indications, technique and complications

- Doppler evaluation and endovascular management of varicoseveins
- Neurointerventions in stroke. Aneurysm , AVM,fistula
- Bone biopsy
- Radiofrequency ablation : indications, techniques andcontraindications
- Digital subtraction angiography: equipment, applications,
- Radiation protection during interventionalprocedures

NUCLEAR MEDICINE

At the completion of this rotation the resident should be able to interpret common nuclear medicine examinations (including cardiac cases, PETCT and SPECT).
Student should be able to evaluate the examinations for completion and determine what further images (including non nuclear medicine) need to be done.
Student should have a good understanding of the physical and biological properties of the commonly used radiopharmaceuticals and become familiar with safe handling of isotopes and basic radiation safety measures while dealing withisotopes.

Students must be well versed in the handling and the administration of the commonly used radioisotopes

PET CT

Select PET CT protocol according to the clinicaldiagnosis.
Demonstrate knowledge of the PET CT finding of the common pathological conditions.

- Interpret the extent of the pathology and tracer uptake of
- Know limitations of PET CT in the diagnosis of certain diseases.

21. RECENT ADVANCES IN RADIOLOGY:

Student should be aware of recent advances in Radiology, as published in major journals of Radiology around the world. See under AI below.

22. ONCOLOGIC RADIOLOGY

At the end of the rotation the resident should be able to interpret radiological investigations in patients with neoplastic diseases (both benign andmalignant)
Understand pathology and patho-physiology of commonneoplasms.
Learn the algorithmic approach to image these patients based on the suspected disease, its biological behavior and potential and limitations of various imagingmodalities.
Perform appropriate investigation (both conventional and newer methods), interpret the results and reach at a reasonable diagnosis/ differential diagnosis based on the clinical and biochemicalresults.
Learn to communicate the results in a precise way in a written report to the concernedunit.

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23. OTHER AREAS OF COMPETENCY – ETHICS, LEGAL, BIOSTATICS, RESEARCH METHODOLOGY AND CLINICAL EPIDEMIOLOGY

- Ethics- To comply with regulatory laws like PCPNDT acts, AERB, prohibition of Dichotomy etc.

- Medico legal aspects relevant to the discipline

- Biostatistics, Research Methodology and Clinical Epidemiology.

- The trainee should be encouraged to participate in research, and to pursue one or more projects up to and including publication. An understanding of the

principles and techniques used in research, including the value of clinical trials and basic biostatistics, should be acquired. Presentation of research and audit results at state and national meetings should be encouraged.

- Trainees will be expected to be familiar with current radiology literature.

- The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.

- The trainee should be encouraged to attend appropriate educational meetings and courses.

- The trainee should participate in and initiate relevant clinical audit.

24. ARTIFICIAL INTELLIGENCE

- The trainee must be familiar with the increasing role of artificial intelligence in Radiology, and implications and future directions of this fast growing area.

- The trainee must understand the concepts of machine learning, deep learning, convolutional neural networks, data mining and radiomnics.

- The trainee should possess familiarity with all stages of model development, model translation, and use in clinical practice. This includes

□the data collection and annotation process,
□algorithm selection,
□model development and training,
□model validation and assessment,
□requirements for clinical translation,
□interpretation of performance metrics and model output, and
□identification of modes of model failure.

- The trainee must acquire the ability to critically evaluate various algorithms' strengths and recognize their potential pitfalls will be essential to determine the validity and clinical applicability of their predictions. Therefore, a working knowledge of these concepts is critical for trainees using ML tools to augment imaging interpretation.

- Trainees should actively participate in model development by providing the clinical context, framing the imaging question, curating ground truth data sets, ensuring seamless deployment in reading rooms, and continuously monitoring and validating algorithm performance. Multidisciplinary collaboration with data science experts, software engineers, and referring clinicians should be encouraged.

25. BASIC LIFE SUPPORT -BLS

Basic Life Support (BLS) refers to the care provided to patients who are experiencing respiratory arrest, cardiac arrest or airway obstruction. BLS includes psychomotor skills for performing high-quality cardiopulmonary resuscitation (CPR), using an automated external defibrillator (AED) and relieving an obstructed airway for patients of all ages. The trainee is expected to be competent in all aspects of basic life support, including:
Primary assessment of the unconscious patient
oLevel of Consciousness – AVPU
oAirway – Head tilt / Chin life and Modified Jaw thrust
oBreathing and Pulse
Providing CPR / AED
oHigh quality compressions
oVentilations
oUsing an AED
Providing care for an obstructed airway

26. RADIOLOGICAL PHYSICS – SUMMARY

1.Introduction of general properties of radiation and matter: Fundamentals of nuclear physics and radioactivity

2.Interaction of x-rays and gamma rays with matter and their effects on irradiated materials

3.X-ray Generating Apparatus

4.Screen-film radiography

5.Film processing: Dark room, dry processing, laser /dry chemistry cameras, artifacts.

6.Fluoroscopy: Digital including flat panel units, fluoroscopy cum radiography units

7.Digital radiography: Computed Radiography, Flat panel radiography

8.Other equipments: Ultrasound including Doppler, CT, PET CT MRI and DSA

9.Contrast Media (Iodinated, MR & Ultrasound) - types, chemical composition, mechanism of action, dose schedule, route of administration, adverse reaction and their management

10.Nuclear Medicine: Equipments and isotopes in various organ systems and recent advances

11.Picture Archiving and Communication System (PACS) and Radiology Information System (RIS) to make a film-less department and for Teleradiology

12.Radiation protection, dosimetry and radiation biology

13.Image quality and Quality Assurance (QA)

14.Recent advances in radiology and imaging

The student should have knowledge of the following physics experiments:

- Check accuracy of kVp and timer of an X ray unit
- Check accuracy of congruence of optical radiation field
- Check perpendicularity of x ray beam
- Determine focal spot size
- Check linearity of timer of x ray unit
- Check linearity of mA
- Verification of inverse square law for radiation
- Check film screen contact
- Check film screen resolution
- Determine total filtration of an x ray unit
- Processor quality assurance test

- Radiological protection survey of an x ray unit
- Check compatibility of safe light
- Check performance of view box
- Effect of kVp on x ray output

27. RADIOGRAPHY AND PROCESSING TECHNIQUES

1.Processing techniques: includes dark room and dry processing.

2.Radiography of the musculo-skeletal system including extremities.

3.Radiography of the chest, spine, abdomen and pelvic girdle.

4.Radiography of the skull, orbit, sinuses.

5.Contrast techniques and interpretation of GI tract, hepato-biliary tract, pancreas etc.

6.Contrast techniques and interpretation of the Central Nervous system.

7.Contrast techniques and interpretation of the cardiovascular system including chest.

8.Contrast techniques and interpretation of the genito - urinary system including Obstetrics and Gynaecology.

9.Paediatric radiology including MCU, genitogram, bone age.

10.Dental, portable and emergency (casualty) radiography.

ANNEXURES:

1. **Log book**
2. **Rotational posting Summary**
3. **Competency based curriculum – all forms**

ANNEXURE 1:

LOG BOOK

Certified to be the Bonafide Record of _____,
a resident undergoing his training for _____Course in
Department of Radiodiagnosis College & Hospital for the period from
_____to _____.

Date: **Head of Department**

ANNEXURE 2 – ROTATIONAL POSTINGS SUMMARY:

ROTATIONAL POSTINGS SUMMARY : 1st / 2nd / 3rd Year

S.No	From	To	Speciality Posting

Signature of Professor / HOD

Key:
O – As observer
S – To assist under supervision
I – Independently under supervision

ANNEXURE 3:

Competency Based Structured curriculum for Conventional and Digital Radiography

Basics / CORE - Y1

S.no.	Topics
1	Understanding Normal Radiographic Anatomy and Variants
2	Understanding patient positioning, and the artefacts produced by variant positioning
3	Understanding exposure factors and their influence on the final image
4	Understanding dose reduction and image optimization techniques
5	Understanding the range of available imaging modalities, including conventional and digital techniques
6	Performing patient positioning, prime factor selection, exposure, development and filming.

Chest and Cardiovascular imaging

S.no	Contents	Y1		Y2		Y3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I

1	**Indications / Contraindications for Radiography**		S		I		I
2	**PA and lateral views, inspiratory and expiratory views, portable views**		S		I		I
3	**Lordotic and Decubitus views**		O		S		I
4	**Interpretation of causes and features of cardiac chamber enlargement**		S		I		I
5	**Interpretation of prosthetic valves, closure devices**		S		I		I
6	**Interpretation of effusion, collapse, consolidation and fibrosis**		S		I		I

Gastrointestinal Imaging

S.no	**Contents**	**Y1**		**Y2**		**Y3**	
		No.	O/S/I	**No.**	**O/S/I**	**No.**	**O/S/I**
1	**Indications / Contraindications for Radiography**		S		I		I
2	**Supine and erect views, interpretation and reporting**		S		I		I
3	**Special views, interpretation and reporting**		O		S		I
4	**Interpretation of the bowel gas pattern, the soft tissue, air fluid levels and calcifications**		S		I		I

MSK imaging

S.no	**Contents**	**Y1**		**Y2**		**Y3**	
		No.	O/S/I	**No.**	**O/S/I**	**No.**	**O/S/I**
1	**Indications / Contraindications for Radiography**		S		I		I
2	**Standard views, interpretation and reporting**		S		I		I
3	**Special views, interpretation and reporting**		O		S		I

4	**Interpretation of trauma, tumors, congenital and inflammatory lesions**		S		I		I

COMPETENCY BASED STRUCTURED CURRICULUM FOR ULTRASONOGRAM (USG)

S.NO	TOPICS
1	BASICS OF ULTRASOUND PHYSICS
2	BIOLOGIC EFFECTS AND SAFETY
3	CONTRAST AGENTS FOR ULTRASOUND

USG – ABDOMEN

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal anatomy of abdominal organs including normal variants & congenital malformations		S		I		I
2	Sonographic techniques for imaging each organ		S		I		I
3	Extended focused assessment with USG in trauma – E FAST		S		I		I
4	USG imaging of pathologies affecting liver		S		I		I
5	Imaging of the biliary tree & GB pathologies on USG		S		S		I
6	Pancreas & its pathologies imaging on USG		O		S		I
7	USG imaging of kidney, ureter, urinary bladder		S		I		I
8	Imaging of splenic pathologies on USG		S		I		I
9	Imaging of the gastrointestinal tract on USG, including endoscopic ultrasound		O		S		I
10	Adrenal sonography & imaging features of adrenal pathologies		O		S		I

11	Dynamic ultrasound – hernias of groin and anterior abdominal wall		S		I		I
12	Intraoperative ultrasound		O		S		I
13	USG imaging in post operative abdomen		S		S		I
14	Elastography		S		S		I

USG – PELVIS

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I		O/S/I
1	Normal anatomy of the pelvic organs and imaging techniques		S		I		I
2	Imaging of the female pelvis including transvaginal USG		S		S		I
3	Imaging of the male pelvic organs including TRUS		O		S		I

USG – BREAST

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal appearance of breast on USG & sonographic techniques		S		I		I
2	Imaging of breast pathologies including ANDI , abscess, tumours		S		S		I
3	Sonomammogram & BIRADS		S		I		I
4	Post operative breast imaging		O		S		I

USG - NECK

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Imaging anatomy of the structures in the neck		S		I		I
2	Imaging of thyroid gland and its pathologies including TIRADS		S		I		I

3	USG imaging of the salivary gland pathologies		S		S		I
4	USG imaging of cervical nodal pathologies		S		I		I
5	Vessels in the neck – USG imaging features		S		I		I
6	Parathyroid imaging on USG		O		S		I
7	USG evaluation of the brachial plexus		O		S		I

USG – SCROTUM

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Imaging of the scrotum and testes		S		I		I
2	USG imaging in acute scrotal pain		S		I		I
3	Imaging of the scrotum in trauma, cryptorchidism and masses		O		S		I

USG – MSK

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	USG anatomy of the MSK system – normal appearance and pitfalls		S		I		I
2	Imaging of shoulder pathologies in USG		O		S		I
3	Imaging of the elbow & wrist on USG		O		S		I
4	Imaging of hip in USG		S		S		I
5	Knee pathologies on USG		S		S		I
6	Ankle pathologies on USG		O		S		I
7	USG evaluation of soft tissue		S		S		I

PEDIATRIC US

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I

1	Cranium imaging in neonates		S		S		I
2	Pediatric head & neck on USG		S		I		I
3	USG imaging of pediatric abdomen & pelvis		S		I		I
4	USG of the hip in neonates		O		S		I
5	USG of the paediatric spine		O		S		I

MISCELLANOUS

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	USG imaging of soft tissue lesions		S		S		I
2	Ocular ultrasound (B scan)		S		S		I
3	USG chest		S		I		I

Competency Based Structured curriculum for Doppler Studies

Basics / CORE - Y 1

S.no.	Topics
1	Understanding Doppler Physics
2	Choosing the most appropriate instrumentation and settings for optimal doppler signal
3	Understanding the spectral doppler waveform, waveform analysis
4	Recognize the technical artifacts in doppler waveforms and adjust equipment settings as needed to eliminate error
5	Understanding the physiology of the cardiac cycle, of flow hemodynamics and vascular resistance

S.no	Contents	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Physics of doppler, optimizing colour and spectral doppler parameters		S		I		I
2	Doppler assessment of peripheral veins for thrombus		S		I		I
3	Doppler assessment of varicose veins and venous insufficiency		S		I		I
4	Doppler assessment of peripheral arteries of the lower limb		S		I		I
5	Doppler assessment of peripheral arteries of the upper limb		S		S		I
6	Doppler ultrasound assessment of arterial emergencies		S		I		I
7	Doppler assessment of iliac vessels		S		I		I
8	Carotid and vertebral artery sonography, assessment of plaque, stenosis, occlusion		S		I		I
9	Transcranial Doppler Study		S		I		I
10	Ultrasound evaluation before and after temporary hemodialysis access		S		I		I
11	Ultrasound assessment for hemodialysis access – fistula mapping, AV fistula assessment		O		S		I
12	Ultrasound assessment during and after Aortic and peripheral intervention		O		S		S
13	Ultrasound assessment of the abdominal aorta, and splanchnic vessels, assessment following endovascular aortic aneurysm repair		O		S		S
14	Ultrasound assessment of native renal vessels		S		I		I

15	**Ultrasound assessment of the hepatic vasculature, portal vein doppler**		S		I		I
16	**Doppler assessment of the male genitalia, penile artery doppler**		O		S		S
17	**Doppler assessment of the uterus and ovaries**		O		S		I
18	**Doppler evaluation of organ transplants**		O		S		S

Competency Based Structured Curriculum for Nuclear Medicine
Basics / CORE - Y 1

S.no.	Topics
1	**To understand the basic principles of atomic and nuclear physics including the basic atomic structure, principles of radioactivity and basic of radioactive decay**
2	**To describe the basic physical principles of nuclear medicine imaging technology, including gamma cameras, single photon emission computed tomography (SPECT), positron emission tomography (PET)**
3	**To understand the basic physical principles of hybrid imaging, including PET-CT, SPECT-CT, and MR-PET**
4	**To understand safety aspects in nuclear medicine, including patient dosimetry, staff dosimetry, contaminationmonitoring, choice of equipment, quality control and safety/risk management, Storage and drug handling**
5	**To understand standardized uptake values (SUV)**
6	**To perform radiopharmaceutical administration of common isotope imaging studies**

S. no	Contents	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Bone Scan		O		S		I

2	Thyroid Uptake Scan		O		S		I
3	V/Q Scan		O		S		I
4	GI Bleed scan		O		O		S
5	Renal: DTPA / MAG 3		O		S		I
6	Renal: DMSA		O		S		I
7	Liver Sulphur colloid / RBC Scan for Hemangioma		O		O		S
8	MIBG / OCTREOTIDE		O		O		S
9	Cardiac (including performing exercise and pharmacological stress tests under supervision – also expect correlation of at least 2 cases with an anatomical modality such as CTCA or Catheter Angiography)		O		S		I
10	Sentinel lymph node mapping		O		O		S
11	White Cell / Gallium		O		O		I
12	CT/PET – NSCLC, Colorectal Cancer, Lymphoma, head and neck tumours		O		S		I
13	Paediatric Nuclear Medicine, ESP Renal, (obstruction, infection, reflux) bone, (fracture, non-accidental injury, infection) Liver,-biliary atresia versus neonatal hepatitis		O		S		I
14	Miscellaneous Nuclear Scintigraphy in Neurology and other systems		O		O		S
15	Therapy-Iodine 131 for thyrotoxicosis or thyroid cancer		O		O		S
16	Strontium for palliation of bony metastases		O		O		S

OBSTETRICS CURRICULUM

NO	CONTENT	I YR		II YR		III YR	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Evaluation of fetal anatomy in first trimester		S		I		I
2	Determination of site of implantation, number of pregnancies		S		I		I

3	**Determination of gestational sac size using first trimester biometry**		**S**		**I**		**I**
4	**Ultrasound evaluation of suspected pregnancy failure**		**S**		**I**		**I**
5	**Ultrasound evaluation of fetal aneuploidy in first and second trimester**		**O**		**S**		**I**
6	**Fetal biometry and growth**		**I**		**I**		**I**
7	**Ultrasound evaluation of fetal central nervous system**		**O**		**S**		**I**
8	**Ultrasound evaluation of fetal face and neck**		**O**		**S**		**I**
9	**Ultrasound evaluation of musculoskeletal system**		**O**		**S**		**I**
10	**Ultrasound evaluation of fetal thorax**		**O**		**S**		**I**
11	**Ultrasound evaluation of fetal heart**		**O**		**S**		**I**
12	**Us evaluation of fetal GIT and anterior abdominal wall**		**O**		**S**		**I**
13	**Ultrasound evaluation of fetal Gut**		**O**		**S**		**I**
14	**USG evaluation of fetal syndromes**		**O**		**O**		**S**
15	**USG evaluation of hydrops fetalis**		**O**		**S**		**I**
16	**USG evaluation of gravid cervix**		**S**		**I**		**I**
17	**USG evaluation of placenta, membranes, umblical cord**		**S**		**I**		**I**
18	**Amniotic fluid volume in fetal health and disease**		**I**		**I**		**I**
19	**Role of doppler sonography in obstetrics**		**S**		**I**		**I**
20	**Ultrasound evaluation of retained product of conception**		**I**		**I**		**I**
21	**Ultrasound evaluation of fetal procedures**		**O**		**O**		**S**

GYNAECOLOGY

No.	**CONTENT**	**YI**		**YII**		**YIII**	
		No.	**O/S/I**	**No.**	**O/S/I**	**No.**	**O/S/I**
1	**Normal anatomy of female pelvis**		**I**		**I**		**I**
2	**Abnormal uterine bleeding**		**I**		**I**		**I**
3	**Ultrasound evaluation of uterus, ovaries, fallopian tube**		**I**		**I**		**I**

4	**Sonographic imaging in infertility and associated production**		**S**		**I**		**I**
5	**Ectopic pregnancy**		**S**		**I**		**I**
6	**Role of imaging in urogynaecology**		**S**		**I**		**I**
7	**Role of imaging in pelvic pain**		**S**		**S**		**I**

Competency Based Structured curriculum for Non Vascular Interventional Radiology postings

Basics - PGY 1

S.no.	Topics
1	Universal protocol in Interventional Radiology
2	CPR, Emergency drugs, Basic life support
3	Commonly used medications in Interventional Radiology
4	Drug administration for analgesia& anesthesia
5	Tumor Ablation techniques -the basics
6	Preprocedure and post procedure evaluation.
7	Percutaneous Interventions like FNAC
8	Infections control and sterile techniques
9	Manage patients drains e.g. monitoring output, skin care and exchange
10	Spinal Injections for pain control
11	Drainage of abscess

12	Instruments used in non Vascular Interventional Radiology,
13	Slide preparation and preservation

Gastro-Intestinal Radiology

S.no	Contents	PGY 1		PGY 2		PGY 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Nutrition support – gastrostomy/ gastrojejunal tube insertion		O		S		I
2	Management of nonvascular Luminal stenosis/ obstruction with stricturoplasty& stent insertion		O		S		I
3	Dilatation of benign strictures, achalasia		O		S		I
4	Drainage of fluid collections including ascites and abscess		S		I		I

Hepato-Pancreato-Biliary and Spleen

S.no.	Contents	PGY 1		PGY 2		PGY 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/O
1	Liver biopsy – percutaneous, plugged		O		S		I
2	Tumour ablation techniques		O		S		I
3	Drainage of liver / spleen abscess		S		I		I

Thoracic Radiology

S.no	Contents	PGY 1		PGY 2		PGY 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Drainage of fluid collection		I		I		I
2	Biopsy		O		S		I
3	Complex biopsy (including		O		S		S

	coaxial/plugged/ trans-visceral)						
4	Treatment of pneumothorax		I		I		I

Uro-radiology

S. no	Contents	PGY 1		PGY 2		PGY 3	
		NO.	O/S/I	NO.	O/S/I	NO.	O/S/I
1	Percutaneous nephrolithotomy		O		S		I
2	Management of urinary tract obstruction – nephrostomy and ureteric stents		O		S		I
3	TRUS Biopsy - Benign Prostate Hyperplasia& CA Prostate		O		S		I
4	Tumor ablation		O		S		S

Musculoskelatal Radiology

S.no.	Contents	PGY 1		PGY 2		PGY 3	
		NO.	O/S/I	NO.	O/S/I	NO.	O/S/I
1	Image Guided Bone Biopsy		O		S		I
2	Image Guided Aspiration of Joint Effusion / bone marrow		S		I		I
3	Image guided intra articular injections		S		I		I

Obstetrics and gynaecology

S.no.	Contents	PGY 1		PGY 2		PGY 3	
		NO.	O/S/I	NO.	O/S/I	NO.	O/S/I
1	Aspiration from ovarian cysts		I		I		I
2	Biopsy from gynecological maligancy		O		S		I
3	Trans visceral biopsy		O		O		S
4	Chorionic villous biopsies		O		S		I
5	Amniocentesis		O		S		I

6	Cord blood Analysis		O		S		S
7	Fetal Reduction		O		O		S

Interventional pain management

S.no.	Contents	PGY 1		PGY 2		PGY 3	
		NO.	O/S/I	NO.	O/S/I	NO.	O/S/I
1	Anatomy , Pharmacology and use of drugs		S		I		I
2	Nerve blocks and Neurolytic techniques		S		I		I
3	Facet joint, epidural and nerve root injection		O		S		I
4	Guided Lumbar Puncture		S		I		I
5	Vertebroplasty, Kyphoplasty		O		S		I

Competency Based Structured curriculum for Interventional Radiology

Intervention basic (I year)

1 Universal precautions, hand washing
2 CPR, emergency drugs, basic lie support
3 DSA principle, equipments
4 Needles, guide wire, catheter, embolic material
5 Vascular and biliary anatomy
6 Principles of Vascular access, Obtaining arterial and venous vascular access.
7 Basic angiogram /venogram techniques
8 Complications of angiogram techniques
9 Preprocedure and post procedure evaluation and management
10 foreign body retrieval

Head

Sno	Content	1 yr		2 yr		3 yr	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Cerebral angiogram		S		S		I
2	AVM		O		S		I
3	Aneurysm management		O		O		S

4	Thrombolysis and throbectomy		O		S		I
5.	Preoperative Embolization for tumor		O		S		I

Vascular intervention(peripheral vessels)

No	Contents	1 year		2 year		3 year	
		NO.	O/S/I	NO.	O/S/I	NO.	O/S/I
1	Lower limb arterial angiogram		S		I		I
2	Peripheral Vascular disease stricture and management		O		S		I
3	Femoral artery pseudo aneurysm and management		O		S		I
4	Popliteal pseudo aneurysm and management		O		S		S
5	Lower limb venogram		S		I		I
6	Lower limb venous malformation		S		I		I
7	Embolisation of aneurysm		O		S		I
8	Thrombolysis		O		S		I
9	AV fistula, basics of hemodialysis		S		I		I
10	AV fistulogram, AV plasty		O		S		I
11	Lymphangiogram (if available)						
12	Sclerotheraphy for cystic hygroma		S		I		I
13	Evaluation of thoracic outlet syndrome		O		S		I
14	Percutaneous sclerosant injection		O		S		I
15	Varicose veins – endothermal ablation		O		S		I

Neck

S No	Content	1st year		2nd year		3rd year	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Carotid artery angiogram		S		I		I
2	Pre operative embolization for JNA		O		S		S

3	Procedure for chemodectoma		O		O		S
4	Lymphangiogram		O		S		I
5	Cystic hygroma sclerosant injection		S		I		I

Chest intervention

S No	Content	1yr		2yr		3yr	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Bronchial artery embolisation Anatomy, technique, indication, complication		O		S		I
2	Thoracic aortogram		S		S		I
3	Cavogram to demonstrate SVC IVC narrowing and collaterls in SVC IVC obstruction		S		I		I
4	Pulmonary AVM		O		O		S
5	Pulmonary thrombectomy		O		O		S
6	Aortic aneurysm and intervention		O		O		S
7	Aortic dissection and repair		O		O		S

Abdomen

S No	Content		1yr		2yr		3yr
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Hepatic angiogram		S		I		I
2	Biliary Intervention PTBD, biliary stenting, appropriate needles and catheters		O		S		I
3	TIPS, DIPS, BRTO,Trans jugular biopsy		O		S		S
4	Portal vein Embolisation,		O		S		S
5	IVC gram, IVC filter		O		S		I
6	GIT bleed, pseudo aneurysm intervention		O		O		S
7	Tumour Embolisation, TACE, Tare, Raf, CRYO, absolute alcohol		O		O		S

Obstetrics and gynaecology

S No	Content	No.	1yr	No.	2yr	No.	3yr
		No.	O/S/I	No.	O/S/I	No.	O/S/I

1	Uterine artery embolisation		S		I		S
2	Ovarian and pelvic vein embolisation		O		S		S

COMPETENCY BASEDSTRUCTURED CURRICULUM FOR CT (COMPUTED TOMOGRAPHY)

BASICS – CORE - Y 1

S.NO	TOPICS
1	BASIC IMAGINING PRINCIPLES OF CT
2	CONTRAST MEDIA USED IN CT
3	OPTIMISING IMAGE ACQUISITION – IMAGING PROTOCOLS

CT - BRAIN

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Imaging anatomy, vasculature and normal anatomical variants of CT brain		I		I		I
2	Imaging features on CT and differential diagnosis of stroke, haemorrhage, and other vascular lesions of the brain		S		I		I
3	Imaging diagnosis of skull trauma and its neurological sequelae.		S		I		I
4	Imaging features and differential diagnosis of white matter disease, inflammation and degeneration.		O		S		I
5	Diagnosis of benign and malignant tumours of the brain.		O		S		I
6	Cerebral angiogram - reporting of AVM, aneurysm		O		S		I

CT – HEAD AND NECK

S.NO	TOPICS	Y 1	Y 2	Y 3

		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Basic anatomy of temporal bone, facial skeleton, skull base and cranial nerves, orbit and visual pathways, sinuses, pharynx, oral cavity ,larynx ,neck, mandible, teeth and temporomandibular joints, salivary glands ,deep spaces of the face and neck, thoracic inlet and brachial plexus, thyroid gland and parathyroid glands		I		I		I
2	Imaging features of maxillofacial and neck trauma including vascular injury and its sequelae		S		I		I
3	Imaging features and differential diagnoses of paranasal sinus pathology		S		I		I
4	Neck imaging including embryology and congenital cystic lesion, the clinical significance of lymph nodes, metastatic, inflammatory, and infectious disease &non-nodal masses of the neck.		S		I		I
5	Thyroid imaging including congenital lesions, inflammatory lesions, benign thyroid masses & malignancies of the thyroid gland		S		S		I
6	Imaging features and pathologies of parathyroid gland – (4D CT)		O		S		I
7	Imaging features of pathological conditions affecting oral cavity, pharynx, larynx, salivary glands.		S		S		I
8	Temporal bone imaging including fractures, inflammatory disease &tumors of the temporal bone.		S		S		I
9	Imaging features of pathologies affecting orbits		O		S		I

CT - CHEST

S.NO	TOPICS	Y 1	Y 2	Y 3

		No.	O/S/I	No.	O/S/I	No.	O/S/I
1.	Anatomy of the respiratory system, heart and vessels, mediastinum and chest wall on radiographs, CT and MR.		I		I		I
2.	Imaging features of thoracic trauma including pneumothorax, hemothorax,pulmonary laceration & rib fractures		S		I		I
3.	Features on radiographs and CT and differential diagnosis of atelectasis, diffuse infiltrative and alveolar lung disease, airways and obstructive lung disease.		S		I		I
4.	Recognise solitary and multiple pulmonary nodules, benign and malignant neoplasms,		S		S		I
5.	Thoracic diseases in immuno-compromised patients and congenital lung disease.		O		S		I
6.	Pulmonary angiogram - disorders of the pulmonary vascular system and great vessels		S		S		I
7.	Abnormalities of the chest wall mediastinum and pleura and including the post operative chest and trauma.		S		S		I

CT – CARDIAC

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Basics of cardiac CT including normal anatomy of heart and coronary vessels, incidental findings		O		S		I
2	Specialist CT – ECG gated cardiac CT, coronary calcium scoring, CT angiography		O		S		I
3	PET CT – malignancy / viability		O		O		I

CT - GIT

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal anatomy of the abdomen and the main variants including the internal viscera, abdominal organs,		I		I		I

	omentum, mesentery and peritoneum						
2	**Anatomy of the arterial supply and venous drainage, including important variants, of the various portions of the gastrointestinal tract.**		**I**		**I**		**I**
3	**Imaging features of abdominal trauma and acute conditions, including perforation, haemorrhage, inflammation, infection, obstruction, ischaemia, infarction, grading of acute pancreatitis and various forms of cholecystitis.**		**S**		**I**		**I**
4	**Imaging features of chronic liver disease, including portal hypertension.**		**S**		**I**		**I**
5	**Imaging features of peritoneum, mesentery and abdominal wall pathologies.**		**O**		**I**		**I**
6	**Imaging features of diverticulitis, inflammatory diseases, colon ischaemia and radiation-induced colitis**		**O**		**S**		**I**
7	**Imaging features in regard to the stage and extent of tumours, including features that indicate nonresectability and to differentiate primary and secondary tumours of the solid abdominal organs and gastrointestinal tract.**		**O**		**S**		**I**
8	**Post-procedure imaging related to previous treatment such as surgery or interventional radiology and post therapy evaluation of diseases.**		**O**		**S**		**I**
9	**Imaging features of major vascular abdominal lesions including arterial diseases, arterial, portal or hepatic venous obstruction and to understand their consequences**		**O**		**S**		**I**

CT – GUT

S.NO	**TOPICS**	**Y 1**		**Y 2**		**Y 3**	
		No.	**O/S/I**	**No.**	**O/S/I**	**No.**	**O/S/I**
1	**Knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of uronephrology, gynaecology and physiology of**		**I**		**I**		**I**

	renal excretion of contrast media						
2	Imaging features of calculus disease, urinary tract obstruction and reflux.		S		I		I
3	Imaging features of renal parenchymal diseases, including infection and renovascular disease.		S		I		I
4	Imaging features and differential diagnoses of tumours of urogenital tract.		S		S		I
5	Post operative imaging including renal transplant.		O		S		S
6	Imaging features of pathologies affecting uterus, ovaries, tubes including infertility imaging.		O		S		I

CT - MSK

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal anatomy of the musculoskeletal system including normal skeletal variants that mimic disease.		I		I		I
2	Imaging presentations of trauma involving the skeleton and soft tissue.		S		I		I
3	Imaging presentation of degenerative disorders, infection and inflammation of the musculoskeletal system.		S		I		I
4	Imaging manifestations of metabolic bone diseases		O		S		I
5	Imaging features of tumours of MSK		O		S		I

COMPETENCY BASEDSTRUCTURED CURRICULUM FOR MRI (MAGNETIC RESONANCE IMAGING)

BASICS- CORE – Y 1

S.NO	TOPICS
1	IMAGING PRINCIPLES OF MRI INCLUDING PULSE SEQUENCES
2	ARTIFACTS IN MRI
3	IMAGING PRINCIPLES IN MRA, MRV

4	CONTRAST ENHANCED MRI AND CONTRAST AGENTS USED

MRI – BRAIN

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal MRI anatomy of the brain and spinal cord including anatomical variants, congenital CNS lesions		S		I		I
2	Techniques of imaging brain in MRI – sequences used		S		I		I
3	Imaging features of intracranial neoplasms		O		S		I
4	Imaging features of infections and inflammation affecting brain and meninges		O		S		I
5	Imaging features of stroke and its prognostication		S		I		I
6	Imaging of cerebral aneurysms and cerebrovascular malformations		O		S		S
7	Imaging features of neurodegenerative disorders		O		S		S
8	Imaging features in MRI post trauma/ post surgery patients		S		I		I
9	MRI imaging of cranial nerves and their pathologies		O		S		I
10	Orbital pathologies on MR imaging		O		S		I
11	Functional MRI, DTI & spectroscopy		O		S		I
12	Imaging pathologies of non-brain structures covered in MRI brain		O		S		I

MRI - SPINE

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Imaging anatomy of spine, including normal variants and congenital malformations		S		I		I
2	Imaging in spinal cord injury		S		I		I

3	Imaging features of degenerative disorders of spine		O		S		I
4	Imaging features of infections and inflammations of spine		S		S		I
5	Finding in vascular lesions of spine and systemic diseases affecting spine		O		S		I
6	Imaging features of peripheral nerve lesions		O		S		I
7	Post operative spine imaging and MRI techniques used		O		S		I

MRI – BREAST

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal MRI imaging of breast and breast parenchymal - enhancement		S		I		I
2	Imaging features of breast pathologies		O		S		I
3	Imaging of post operative breast including implants		O		S		I
4	Multiparametric breast MRI including diffusion		O		O		S
5	Contrast kinetic curve		O		S		I

MRI – PELVIS

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Imaging anatomy of pelvic organs, compartments and boundaries in MRI		S		I		I
2	Imaging of ovarian, tubal, uterine, cervical, vaginal and vulval pathologies		O		S		I
3	Multiplanar imaging of pathologies affecting prostate and urinary bladder		O		S		I
4	Imaging features of pathologies affecting testes, scrotum and soft tissues		O		S		I

MRI - MSK

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Normal MSK anatomy in relevance to clinical radiology including normal anatomical variants		S		S		I
2	Imaging features of pathologies affecting shoulder, knee, ankle, wrist		O		S		I
3	Imaging features of MSK infections		O		S		I
4	Imaging features, tumour characterisation and staging of MSK tumours		O		S		I
5	Imaging features of vascular and hematological conditions		O		S		I
6	Imaging features of metabolic, endocrine and toxic disorders		O		S		I
7	Imaging features of congenital disorders of MSK		O		S		S

MRI - ABDOMEN

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	MRI anatomy of abdominal organs		S		I		I
2	Imaging features of liver pathologies on MRI and contrast imaging		O		S		I
3	MRCP – technique, indications, uses		S		I		I
4	MRI imaging of adrenals including chemical shift imaging		O		S		I
5	MRI imaging of focal and diffuse pathologies of spleen		O		S		I
6	MRI characterisation of anatomical variants, cysts and mass in pancreas		O		S		I
7	MR imaging of git including mr enterography, enteroclysis and defecography		O		S		S
8	Liver iron quantification and recent advances		O		O		S

CARDIAC MRI

S.NO	TOPICS	Y 1	Y 2	Y 3

		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Basic Cardiac MRI Imaging		O		S		I
2	MRI Specialist Tagged sequences, advanced post processing and quantitative techniques		O		O		S
3	Congenital Cardiac anomalies		O		S		I
4	Myocardial viability		O		S		I
5	MR Angiography and venography of peripheral vasculature		O		S		I

COMPETENCY BASEDSTRUCTURED CURRICULUM FOR FLUOROSCOPY

BASICS – CORE – Y 1

S.NO	TOPICS
1	CONTRAST MEDIA USED
2	REACTIONS OF CONTRAST MEDIA AND THEIR MANAGEMENT
3	TECHNIQUES OF FLUOROSCOPIC IMAGING

S.NO	TOPICS	Y 1		Y 2		Y 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Fluoroscopic imaging of gastrointestinal tract including barium swallow, meal, follow through, enema		S		S		I
2	Fluoroscopic imaging of genitourinary tract including IVU, MCU, AUG		S		I		I
3	Imaging of the hepatobiliary system including T tube cholangiogram, intravenous cholangiogram		O		S		I
4	Hysterosalpingogram		O		S		I
5	Fistulogram		S		I		I
6	Sinogram		S		S		I

7	**Sialography**		**O**		**S**		**I**

Competency Based Structured curriculum for Mammography

Basics / CORE - PGY 1

S.no.	Topics
1	Anatomy, changes with age and normal variations of Breast
2	Understand clinical presentation, pathogenesis and treatment of breast disease
3	Choosing the appropriate imaging examination
4	Mammography – Standard views, special views
5	Mammography – Image optimization, dose reduction

S.no	Contents	PGY 1		PGY 2		PGY 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Screening Mammograms		I		I		I
2	Diagnostic Mammograms		S		I		I
3	Localisation Procedures		S		I		I
4	Staging and Management of breast tumors, Participating in tumor boards, assessing tumor response.		O		O		S
5	Stereotactic techniques, CAD, Tomosynthesis		O		S		I

Structured Curriculum for Echocardiography

S.no	Contents	PGY 1		PGY 2		PGY 3	
		No.	O/S/I	No.	O/S/I	No.	O/S/I
1	Basics and Standard views		S		I		I
2	Interpreting pathological appearances, doppler flow assessment		O		S		I
3	Advanced cardiac ultrasound, stressed and non stressed echocardiography		O		O		S

MONTHLY POSTING ASSESSMENT

S.No	From	To	Speciality Posting	Performance Remarks	Signature

9: GUIDELINES FOR RECORDING THESIS/ RESEARCH / OTHER EDUCATIONL ACTIVITIES / RELATED FORMS

PLEASE FIND THE DETAILS UNDER FOLLOWING HEADINGS

- PERIODIC COMPETENCE ASSESSMENT EXAMS
- THEORY/ PRACTICALS/ VIVA /SPOTTERS/ DEMO
- CLINICAL AUDIT
- PRIZES, MEDALS AND AWARDS
- GRANTS RECEIVED FOR RESEARCH
- ADMINISTRATIVE / ORGANISATIONAL ACTIVITIES DURING RESIDENCY
- TEACHING EXPERIENCE
- JOURNAL CLUB
- CASE PRESENTATION
- PRESENTATIONS IN DEPARTMENT SEMINAR /
- GROUP DISCUSSION
- CLINICO RADIOLOGICAL MEETINGS/ MULTIDISCIPLINARY MEETINGS
- CONFERENCES AND CME
- RESEARCH PAPERS PUBLISHED IN INTERNATIONAL / NATIONAL JOURNALS

Dissertation:

Postgraduate research involvement has been part of the training program. All registrars are expected to complete a research project and submit their thesis before the end of 2 years. The postgraduate is expected to identify an area of research of personal interest, and working with a faculty mentor, is expected to develop, carry out, and complete a research project.

1. Every candidate pursing Degree course is required to carry out work on a selected research project under the guidance of recognised postgraduate teacher. The results of such works shall be submitted in the form a dissertation.

2. The dissertation is aimed to train a postgraduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data for critical analysis, comparison of result and drawing conclusions.

3. Chief guide will be from the department of Radio-diagnosis while co-guides will be from either the department of Radio-diagnosis or other discipline related to the dissertation topic.

4. Every candidate shall submit a thesis protocol to the Dean of the Institute in the prescribed proforma containing particulars of proposed dissertation work four

months from the date of commencement of the course. The thesis protocol shall be sent through the proper channel. Protocol in essence should consist of-

- Introduction and objective of the research project.
- Brief review of literature
- Suggested material and methods
- Bibliography

5. Such thesis protocol will be reviewed and the Institute will register the dissertation topic. No change in the dissertation topic or guide shall be made without prior approval of the Dean of the Institute.

6. Submission of thesis.

Thesis will be submitted at the end of two years

Thesis should consist of

- Introduction
- Review of Literature
- Aims and Objective
- Material and methods.
- Results
- Discussion
- Summary and Conclusions
- Tables
- Annexure
- Bibliography

1. Two copies of Dissertation thus prepared shall be submitted to the Dean, six months before the final examination.

2. Two external examiners appointed by the Institute shall value the dissertation.

Approval of dissertation work is an essential precondition for candidate to appear in the final MD examination.

Dissertation is graded as follows:

- -Highly Commendable
- -Commendable
- -Satisfactory
- -Rejected

THESIS TOPIC:

THESIS PROTOCOL:

PRESENTATIONS:

FEED BACK:

THESIS GUIDES:

EXTERNALAPPRAISER:

SUPERVISOR:

DATE	THESIS REVIEW	FACULTY

DISSERTATION

TOPIC:

AIM:

METHODOLOGY:

ANALYSIS:

CONCLUSION:

Signature of Guide **Signature of HOD**

RESEARCH PAPERS PUBLISHED IN INTERNATIONAL / NATIONAL JOURNALS

S.NO	TITLE	AUTHORS	JOURNAL	PAGE NO/ ISSUE/YEAR

Signature of
Professor

CONFERENCES AND CME

S.NO	DATES	CONFERENCE/ COURSE	VENUE	DELEGATE/ PRESENTED PAPERS

CLINICO RADIOLOGICAL MEETINGS/ MULTIDISCIPLINARY MEETINGS

S.NO	TOPIC/TITLE	CONFERENCE	DATE	INTERNATIONAL/ NATIONAL/ STATE

PRESENTATIONS IN DEPARTMENT SEMINAR / GROUP DISCUSSION

S.NO	DATE	TOPIC	EVALUATION	FACULTY

CASE PRESENTATION

S.NO	DATE	DIAGNOSIS / CASE DISCUSSED	EVALUATION	FACULTY

JOURNAL CLUB

S.NO	DATE	TITLE OF JOURNAL	EVALUATION	FACULTY

TEACHING EXPERIENCE

S.NO	DATE	TOPIC	DURATION	COURSE - DRA/ MBBS / BSc/ MSc

ADMINISTRATIVE / ORGANISATIONAL ACTIVITIES DURING RESIDENCY

S.NO	ORGANISATIONAL ACTIVITIES	REMARKS

GRANTS RECEIVED FOR RESEARCH

S.NO	RESEARCH ACTIVITY	GRANTS RECEIVED	GRANTS FUNDED BY

PRIZES, MEDALS AND AWARDS

S.NO	DATE	PRIZE / MEDAL	EVENT

CLINICAL AUDIT

DATE	AUDIT REVIEW	FACULTY

PERIODIC COMPETENCE ASSESSMENT EXAMS
THEORY/ PRACTICALS/ VIVA /SPOTTERS/ DEMO

S.NO	DATE	SYSTEM	MARKS OBTAINED (OUT OF 100)	FACULTY SIGNATURE

10: MICR examination pattern – summary (refer to MICR exam overview March 2022 document)

BASIC LEVEL:(at the end of first year)
PART 1: Has two modules
Part 1A: Radiological anatomy
Part 1B: Radiological Physics

Module (1A):	**Radiological anatomy: Anatomy, variants and Embryology (relevant to radiology)**	**150 computer based questions**	**3hours**	**150 marks**
Module (1B):	**Radiological Physics: Imaging physics, Radiology, Imaging**	**200 computer based questions**	**3hours**	**200 marks**

PART 2A: CORE (Clinically Oriented Reasoning & Evaluation) (at the end of 2nd year)

PART 2A PAPER 1	**Neuroradiologyand spine, Head and Neck,Thoracic and Cardiovascular imaging**	**Variable**	**Approximately 2 hours**	**Variable**
PAPER 2	**GI, hepatobiliary genitourinary , male reproductive, MSK systems**	**Variable**	**Approximately 2 hours**	**Variable**
PAPER 3	**Fetal,female reproductive system,pelvis,**	**Variable**	**Approximately 2 hours**	**Variable**

	breast, pediatrics, drugs / contrast			
PART 2B SESSION 1	**Long cases Reporting Pattern: A brief clinical data will be provided. All cases to be attended.** **A case may have more than one modality and multiple images for analysis and interpretation.**	**10 cases Computer based.**	**2 hours**	**100 marks**
SESSION 2	**Essential Radiology reporting, Any plain Radiograph – normal and abnormal (30 to 40 questions); Trauma & Emergency imaging – Plain Radiograph, CT, MRI and Angio (10-20 questions)**	**50 cases Computer based**	**1 hour**	**50 marks**

PART 3:CERTIFYING EXAM (at the end of 3rd year/ MD/DNB FINAL YEAR COMPLETION CERTIFICATE mandatory prior to appearing for exam)

3A - segment **Skills / OSCE 6 stations**	**Station 1**	**Abdomen ultrasound**	**90 minutes**	**100 marks Stations 1-5 carry 15 marks each;** **Station 6 carries 25 marks**
	Station 2	**Obstetrics (any one case)**		
	Station 3	**Small parts including MSK (any one case)**		
	Station 4	**Biopsy, FNAC, vascular puncture skills**		
	Station 5	**Radiology equipment, interventional radiology Instruments, lines, tubes &hardware**		
	Station 6	**Non-interpretative skills* (see MICR overview document for details)**		

3 B - segment Case discussion / Viva	**Station 1**	**CVS +RS**	**Examined in person or online viva With supervision**	**30 minutes for each station = Total 2.5 hours**
	Station 2	**CNS +HN**		
	Station 3	**MSK + Breast/female pelvis**		
	Station 4	**GIT + URO (including male genital tract)**		
	Station 5	**Paediatric and Obstetrics,**		

Please read other related documents: MICR exam overview and MICR FAQ for registration process

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