1. Introduction:

The specialty of radiology has grown enormously over the last few decades, helped with the advent and the introduction of new diagnostic modalities, and also, with the development of sub-specialties. The Radiologists are expected to be trained both academically and practically and must understand research methodology and participate in research as well.

By ensuring full training and high standards, the Arab Board of Radiology & Medical Imaging will not only graduate competent radiologists capable of attending to the various diagnostic, therapeutic and research aspects of radiology practice, but also ensure that the manpower needs of the Arab countries are served within the cultural, ethnic and socio-economic frame of the Region.

The completion of recognized training and success at passing all parts of the exam will result in the award of the following qualification: The Diploma of the Arab Board of Radiology and Medical Imaging

2. Objectives of Training

2.1 - DEFINITION

Diagnostic Radiology is a branch of medical sciences concerned with the use of radiological and imaging techniques in the diagnosis and treatment of diseases.

2.2 - GENERAL OBJECTIVES

By completion of the educational program, the graduate physician will be competent to function as a specialist in Diagnostic Radiology. The physician will be able to advise on, supervise, and perform the imaging procedures to such a level of competence, and across a broad range of radiological practice, as to function as a consultant to referring general physicians and specialists.
Knowledge, technical skills, and communication skills are the three pillars on which a radiological career is built, and are all linked to an attitude to the practice of medicine which recognizes both the need to establish a habit of promoting a team approach to the provision of imaging services and continuous learning .
The radiologist is first and foremost a physician and is expected to uphold the professional ethical standards, maintain confidentiality and develop understanding of issues such as quality assurance, clinical governance and risk management as well as be aware of the local infection control requirement

2.3 - SPECIFIC OBJECTIVES

2.3.1 The trainee should:

- Understand the nature of formation of all types of radiological images, including physical and technical aspects, patient positioning and contrast media used.
- Know the theoretical, practical and legal aspects of radiation protection, and possible harmful effects of radiation.
- Understands and applies regulations of radiation protection that are relevant to his country of practice as well as the general internationally accepted principles such as ALARA
- Know human anatomy with emphasis on radiological applications both conventional and cross- sectional.
- Understand the multiple applications and uses of clinical radiology, including appropriate application of imaging to patients, importance of informed consent, complications of radiological procedures including reaction to contrast media and factors affecting film interpretation and differential diagnosis.
- Understand the fundamentals of quality assurance in radiology
- Understand the fundamentals of epidemiology, biostatistics and decision analysis.
- Show competence in technical and interpretative skills.
- Demonstrate the ability to manage the patient independently during a procedure, in close collaboration with a specialist or the referring physician. The radiologist should know when to discontinue the procedure, or when to refer the patient to another physician
- Understand the likely outcomes of radiological investigations in both the normal situation and where pathology is demonstrated and have the ability to recognize unexpected findings and manage complications effectively.
- Understand the appropriate follow-up care of patients who have received investigations and/or interventional therapy.
- Develop and demonstrate a sound and systematic style of reporting.
- Show competence in effective consultation, conduction of clinico-radiological conferences, and the ability to present scholarly material and lead case discussions.
- Show evidence of scholarly activity through documentation of participation in research and attendance of scientific meetings

2.3.2 Training Regulations

This is a four years structured residency training program aimed at training the medical graduate to the level of specialist in radiology and medical imaging. The training will be conducted in centres recognized by the Arab Board of Radiology & Medical Imaging.

2.3.3 The Trainee

*A. **Basic Requirements:***

- The trainee should be a holder of a diploma in human medicine, M.D/M.B.Bch. or equivalent from a recognized medical school of any Arab country or from a medical school in any foreign country provided that this medical school is accredited by its country of origin and the accreditation is affirmed by the Arab Board regulations
- The trainee should have completed a minimum period of 12 months of internship.
- The trainee should be licensed to practice medicine by the appropriate licensing authority.
- The trainee is supposed to be a citizen of an Arab country and/or be able to read, write and speak the Arabic language.
- The trainee should be enrolled in an approved training program.
- The trainee shall duly complete and sign the registration form and affirm it by the appropriate authority.
- The trainee shall comply with any other requirements which may be introduced by the Arab Board of Radiology & Medical Imaging in the future.

*B. **General Requirements:***

- The training is conducted only in the approved centres/hospitals
- The trainee shall work on a full time basis throughout the period of training. In compelling circumstances waiving this requirement and subsequent adjustment of the training period will be decided on a case-by- case basis
- The trainee shall participate in all academic and clinical activities of the department of Radiology in particular and make the effort to attend other relevant activities in the training centre.
- The trainee shall assume increasing responsibilities according to the level of training and attained competence.
- The trainee shall maintain proper professional standards in relations with patients, colleagues & technical, nursing and administrative staff.
- The trainees shall adhere to the standards of confidentiality and ethical practice required in their workplace.

*C. **Specific Requirements:***

The trainee is responsible for any patient examined in the Radiology Department with regards to the following points:

- **Check** the patient's file for clinical data, provisional diagnosis, laboratory investigations etc.
- **Ascertain** that full clinical history including all the radiological relevant data are available in the request form prior to any step in patients examination.
- **Assess** the requested radiological study to recommend the suitable preparation procedure.

- **Supervise**, assist, or perform the required radiological study including contrast media injection and patient's after care
- **Inspect** all radiological studies performed before the patient leaves the radiology department to ensure adequate and complete study
- **Provide** emergency reporting and prepare preliminary reports to be checked by the trainer.

D. ***Mandatory Requirements:***

- The trainee has to attend and participate in the cyclic academic and clinical activities of the radiology department. Attendance and participation must not be less than 80% of the total number of activities at any training rotation/period.
- The trainee has to keep a Log Book (electronic) record of all activities performed and learned during the training programme. Activities such as reporting may be entered in terms of sessional commitment. For practical procedures the activity should be dated and categorized as to whether it has been performed by the trainee him/herself or as an assistant or participant. The Log Book should be counter signed by the trainer at the end of each rotation and finally the completed Log Book shall be signed by the educational supervisor at the end of each academic year and at the end of the training.

3. Educational Supervisor

3.1 - Qualifications

- Radiologist with a higher qualification in Radiology being a holder of American Board, FRCR, ABRMI or equivalent.
- Of the rank of Consultant Radiologist.
- Has an experience of at least 5 years after the higher qualification.
- Should have a recognizable experience in teaching and postgraduate training.

3.2 - Responsibilities

- Monitoring of the training program and the trainees.
- Receive , assess and approve the periodic evaluation reports from the trainers
- Ensure the provision and regularity of the scientific training activities.
- Participate in and monitor training activities.
- Participate in the arrangements of the training courses and preparatory courses for the examinations.
- Inspect and approve the trainee's Log Book.
- Be accountable for the actual performance of the trainees
- Provide periodic evaluation reports of the trainee at the end of each academic year.
- Identify potential problems in trainee performance and perform counseling / take the necessary corrective steps

4. Trainer:

4.1 - Qualifications

- Achieved a high qualification In Radiology such as American Board, ABRMI or equivalent.
- Has an experience of at least 3 years after the higher qualification.
- Of the rank of Consultant Radiologist.
- Is employed on a full time basis , in the selected training hospital/ center

4.2 - Responsibilities and Duties of the Trainer

- Responsible for the actual performance of the trainee.
- Look after the trainee and give him/her the requirements of the training including technical experience with increasing responsibilities according to the trainee's abilities and progress.
- Responsible for approval of the holidays and leaves.
- Responsible for arranging the rotations for the trainees.
- Responsible for the preliminary approval of the trainee admittance to examinations.
- Organization and delivery of the training and educational activities in collaboration with the educational supervisor

5. Radiology training curriculum

By the end of training, trainees should have skills to apply practical knowledge and deep understanding of:

- The basic radiation physics and radiation safety
- The concepts and terminology of diagnostic and interventional radiology
- The role and usefulness of the various diagnostic and interventional techniques in all age groups
- The responsibilities of a radiologist to the patient, including the legal framework and necessity for informed consent
- The various types of contrast media, drugs (including intravenous sedation) and monitoring used in day to day radiological practice
- The indications, contraindications, doses (adult and pediatric) and the management of reactions and complications of contrast media and sedation drugs
- The principles of radiation protection and the legal framework for protection against ionizing radiation
- The safety requirements for radionuclide imaging
- The basic radiological and radiographic procedures
- The practice of clinical audit and risk management
- The principles of medical research
- The principles and practice of evidence based medicine as it applies to the radiology discipline

6. Skills

By the end of training trainees should be able to:

- Demonstrate safe radiological practice
- Interpret and formally report all core radiological procedures and Techniques performed during routine work
- Perform all routine radiological procedures
- Perform and report on call investigations appropriate to the level of training and to the level of provided supervision
- Attend and conduct clinico-radiological conferences and multidisciplinary meetings
- Participate in regular critical film review
- Use information technology within the library services and the Web to search for radiological literature
- Perform basic word-processing, and access computerized medical databases, electronic mail systems and the internet

7. Program Structure

The training combines theoretical and practical aspects in the form of didactic lectures, seminars, tutorials and one-to-one teaching & hands on training. For convenience, the curriculum will be divided into two "parts" however in practice the two "parts" will be followed in parallel

FIRST PART

(First year)

During this period the trainee is exposed to the basic radiological information essential to establish his career as a radiologist obtained mainly through lectures which should cover the following aspects:

- Physics.
- Radiological Anatomy.
- Radiological Techniques and Positioning.
- Image processing principles.
- Emergency and intensive care Radiology.
- Radiobiology, radiation Protection and dosimetry.

I. Radiology physics

The physical principles of Conventional Radiology. Ultrasound, Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Nuclear Medicine Imaging are included with emphasis on the effect of these principles on the quality of the generated images and the resultant diagnostic data.

a. **Conventional Radiology**

- Basic concepts:

  • Introduction to medical Imaging

- Radiation and the atom
- Interaction of radiation with matter
- Computers in medical Imaging

- Diagnostic radiology:
  - X- ray production, tubes, generators
  - Screen- film radiography
  - Film processing
- Fluoroscopy [Suites, equipment, modes of operation, image quality, radiation dose].
- Image quality [Contrast, resolution, noise, operating curves].
- Digital Radiography [Implementation, CR devices, image processing, patient's dose, contrast versus resolution in digital imaging].

b. **Image processing principles:**

The radiographic film, the film cassette,intensifying screens & film screen combination, the processing machines and techniques, Digital processing, film criticism, and common faults and film artefacts

c. **Nuclear Medicine**

- Radioactivity and nuclear transformation
- Radionuclide production and Radiopharmaceuticals
- Radiation detection and measurements [Types of detectors, counting statistics].
- Nuclear imaging [Scintillation cameras, computers,..]
- Emission Tomography
- SPECT
- PET

d. **Computerized Tomography**

- Basic principles
- Geometry and Historical Development
- Detectors and Detector Arrays
- Details of Acquisition
- Tomographic Reconstruction
- Digital Image Display
- Radiation Dose
- Image Quality
- Artifacts

e. **Ultrasonography**

- Characteristics of Sound
- Interaction of Ultrasound with Matter
- Transducers
- Beam Properties

- Image Data Acquisition
- Two- Dimensional Display and Storage
- Image Quality and Artifacts
- Doppler Ultrasound & color Doppler
- System Performance and Quality Assurance
- Acoustic Power and Bioeffects

f. **Magnetic Resonance Imaging**

- Magnetization Properties
- Generation, Detection and localization of MR Signal
- Pulse Sequences, Spin Echo, Inversion Recovery, Gradient Recalled Echo
- Signal from Flow and MR angiography
- Perfusion and Diffusion Contrast
- Magnetization Transfer Contrast
- K- space Data acquisition and image reconstruction
- Three- Dimensional Fourier transform image acquisition
- Image characteristics
- Artifacts
- Instrumentation
- Safety and Bioeffects

g. **Mammography**

- X- ray Tube design
- X- ray Generator and phototimer system
- Compression, scattered Radiation, and magnification
- Screen- film cassettes and digital mammography
- Ancillary procedures [Stereotactic breast biopsy & localization]
- Radiation Dosimetry
- Regulatory requirements [Accreditation, Quality assurance]

II. **Radiological positioning and techniques**

- Radiography of different anatomic regions in the human body (Skull, Spine, Chest, Abdomen and pelvis, Upper and Lower limbs,...) is outlined with detail of the exposure factors and accurate positions of each anatomic part
- The current radiological techniques for conventional radiology and imaging including patient preparation, examination technique, and contrast material used, patient after care and the possible complications of each technique as well as management of these complications.
- Contrast media: Types (positive, negative), chemical components, indications and contraindications for use, reactions to certain types and management of these reactions

III. **Radiological Anatomy**

Anatomy as demonstrated on the radiological and imaging procedures including conventional radiography, contrast studies, US, CT and MRI. The anatomic regions of interest should

cover:

- The skull and its contents including the brain and cerebral vessels, skull base, pharynx and temporal bones
- The face and facial bones, orbits , sinuses , jaws & salivary glands
- The neck, thyroid, larynx & extra cranial vessels
- The spine, spinal cord and meninges
- The musculoskeletal system including bones ,joints, ligaments and muscles
- The heart and great vessels
- The chest including lungs, mediastinum and chest wall
- The gastrointestinal system including solid organs [liver, spleen, pancreas] as well as the oesophagus , stomach , bowel and biliary tree
- The genitourinary system [Kidneys, ureters, urinary bladder, prostate, seminal vesicles, uterus and adnexa]
- The peripheral vessels and lymphatics of the upper and lower limbs
- The breast

IV. **Radiobiology (Radiation protection, dosimetry and biology)**

❖ Radiation Protection

- Sources of exposure to ionizing radiation
- Radiation detection equipment in radiation safety
- Radiation protection and exposure control
- Personnel Dosimetry
- Regulatory agencies and radiation exposure limits

❖ Radiation Dosimetry of the Patient

- X- ray Dosimetry
- Radiopharmaceutical dosimetry: The MIRD method [Medical Internal Radiation Dosimetry]

❖ Radiation Biology

- Interaction of radiation with tissue
- Cellular radiobiology
- Response of organ systems to radiation
- Acute radiation syndrome
- Radiation- induced carcinogenesis
- Hereditary effects of radiation exposure
- Radiation effects in-utero

Basic Radiology (Theoretical & Didactic)

FIRST PART

i. <u>Physics :</u> Approved physics course to be introduced to cover physics, radiobiology and radioisotopes

1) General X-Ray:

- A basic knowledge of physics
- Fundamentals of nuclear physics and general properties of radiation
- Production of X-Ray and their properties
- Interaction of X-Ray & Gamma Ray with matter
- Measurement of X-Ray & Gamma Ray quantity, scintillation counter andthermoluminescence dosimeter and absorbed dose
- X-Ray equipment construction (filter,grid,etc.)
- Physical aspect of radiography, fluoroscopy, image intensifier television, flat detectors
- Types of medical films
- Types of intensifying screens
- Image artifacts
- Computers in radiology (P A C S)

2) Nuclear Medicine:

- Basic principles
- Radiopharmacology
- Dose Calibrator
- Equipment
- Emission Tomography
- Data display.

3) Computerized Tomography:

- Basic principles
- Equipment
- Image reconstruction and display

4) Ultrasonography:

- Basic principles
- Interaction of ultrasound with matter
- Transducers
- Pulse echo system
- Gray-scale system
- Doppler system

5) Magnetic Resonance Imaging:

- Basic principles
- Imaging sequences
- Artifacts

ii. <u>Radiobiology :</u>

- General effect of irradiation
- Effect of irradiation on intrauterine development
- Pre-implantation period
- Period of major organogenesis
- Fetal period
- Protection of the patient in diagnostic radiology
- Health effects of ionizing radiation
- Radiation dose from diagnostic radiology
- Absorbed dose in body tissues
- X-Ray examination of women
- ALARA principle & avoidance of unnecessary dose
- Quality control

iii. <u>Radio-isotopes in diagnosis :</u>

- Preparation of radioactive tracer
- Patient preparation - Data acquisition
- Body systems:bone,renal, cardiac, endocrine ….etc.

iv. <u>Radiological Anatomy :</u> (16 hours)

- Musculo-skeletal (4hours)
- Mediastinum, lung(2hours)
- Gastrointestinal tract (2 hours)
- Nervous system (3 hours)
- Urogenital tract (1 hour)
- Cardio vascular system (1 hour)
- Soft tissues (e.g. Thyroid, breast, etc) (2 hours)
- Obstetrics & Gynecology (1 hour)

v. <u>Radiographic Positioning &Technique :</u> (6 hours)

- Radiographic positions of different body parts
- Appropriate selection of X-Ray equipment and suitable photographic methods
- Exposure factors

vi. Contrast Media: (2 hours)

Types, administration, contra indication, complications & management.

vii. Imaging Procedures: (10 hours)

- Basic procedures in different body systems. (6 hours)
- Interventional radiology (1hour)
- Emergency and intensive care radiology (2 hours)
- Miscellaneous (1hour)

Recommended Books for first year topics:

- Imaging Atlas of Human Anatomy.4th Edition. Jamie Weir, Peter Abrahams, Jonathan D Spratt & Lonie Salkowski, Eds. Mosby Elsevier, 2011
- The Essential Physics of Medical Imaging.3rd Edition. Jerrold T Bushberg, J Anthony Seibert, Edwin M Leidholt& John M Boone, Eds . Wolters Kluwer-Lippincott Williams & Wilkins, 2011
- Farr's Physics for Medical Imaging. 2nd Edition. Penelope Allisy-Roberts & Jerry Williams. Elsevier Mosby, 2007
- A Practical Guide to Special Techniques in Diagnostic Radiology.2nd Edition. Nabil Khattar, S. N, 2004
- Radiologic Science for Technologists: Physics, Biology and Protection. 10th Edition. Stewart C Bushong, Elsevier, 2012
- Clark's Positioning in Radiography. 12th Edition. A Stewart Whitley, Charles Sloane, Graham Hoadley, Adrian D Moore & Chrissie W Alsop. Taylor & Francis, 2005
- Thomson Delmar Radiographic Positioning & Procedures Pocket Guide. 3rd Edition. Richard Carlton, Joanne S Greathouse& Arlene McKenna Adler . Cengage, 2014
- Anatomy for Diagnostic Imaging. 3rd Edition. Stephanie Ryan. Saunders Elsevier, 2010
- Chapman &Nakielny's Guide to Radiological Procedures. 6th Edition. Nick Watson. Saunders Elsevier, 2013

SECOND PART

In each rotation the trainee is expected to acquire knowledge in the subject of the rotation as detailed. The knowledge is expected to translate into competencies in the understanding, interpretation and performance of various imaging and invasive procedures. These competencies will be assessed throughout the training period by the trainers and training supervisors and also the examination at the end of training

Multidisciplinary approach to patient management and medico-legal and quality assurance are subjects inherent to all rotations

I. Breast Imaging

❖ **Specific knowledge**

By the end of training, the trainee should have adequate practical knowledge and deep understanding of:

- The breast anatomy and clinical conditions relevant to clinical radiology
- The radiographic techniques employed in diagnostic mammography
- The principles of current practice in breast imaging and breast cancer screening
- The proper application of other imaging techniques (ultrasound, CT scan, magnetic resonance imaging and radionuclide imaging)

❖ **Skills**

- Report and interpret mammograms demonstrating common breast disease
- Perform ultrasound of the breast

❖ **Subjects to be covered:**

- The anatomy and physiology of the breast
- The pathology of benign and malignant breast conditions
- The epidemiology of breast cancer
- The principles of population screening for breast cancer
- The principles of mammographic technique and factors affecting quality
- The technique of breast ultrasound and factors affecting quality
- The technique of scintimammography and sentinel node imaging
- Magnetic resonance imaging of the breast
- Digital imaging of the breast and factors affecting image quality
- The indications, contraindications, limitations and complications of each imaging techniques.
- The basics of management of breast disease.
- Local, national and international imaging guidelines.

❖ **Advanced skills (In case of subspecialization)**

- Use MRI in diagnosing and managing breast diseases
- Perform the following procedures:
    - Cyst aspiration
    - Ultrasound guided and stereotactic fine needle aspiration cytology, localizationand core biopsy
    - Mammographic and US guided localization for biopsy and treatment
    - Mammographic surgical specimen localization

❖ **Recommended Reading:**

- Diagnostic Imaging: Breast. 2nd Edition. Wendie Berg, Wei Tse Yang. Amirsys, 2013
- Teaching Atlas of Mammography. 4th Edition. Laszlo Tabar, Peter B Dean &Tibot

Tot. Thieme, 2011

- Breast Imaging.3rd Edition. Daniel B Kopans. Lippincott Williams & Wilkins, 2006

II. Cardiac Imaging

❖ Specific knowledge

By the end of training, the trainee should have adequate practical knowledge and deep understanding of:

- The cardiac anatomy and clinical practice relevant to clinical radiology
- The manifestations of cardiac disease demonstrated by conventional radiography
- The applications of the following techniques in the field of diagnostic cardiology:
  - Echocardiography (including trans-esophageal)
  - Radionuclide investigations
  - CT cardiac imaging
  - Cardiac MRI
  - MDCT coronary angiography

❖ Skills

- Interpret and report plain radiographs performed to show cardiac disease and postoperative appearances
- Interpret common and relevant cardiac conditions demonstrated by computed tomography and magnetic resonance imaging
- Interpret MDCT coronary angiograms
- Interpret and report nuclear medicine cardiac studies

❖ Subjects to be covered:

- The anatomy, normal variants and physiology of the central cardiovascular system
- The pathological processes of benign and malignant conditions involving the central cardiovascular system
- The techniques of cardiac imaging using:
  - Plain films
  - Ultrasound/echocardiography
  - CT and CT angiography
  - MR and MR angiography
  - Radionuclide radiology
- The indications, contraindications, limitations and complications of each imaging technique

III. Gastrointestinal Radiology

❖ **Specific knowledge**

By the end of training, the trainee should demonstrate adequate practical knowledge of:

- The gastrointestinal and biliary anatomy and related clinical practice relevant to clinical radiology
- The radiological manifestations of disease within the abdomen demonstrated by: conventional radiography, contrast studies (including Barium studies and ERCP), ultrasound, computed tomography, magnetic resonance imaging, radionuclide investigations and angiography
- The applications, contraindications and complications of relevant interventional procedures

❖ **Core skills**

- Interpret and report plain radiographs
- Perform and report the following contrast examinations:
  - swallow and meal examinations
  - small bowel studies
  - enema examinations
- Perform and report abdominal ultrasound examinations
- Supervise and report computed tomography of the abdomen , CT angiography and virtual endoscopic studies
- Supervise and report MRI of the abdomen
- Perform Ultrasound or CT-guided biopsy and drainage procedures
- Appropriately perform the following techniques:
  - Sinogram
  - Sialogram
  - GI motility studies
- Recognize the current applications of radionuclide investigations in the following areas:
  - Liver
  - Biliary system
  - Gastrointestinal bleeding
  - Assessment of inflammatory bowel disease
- Identify the applications of angiography and vascular interventional techniques in the GI system
- Identify the relevant applications of percutaneous hepatic & biliary interventional procedures

❖ **Subjects to be covered:**

- The anatomy, normal variants and pathophysiology relevant to GI and hepatobiliary systems
- The pathology of benign and malignant conditions of :
  - the gastrointestinal tract
  - the hepatobiliary system
  - the pancreas and spleen
- The epidemiology of GI, hepatobiliary and pancreatic diseases

- The principles of population screening for colorectal cancer
- The techniques of GI, hepatobiliary and pancreatic imaging using:
    - Plain films
    - Contrast studies
    - Ultrasound
    - CT
    - MR
    - Radionuclide imaging
- The indications, contraindications, limitations and complications of each imaging techniques

❖ **Recommended Reading:**

- Diagnostic Imaging : Abdomen. 2nd Edition. Michael Federle. Amirsys, 2009
- CT & MRI of the Abdomen and Pelvis : A Teaching File. 3rd Edition. Pablo B Ros&Koenraad J Mortele, Eds. Wolters Kulwer- Lippincott Williams & Wilkins, 2013

IV. Head and Neck/ ENT/ Dental Imaging

❖ **Knowledge**

By the end of training, the trainee should have adequate practical knowledge of:

- The head and neck anatomy relevant to clinical practice in radiology
- The manifestations of ENT/dental diseases as demonstrated by conventional radiography, relevant contrast examinations, ultrasound, CT and MRI
- The application of ultrasound to neck structures as a tool of diagnosis
- The application of head and neck radionuclide investigations including PET

❖ **Skills**

- Perform and report ultrasound examinations of the neck
- Perform image-guided FNA of thyroid & lymph node masses
- Supervise and report computed tomography of the head and neck for ENT pathology
- Supervise and report computed tomography for orbital pathology
- Supervise and report magnetic resonance imaging of the head and neck problems
- Interpret radionuclide thyroid investigations

❖ **Subjects to be covered:**

- The anatomy, normal variants and pathophysiology relevant to head and neck radiology
- Head and neck pathology
- The techniques of head and neck imaging using:
    - Plain films
    - Ultrasound
    - CT
    - MRI

- Contrast studies
- Radionuclide imaging including PET

- The indications, contraindications, limitations and complications of each imaging method

❖ **Recommended Reading :**

- Diagnostic Imaging: Head & Neck.2nd Edition. H RicHarnsberger Ed.,Amirsys, 2010
- Diagnostic Imaging of the Head &Neck : MRI with CT & PET Correlations. Anton N Hasso. Wolters Kluwer- Lippincott Williams & Wilkins, 2011

V. Musculoskeletal Imaging

❖ **Knowledge**

By the end of training, the trainee should demonstrate adequate practical knowledge of:

- Musculoskeletal anatomy relevant to clinical practice and the normal variants
- The manifestations of musculoskeletal diseases as demonstrated by conventional radiography, CT, MRI contrast examinations, radionuclide investigations and ultrasound

❖ **Skills**

- Supervise and report CT and MR examinations of the musculoskeletal system
- Perform and interpret ultrasound examinations of the musculoskeletal system
- Use appropriately relevant contrast examinations including arthrographic techniques

❖ **Subjects to be covered:**

- The anatomy, normal variants and pathophysiology relevant to musculoskeletal radiology
- Diseases of the musculoskeletal system
- The techniques of musculoskeletal imaging using plain film radiography, ultrasonography, computed tomography, magnetic resonance imaging, radionuclide imaging and fluoroscopic procedures including arthrography
- The indications, contraindications , limitations and complications of each imaging method

❖ **Recommended Reading:**

- Fundamentals of Skeletal Radiology, 4th Edition. Clyde A Helms. Elsever Saunders, 2013
- Orthopedic Imaging, A practical approach, 6th Edition. Adam Greenspan & Javier Beltran. Wolters Kluwer, 2014
- Diagnosis of Bone and Joint Disorders, 4th Edition. Donald L Resnick. W.B. Saunders , 2002
- Orthopedic Radiology, 2ndEdition, Barbra Weissman. W.B. Saunders 2002
- MRl in Orthopedic & Sports Medicine. 3rd Edition. David S Stoller Ed.. Wolters Kluwer- Lippincott Williams & Wilkins. 2007

- Arthritis in Black and White, 3rd Edition. Ann C Brower Donald Fleming. Elsevier, 2012
- Imaging of Arthritis and Metabolic Bone Disease. Barbara Weissman. Elsevier Health Sciences, 2009
- Metabolic Bone Disease. Rosenthal, D.I., In: The Radiologic Clinics of North America, volume 29, No.l, January 1991.
- Trauma Radiology Companion, Eric J Stern. Lippincott - Raven 1997.
- A-Z of Musculoskeletal and Trauma Radiology. James R D Murray, Erskine J Holmes & Rakesh R Misra. Cambridge University Press, 2008
- Radiology of Skeletal Trauma, 3rd Edition. Lee F Rogers. Elsevier Health Sciences, 2001
- MRI of the Musculoskeletal System. 6th Edition. Thomas H Berquist. Wolters Kulwer-Lippincott Williams & Wilkins, 2012
- Musculoskeletal Imaging: Case Review Series. 2nd Edition. Joseph Yu & Joseph S Yu. Mosby Elsevier, 2008

VI. Neuroradiology

❖ Knowledge

By the end of training, the trainee should demonstrate adequate practical knowledge of:

- Neuroanatomy relevant to clinical practice
- The manifestations of central nervous system disease as demonstrated on conventional radiography, CT, MRI, Nuclear Medicine and angiography
- The applications, contraindications and complications of invasive neuro radiological procedures
- The applications of radionuclide investigations in neuroradiology
- The applications of CT , MRI and MR angiography in neuroradiology

❖ Skills

- Supervise and report cranial and spinal CT and MR examinations
- Interpret cranial and carotid ultrasound including Doppler
- Supervise and report imaging of the cerebrovascular MR and CT angiography
- Perform and interpret myelography

❖ Subjects to be covered:

- The anatomy, normal variants and physiology of the central and peripheral nervous systems , spine and spinal cord in adults and children
- The pathological correlation of diseases and variations of the CNS, and manifestations in the various imaging modalities
- The full range of currently used diagnostic and therapeutic techniques including conventional radiography, CT, MRI including MR spectroscopy, functional imaging, angiography, ultrasound, myelography and nuclear medicine including SPECT and PET
- The currently used interventional techniques, their indications, contraindications,

limitations and complications and protocols for use
- Patient safety and protection
- Fundamentals of quality assurance in neuroradiology

❖ **Recommended Reading:**

- Spinal Trauma- An Imaging Approach. Victor N Cassar-Pullicino& Herwig Imhof. Thieme, 2006
- Osborn's Brain. Anne G Osborn. Amirsys, 2012
- Handbook of Head & Neck Imaging, (2nd Edition). Rick Harnsberger. Mosby 1995
- Diagnostic Cerebral Angiography.2nd Edition Anne G Osborn. Lippincott - Williams & Wilkins 1999
- Magnetic Resonance Imaging of the CNS Disease. A Teaching File, 2nd Edition. Douglas H Yock. Mosby, 2002
- Clinical Neuroanatomy. 7th Edition. Richard S Snell. Wolters Kluwer-Lippincott Williams & Wilkins, 2010
- Magnetic Resonance Imaging of the Brain & Spine, 4th Edition. Scott W Atlas. Wolters Kluwer-Lippincott Williams & Wilkins, 2009
- Diagnostic Imaging : Spine . 3rd Edition. Jeffrey s Ross & Kevin R Moore. Amirsys, 2015
- Neuroradiology , The requisites. 3rd Edition. David M Youssem& Robert D Zimmerman. Mosby Elsevier, 2010

VII. Obstetric and Gynecological Imaging

❖ **Knowledge**

By the end of training, the trainee should demonstrate adequate practical knowledge of:

- Obstetric and gynecological anatomy relevant to clinical radiology
- The physiological changes affecting imaging of the female reproductive organs
- The changes in maternal and fetal anatomy during gestation
- The applications of US, CT and MRI in gynecological disorders and obstetrics

❖ **Skills**

- Perform and report ultrasound examinations in gynecological disorders, including possible complications of early pregnancy using both transabdominal and endovaginal techniques
- Observe, and preferably, perform obstetric US
- Supervise and report CT and MRI of gynecological disorder
- Understand fetal MRI
- Interpret angiography and interventional techniques in gynecological diseases & understand indications for intervention

❖ **Subjects to be covered:**

- The anatomy, normal variants and pathophysiology relevant to the female genitourinary

system
- The pathological processes of the female genitourinary system
- The epidemiology of gynecological diseases
- The techniques of gynecological imaging including: plain film radiography, ultrasonography, contrast studies and fluoroscopic examinations of the genitourinary tract, computed tomography, magnetic resonance and radionuclide imaging
- The indications, contraindications, limitations and complications of each imaging method

❖ **Recommended Reading:**

- Ultrasonography in Obstetrics & Gynecology, 5th Edition. P W Callen, Ed. W.B. Saunders, 2007
- A Practical Guide to Ultrasound in Obstectrics and Gynecology.2nd Edition. Eric E Sauerbrei, Khanh Nguyen, & R L Nolan. Lippncott - Raven, 1997.
- Diagnostic Imaging of Fetal Anomalies. David A Nyberg, John P McGahan, Dolores H Pretorius & Gianluigi Pilu. Lippincott Williams & Wilkins, 2002
- Prenatal Diagnosis of Congenital Anomalies. Roberto Romero. Appleton & Lange, 2000
- Diagnostic Imaging: Obstetrics.2nd Edition. Paula J Woodward, Anne Kennedy, Roya Sohaey. Amirsys, 2011
- Diagnostic Imaging: Gynecology.2nd Edition. Akram M Shaaban, Ed. Amirsys, 2014

VIII. Oncological Imaging

❖ **Knowledge**

By the end of training, the trainee should demonstrate adequate practical knowledge of:

- The clinical oncological practice relevant to radiology
- Tumor nomenclature and staging
- The applications of ultrasound, radionuclide investigations, computed tomography, and magnetic resonance imaging, angiography and Interventional techniques in oncological imaging and staging, as well as treatment & monitoring the response of tumours to therapy
- The radiological manifestations of complications which may occur in tumour management

❖ **Skills**

- Perform and report investigations in oncological staging and monitoring the response of tumours to therapy including ultrasound, Computed tomography, magnetic resonance imaging and radionuclide investigations
- Perform image-guided biopsy of tumour masses using ultrasound or CT guidance

❖ **Subjects to be covered**

- The anatomy, normal variants and pathophysiology of the major tumour bearing

organs
- The oncologic staging systems
- The techniques of oncological imaging using plain film radiography, ultrasonography, computed tomography, magnetic resonance, Radionuclide imaging and fluoroscopic procedures
- RECIST &Cheson criteria
- The indications, contraindications, limitations and complications of each imaging method

IX. Pediatric Radiology

❖ Knowledge

By the end of training, the trainee should demonstrate adequate practical knowledge of

- Pediatric anatomy relevant to clinical radiology
- Disease entities specific to the pediatric age group and their clinical manifestations relevant to radiology
- Disease entities specific to the pediatric age group and their manifestations as demonstrated on conventional radiography, ultrasound, contrast studies, CT, MRI and radionuclide investigations
- Recognition of features of child abuse

❖ Skills

- Perform and report ultrasound studies in the pediatric age group
- Perform and report routine fluoroscopic procedures in the pediatric age group, particularly urinary tract and gastrointestinal systems
- Supervise and report computed tomography ,magnetic resonance imaging and radionuclide investigations in the pediatric age group

❖ Subjects to be covered

- The anatomy, normal variants, developmental abnormalities and relevant physiology in pediatric patients
- The pathological processes in the pediatric age group in the different body systems
- The techniques of imaging used in the wide variety of pathological processes occurring in the pediatric age group including digital radiography, ultrasonography, computed tomography, magnetic resonance, radionuclide imaging and fluoroscopic procedures
- The indications, contraindications, limitations and complications of each imaging method
- The principles and use of radiation dose reduction and radiation protection techniques
- Drug dose regimes used in diagnostic procedures
- Sedation issues in pediatric patients
- The medico-legal aspects of pediatric practice

❖ Recommended Reading:

- Teaching Atlas of Pediatric Imaging. Paul Babyn. Thieme, 2006

- Pediatric Imaging : Case Review Series. 2nd Edition. Thierry AGM Huisman. Mosby Elsevier, 2010
- Caffey's Pediatric Diagnostic Imaging. 12th Edition. Brain D Coley, Ed. Elsevier Saunders, 2013
- Pediatric Neuroimaging. 5th Edition. A James Barkovich& Charles Raybaud. Wolters Kluwer- Lippincott Williams & Wilkins, 2011

X. Thoracic Radiology

❖ Knowledge

By the end of training, the trainee should demonstrate adequate practical knowledge of

- Thoracic anatomy relevant to clinical radiology
- The manifestations of thoracic disease as demonstrated by conventional radiography and CT
- The applications of radionuclide investigations to thoracic pathology
- The applications, risks and contraindications of the technique of image guided biopsy of thoracic lesions

❖ Skills

- Supervise and report computed tomography examinations of the thorax including CT pulmonary angiography
- Observe and perform image-guided biopsies of lesions within the thorax

❖ Subjects to be covered:

- The anatomy, normal variants and pathophysiology relevant to respiratory system
- The pathological processes of both benign and malignant disease involving the thorax
- The epidemiology of lung diseases
- The principles of population screening for lung cancer
- The radiological techniques used in the staging and treatment of lung cancer
- The techniques involved in all imaging and procedures used in evaluating and treating thoracic diseases including digital radiography, ultrasonography, computed tomography, magnetic resonance, radionuclide imaging and fluoroscopic procedures
- The indications, contraindications, limitations and complications of each imaging method

❖ Recommended Reading:

- Thoracic Radiology, The Requisites. 2nd Edition. Theresa C. Mcloud, Mosby, 2010
- Chest Radiology, The Essentials, Jannette Collins and Eric J Stem, Wolters Kulwer-Lippincott Williams & Wilkins,2008
- Imaging of Diseases of the Chest. 5th Edition. David M hansell, David Lynch, H Page McAdams & Alexander A Bankier. Mosby Elsevier, 2009
- Thoracic Imaging. W Richard Webb & Charles B Higgins. Lippincott Williams &Wilkins, 2011
- High Resolution CT of the Lung . 4th Edition. W Richard Webb, Nestor L Muller & David P

Naidich, Lippincott Williams & Wilkins, 2014

- Chest Radiology: Plain film patterns and differential diagnosis. 6th Edition. James C Reed. Elsevier Mosby 2010
- Thoracic Imaging : Case Review Series. 2nd Edition. Thersea C McLoud Gerald F Abbott & Phillip M Boiselle. Mosby Elsevier, 2010
- Muller's Diseases of the Lung: Radiologic and Pathologic Correlations. 2nd Edition. Kyoung Soo Lee, Thomas Franquet, Joungho Han & Takeshi Johkoh. Wolters Kluwer-Lippincott Williams & Wilkins, 2011
- Chest Imaging Case Atlas. 2nd Edition. Mark S Parker, Melissa L Rosado-de-Christenson & Gerald F Abbott. Thieme, 2012

XI. Uroradiology

❖ Knowledge

By the end of training, the trainee should demonstrate adequatepractical knowledge of:

- Urinary tract anatomy relevant to radiological practice
- The manifestations of urological diseases as demonstrated on conventional radiography, ultrasound, CT and MRI
- The current applications of radionuclide investigations for imaging of renal function, vesico-ureteric reflux and staging of renal tumours
- The application of angiography and vascular interventional techniques

❖ Skills

- Perform and report the following contrast studies:
  - Intravenous urogram
  - Retrograde pyeloureterography
  - Nephrostogram
  - Ascending and micturatingcystourethrogram
- Perform and report transabdominal ultrasound of urinary tract pathology
- Supervise and report computed tomography of the urinary tract including CT angiography
- Observe and learn the performance of percutaneous nephrostomies
- Observe and learn drainage of renal abscesses and peri-renal collections
- Perform image-guided renal biopsy
- Supervise and participate in the interpretation of Magnetic Resonance Imaging applied to the urinary tract

❖ Subjects to be covered:

- The anatomy, normal variants and pathophysiology relevant to uroradiology
- The pathology and pathophysiology of diseases involving the urogenital system
- The techniques involved in all imaging and procedures used in evaluating and treating urogenital diseases including plain radiography, ultrasound, contrast studies, CT, MRI & radionuclide studies including PET
- Interventional techniques in the urogenital system. Indications & contraindications and

complications

❖ **Recommended Reading :**

- Genitourinary Radiology : The requisites. 3rd Edition. Ronald J Zagoria, Christopher M Brady & Raymond B Dyer. Elsevier, 2015
- Textbook of Uroradiology.5th Edition. Reed Dunnick, Carl Sandler & Jeffrey Newhouse. Wolters Kluwer-Lippincott Williams & Wilkins, 2012

XII. Vascular and Non-Vascular Interventional Radiology

❖ **Knowledge**

By the end of training, the trainee should demonstrate adequate practical knowledge of

- Vascular anatomy relevant to clinical radiology
- The indications, contraindications, pre-procedure preparation including informed consent, sedation and anesthetic regimens, patient monitoring during procedures and post procedure patient care
- Procedure and post-procedure complications and their management
- The appropriate applications of the following techniques:
    - Ultrasound including Doppler vascular studies
    - Computed tomography and CT angiography
    - Magnetic resonance imaging and MR angiography
    - Arterial catheterization and trans-arterial angioplasty and embolization techniques
    - Venous catheterization and trans –catheter embolization and stenting techniques and IVC filter placement

❖ **Skills**

- Supervise and report CT examinations of the vascular system (CTA) including image processing techniques
- Supervise and report MRI examinations of the vascular system (MRA)
- Perform and report venous and arterial color Doppler
- Perform simple arterial and venous punctures and selective catheterization
- Perform nephrostomy procedures
- Preform Simple musculoskeletal and pain management intervention
- Acquire Advanced Cardiac Life Support (ACLS) certification

❖ **Subjects to be covered:**

- The anatomy, normal variants and physiology of the appropriate vascular systems
- The current interventional equipment used including percutaneous Access needles and kits, catheters and guide wires, other devices, stents and embolization materials
- The full range of the currently used diagnostic and therapeutic techniques
- The indications, contraindications, limitations and complications of each method

❖ **Recommended Reading:**

- Interventional Radiology: A survival Guide. 3rd Edition. David Kessel & Iain Robertson. Churchill Livingstone, 2010
- Handbook of Interventional Radiological Procedures. 4th Edition. Krishna Kandarpa & Lindsay Machan. Wolters Kluwer-Lippincott Williams & Wilkins, 2010
- Vascular & Interventional Radiology :The requisites. 2nd Edition. John A Kaufman & Michael J Lee. Elsevier Saunders, 2013
- Image-Guided Interventions. 2nd Edition. Matthew A Mauro, Kieran PJ Murphy, Kenneth R Thomson, Anthony C Venbrux& Robert A Morgan. P A Saunders, 2014

XIII. Radionuclide Radiology

❖ **Knowledge**

By the end of training, the trainee should have adequate practical knowledge and deep understanding of:

- Computer image processing, tracer principles and techniques, radiation biology and protection, radiopharmacy and radiochemistry in relation to the applications of nuclear medicine data acquisition image processing and display
- The kinetics of radioactive tracers used in nuclear medicine
- The physiological principles of tracer techniques
- The calculation of the effective (ED) radiation dose from radiopharmaceuticals
- The necessary precautions for the safe handling of radiopharmaceuticals
- The diagnosis and treatment of radiation induced disorders
- The properties of commonly used diagnostic radionuclides
- The physiochemical and biological properties of different radiopharmaceuticals in routine clinical practice, clinical trials and under development
- The principles of SPECT
- The principles of Positron Emission Tomography (PET CT)
- Preparation of patients, precautions and complications
- The full range of radionuclide diagnostic techniques available including the indications, contra-indications, limitations and complications
- The legal and regulatory requirements for the practice of radionuclide Radiology in the workplace

❖ **Skills**

Interpret all radionuclide diagnostic imaging procedures in the following areas:

- Breast
- Chest
- Cardiac system
- Gastrointestinal system
- Cerebral system
- Head and neck

- Musculoskeletal system
- Oncology
- Pediatric imaging
- Urogenital radiology
- Endocrine diseases

❖ **Recommended Reading:**

- Diagnostic Imaging : Nuclear Medicine. Kathryn A Morton & Paige B Clark , Eds. Amersys, 2007
- Essentials of Nuclear Medicine Imaging. 6th Edition. Fred A Mettler Jr & Milton J Guiberteau . Elsevier, 2012
- Nuclear Medicine : The requisites. 4th Edition. Harvey A Ziessman, Janis P O'Malley& James Thrall. Elsevier, 2013
- Nuclear Medicine and PET/CT: Technology & Techniques. 7th Edition. Paul E Christian & Kristen M Waterstram-Rich. Elsevier, 2011

Second Part

The following is a suggested series of didactic lectures to cover the curriculum. The individual training centres may wish to adopt the list or modify it

1. Neuroradiology : (32 hours)

- Basic signs in Neuroradiology----------2h
- Imaging modalities in neuroradiology----------1h
- Physical principles of MR imaging----------1h
- Normal brain anatomy CT, MRI ----------1h
- Diagnosis of cerebrovascular stroke ----------2h
- Imaging of brain tumors ----------2h
- Intracranial infections----------1h
- Posterior fossa lesions ----------1h
- Intracranial vascular malformation ----------1h
- Intracranial cysts and calcifications ----------1h
- White matter diseases ----------2h
- Intracranial traumatic lesions ----------1h
- Advanced techniques, MDCT, MRA,MR Diffusion and perfusion studies----------2h
- Diagnostic value of neuro-MR spectroscopy ----------1h
- Congenital brain lesions---------- 2h
- Transcranial US----------1h
- Interventional neuroradiology----------1h

- Nuclear neuroradiology----------1h
- Normal anatomy of the spine by CT, MRI---------- 1h
- Imaging of degenerative spinal diseases----------1h
- Postoperative spine----------1h
- Diagnosis of spinal inflammatory disease----------1h
- Imaging of Spinal neoplasm ----------1h
- Traumatic lesions of the spine----------1h
- Spinal dysraphism ----------1h
- Spinal interventions----------1h

2. Head and Neck : (18 hours)

- Basic signs in head and Neck imaging ----------1h
- Physical principles of MRI in head and neck imaging----------1h
- Head and neck ultrasound ----------1h
- Imaging of maxillofacial trauma, CT----------1h
- Head and neck inflammatory diseases, CT, MRI----------1h
- Imaging of orbital pathology , CT, MR ----------1h
- Imaging anatomy & pathology of the petrous bones, CT, MRI----------1h
- Imaging of the parapharyngeal spaces CT, MRI----------2h
- Imaging of the tongue and mouth flour lesions CT, MRI----------1h
- Imaging of salivary glands, CT, MRI---------- 1h
- Imaging of mandibular pathology, CT, MRI ---------- 1h
- Imaging of sinonasal pathology CT, MRI ----------1h
- Imaging of larynx CT, MRI----------1h
- Imaging anatomy and pathology of the cervical lymph node diseases-----1h
- Thyroid and parathyroid anatomy and pathology----------1h
- Head and neck nuclear imaging ----------1h
- Head and neck interventional techniques----------1h

3. Musculoskeletal Radiology : (27hours)

- Basic Radiological signs of Musculoskeletal diseases----------2h
- Physical principles of musculoskeletal MRI ----------1h
- Diagnosis of skeletal trauma----------2h
- Bone and joint infections X ray, CT, MRI----------2h
- Imaging of bone tumors X ray, CT, MRI ----------3h
- Diagnosis of metabolic and endocrine bone disease----------2h
- Hematological bone disease X ray, MRI ----------1h
- Imaging of polyarthopathies ----------3h
- Musculoskeletal ultrasound ----------2h
- Musculoskeletal nuclear imaging ----------1h

Major joint MR imaging

Knee joint ----------2h

Normal anatomy

Ligamentous pathology, meniscal lesions

Synovial lesions, miscellaneous lesions

Shoulder joint ----------2h

Normal anatomy

Rotator cuff lesion, labral pathology

SLAP injuries, impingement syndrome.

Ankle joint ----------1h

Normal anatomy

Tendon pathology, ligamentous injuries

Bone marrow lesions and avascular necrosis

Wrist joint---------- 1h

Normal anatomy

Ligamentous pathology and TFCC injuries

Carpal and ulnar tunnel syndromes

Hip joint ---------- 1h

Normal anatomy

Avascular necrosis and migratory osteoporosis

Fractures and slipped epiphysis, labral injuries.

Elbow joint ---------- 1h

Normal anatomy

Ligamentous injury and nerve entrapment syndrome

4. Chest and Heart Radiology: (24 hours)

- How to interpret chest X rays, normal and pathology ----------1h
- Normal CT anatomy of the chest ---------- 1h
- Basic Pattern of common lung diseases ---------- 2h
- Diagnosis of focal lung disease, X ray and CT ---------- 2h
- Diagnosis of diffuse lung disease, X ray and HRCT----------2h
- Imaging of the pleural and chest wall pathology ----------1h
- Diagnosis of pulmonary vascular diseases ---------- 1h
- Imaging diagnosis and staging of lung cancer---------- 2h
- Diagnostic value of MRI in chest diseases---------- 1h
- Imaging of the mediastinum ---------- 1h
- Intensive care radiology ---------- 2h
- Imaging of pulmonary TB---------- 1h
- Interventional chest Radiology ---------- 1h
- Chest scintigraphy ---------- 1h
- Chest trauma ---------- 2h
- Imaging of air way disease ---------- 2h
- Imaging of pulmonary circulation ---------- 1h
- Principles and diagnostic values of echocardiography ----------1h

- Basics of MDCT coronary angiography ---------- 1h
- Principles of cardiac MRI ---------- 1h
- Nuclear cardiac imaging ---------- 1h
- Imaging of congenital heart diseases ---------- 2h
- Diagnosis of acquired heart diseases ---------- 1h
- Imaging of ischemic heart disease ---------- 1h
- Pericardial lesions and cardiomyopathies ---------- 1h

5. Gastrointestinal & Abdominal Imaging : (21 hours)

- Basic signs in Gastrointestinal and intestine imaging----------2h
- Diagnosis of hypo pharynx and esophageal pathology----------1h
- Imaging of stomach and duodenum ----------2h
- Diagnosis of small intestinal pathology---------- 2h
- Diseases of the colon ---------- 2h
- Abdominal ultrasound techniques ----------1h
- Hepatic imaging CT, MRI ----------2h
- Biliary and pancreatic imaging ----------2h
- Imaging of splenic pathology ----------1h
- Imaging of acute abdomen ---------- 2h
- Abdominal injuries---------- 1h
- Imaging of peritoneum and mesenteric pathology ----------1h
- Abdominal nuclear medicine----------1h
- Abdominal interventional techniques ---------- 1h

6. **Genitourinary Radiology: (17 hours)**

- Basic signs in Genitourinary diseases ---------- 2h
- Imaging of renal physiology and kinetics of contrast agents ----------1h
- MR-urography diagnostic value and physical principles----------1h
- Imaging of renal pathology----------2h
- Renal trauma ----------1h
- Imaging diagnosis and staging of urinary bladder neoplasms----------1h
- Imaging of the urethra ----------1h
- Imaging of the prostate US,CT, MRI----------3h
- Imaging diagnosis of male infertility ----------1h
- Imaging of the testis and scrotum ----------1h
- Urinary tract nuclear scintigraphy & PET----------1h
- Interventional uroradiology ----------1h
- Role of Imaging in renal transplantation ----------1h
- Imaging of the adrenal glands----------1h

7. **Cardio-Vascular and Interventional Imaging: (20 hours)**

- Head and neck vascular pathology

- Imaging of aortic lesions
- Pulmonary and bronchial arterial pathology
- Imaging of mesenteric vascular diseases
- Peripheral arterial and venous diseases
- Vascular aspects of male infertility
- Basics of vascular interventional radiology

8. Women Imaging: (13 hours)

- Basic signs in women imaging----------2h
- HSG Technique – indications – findings----------1h
- CT pelvis, anatomy and pathology----------1h
- Obstetrics and Gynecology US----------2h
- MR female pelvis and pelvic floor dynamics----------1h
- Osteoporosis pathophysiologyand DXA ---------- 1h
- Breast imaging and intervention ----------5h

9. Pediatric Imaging: (5 hours)

- Basic signs in pediatric imaging----------1h
- Common chest conditions in pediatrics----------1h
- Common gastrointestinal conditions in pediatrics.
- Intussusception reduction----------1h
- Common musculoskeletal anomalies & bone age ----------1h
- Common genitourinary conditions in pediatrics----------1h

TRAINING ROTATIONS

Below is a suggestion for periods of rotation across the training programme divided into yearly arrangements for illustration purposes. The proposed rotations for the first year should be followed as much as possible. The distribution of body sytsems within modality rotations is left for the individual training centres as it is perceived that modalityrotation identification would be simpler than system-based rotation. The total number of weeks of training for each specialty should be met by the end of the 4 years of training

First Year of Training

General X-Ray: 4 months

Fluoro : 1 month

CT: 1.5 months

MRI: 1 month

US: 2.5 months

IR: 0.5 month

NM: -

Pediatric: 0.5 month

Mammography: -

Total: 11 months

Emergency Room Radiology is required 30 days per year

The trainee should obtain Advanced Cardiac Life Support (ACLS) Certificate

Second-fourth years of training

General X-Ray: 6 months

Fluoro : 1 month

CT: 6 months

MRI: 5 months

US: 5 months

IR: 3 months

NM: 2.5 months (including PET)

Pediatric: 2.5 months

Mammography: 2 months

Total: 33 months

The CT rotation should include a minimum of 2 months of Neuro

The MRI rotation should include a minimum of 2 months of Neuro

Emergency Room Radiology is required at the rate of 30 days per year

Board Examination

I-First Part Exam

The exam is composed of two MCQ papers. Both papers test trainees' knowledge and problem solving skills in the following domains:

- Radiation physics
- Radiological anatomy
- Radiological positions and Techniques
- Image processing principles
- Nuclear medicine, radiobiology and radiation protection

The trainees are expected to sit the examination at the end of the first year of training. There will be a maximum of four attempts at passing the First Part Exam. Should the trainee fail to pass after exhausting all the attempts s/he will be asked to leave the radiology training programme

II-The Final Exam

The final certifying exam consists of written, film viewing and oral exams.

Trainees are allowed to sit for the second part exam after passing successfully the first part and after completion of the minimum requirement of four years in training .In addition, each candidate must submit his/hercompleted and locally approved log book for final assessment. The candidate's application should have been approved by the Training and Accreditation Committee of the Scientific Council upon receiving the following documents.

- Duly completed and approved application form for admission to the final exam
- Duly completed and approved Log Book fulfilling all the requirements of the training program.
- A confidential evaluation report from the educational supervisor in the training centre recommending the trainee to sit for the final exam.
- Duly paid examination fees as announced.

Each candidate has four chances to pass the exam. One more additional chance may be granted by the Scientific Council in special circumstances.

a-Written Exam (Part 2 A)

Part 2A exam is composed of two papers in MCQ format covering all the theoretical topics of the imaging curriculum. Each paper consists of 80 questions and is two hours in duration.

b-Film Viewing Exam (Part 2 B)

The date and place of this examination will be announced by the Examination Committee. Only successful candidates who pass the final written exam of Arab Board of Radiology & Medical Imaging will be permitted to appear for the practical and oral examinations. The exam consists of two components:

- The Short Cases where the trainee is exposed to 20 cases, each case represents a single pathology or normal variant. time : 20 minutes
- The Long Cases comprise 10 sets of radiological films, each set corresponds to a single case that is fully investigated radiologically. The candidate has to give a full radiological report on each case describing the technique, findings ,primary &differential diagnosis and management issues including interventional or surgical procedures when appropriate. Time : 7 minutes per case =70 minutes

The total time allowed for the two components is 90 minutes

c-Oral Exam

- This examination will follow the film viewing exam and consists of two parts, each 30 minutes in duration.
- Each session will be conducted by one pair of examiners, l5 minutes for each examiner.

Each candidate is allowed four chances to pass. One additional chance may be granted by the Scientific Council in exceptional circumstances. In case the candidate fails the four chances he has to sit the written part (Part 2 A) again and has two chances

The cases for the exam will be selected by the Examination Committee at least three months before the exam date

The candidate is expected to attain a passing grade in all three components of the part 2B exam and reach an overall passing grade as determined by the Examination Committee. A failure grade in any component will result in failure to pass the exam

SUGGESTED GENERAL REFERENCES

IN RADIOLOGY

- A Textbook of Radiology & Medical Imaging, 7th Edition. David Sutton Ed. Churchill Livingstone, 2003.
- Grainger & Allison's Diagnostic Radiology, 6th Edition .Andy Adam, Adrian K Dixon, Jonathan H Gillard & Cornelia Schaefer-Prokop, Eds. Elsevier Health Sciences, 2014
- Fundamentals of Diagnostic Radiology. 4th Edition. William E Brant & Clyde Helms, Eds. Wolters Kluwer-Lippincott Williams & Wilkins, 2012
- MRI in Practice. 4th Edition. Catherine Westbrook, Carolyn Kaut Roth & John Talbot. Wiley-Blackwell, 2011
- Radiology Review Manual. 7th Edition. Wolfgang Dahnert. Wolters Kluwer-Lippincott Williams & Wilkins, 2011

Web Sites to Search:

WWW.AUNTMINNIE.COM

WWW.RSNA.ORG

WWW.RADIOLOGY.RSNAJNLS.ORG

WWW.RADIOGRAPHIC.RSNAJNLS.ORG

WWW.MYSTATDX.COM

WWW.ACR.ORG

www.aapm.org/education/documents/Curriculum.pdf

www.radiologyebook.com