# M C P S

Membership of College of Physicians & Surgeons Pakistan

# DIAGNOSTIC RADIOLOGY

COLLEGE OF PHYSICIANS AND SURGEONS PAKISTAN

2021

**THIS IS AN EVOLVING DOCUMENT**

The College of Physicians and Surgeons Pakistan would appreciate any criticism, suggestions, advice from the readers and users of this document. Comments may be sent in writing or by e-mail to the CPSP at:

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# ABOUT THE COLLEGE

The College was established in 1962 through an ordinance of the Federal Government. The objectives/functions of the College include promoting specialist practice of Medicine, Obstetrics & Gynaecology, Surgery, Dentistry, and other specialties by securing improvement of teaching and training, arranging postgraduate medical, surgical and other specialists training, providing opportunities for research, holding and conducting examinations for awarding College diplomas and admission to the Fellowship of the College.

Since its inception, the College has taken great strides in improving postgraduate medical and dental education in Pakistan. Competency based structured Residency Programs have now been developed, along with criteria for accreditation of training institutions, and for the appointment of supervisors and examiners. The format of examinations has evolved over the years to achieve greater objectivity and reliability in methods of assessment. The recognition of the standards of College qualifications nationally and internationally, particularly of its Fellowship programmes, has enormously increased the number of residents, and consequently the number of training institutions and the supervisors. The rapid increase in knowledge base of medical sciences and consequent emergence of new subspecialties have gradually increased the number of CPSP fellowship disciplines to seventy five. After completing two years of core training during IMM, the residents are allowed to proceed to the advance phase of FCPS training in the specific specialty of choice for 2-3 years.

CPSP, in addition to its commitment for academic excellence, is also aware of its responsibility for providing mid-level specialist manpower in essential clinical and non-clinical subjects particularly for the district and other healthcare facilities. For this purpose it continues its twenty-two 2-year structured Membership programmes in clinical specialties and

2-year distance-based with face-to-face blended programmes in Health Professions Education and Health Care Systems Management.

**Prof. Zafar Ullah Chaudhry**
President
College of Physicians and Surgeons Pakistan.

## The College conducts MCPS examination in the following 22 disciplines:

1. Anaesthesiology
2. Clinical Pathology
3. Community Medicine
4. Dermatology
5. Diagnostic Radiology
6. Family Dentistry
7. Family Medicine
8. Forensic Medicine
9. Obstetrics &Gynaecology
10. Operative Dentistry
11. Ophthalmology
12. Oral Surgery
13. Orthodontics
14. Otorhinolaryngology
15. Paediatrics
16. Periodontology
17. Prosthodontics
18. Psychiatry
19. Pulmonology
20. Health Professions Education (HPE)
21. Military Medicine
22. Health Care System Management (HCSM)

# GENERAL REGULATIONS

Candidates are admitted in the residency programme and to the examination in the name (surname and other names) as given in the MBBS degree. CPSP will not entertain any application for change of name on the basis of marriage/ divorce / deed.

**ELIGIBILITY CRITERIA FOR INDUCTION IN MCPS**

- MBBS or equivalent qualification registered with the PMDC
- One year house job in an institution recognized by the CPSP.

**REGISTRATION AND SUPERVISION**

All training must be supervised and undertaken on whole time basis. The residents are required to register with the R&RC and submit the name of their supervisor. The supervisor will normally be a Fellow of the College. Only that training will be accepted which is done under a CPSP approved supervisor.
The residents are not allowed to work simultaneously in any other department/institutions for financial benefit and/or for another academic qualification.

**APPROVED TRAINING CENTERS**

Training must be undertaken on whole time basis in units, departments and institutions approved by the College. A current list of approved institutions is available from the College and its regional centres as well as on the College website: www.cpsp.edu.pk

**DURATION OF TRAINING**

The duration of training for MCPS is two years which must be completed including rotations, one month before the date of theory examination. MCPS examination is taken on completion of the specified training and other requirements.

**MANDATORY WORKSHOPS AND COURSE**

It is mandatory for all resident to attend the following CPSP certified workshops and present certificate of attendance before they are allowed to take the MCPS examination:

1. Introduction to Computer and Internet
2. Communication Skills
3. Basic Life Support (BLS) Course

Any other workshop/s as may be introduced by the CPSP.

**NOTE: 1)** The workshops are conducted by the Department of Medical Education and the candidates are advised to register online. The BLS course is conducted by the Advanced Skills Department (ASD) and the registration form is to be submitted with the ASD separately.

**2)** No candidate will be allowed to appear in examination without attending the abovementioned workshops and BLS course.

**E-LOG BOOK**

The CPSP council has made e-logbook system mandatory for all Residency programme residents inducted from July 2011. Upon registration with R&RC each resident is allotted a registration number and a password to log on and make entries of all work performed and the academic activities undertaken in e-logbook on a daily basis or within a week. The concerned supervisor is required to verify the entries made by the resident within a fortnight. Absence of record of entries on E-logbook for an entire quarter shall automatically de-register the candidate from the residency programme. This system ensures timely entries by the resident and prompt verification by the supervisor. It also helps in monitoring the progress of residents and the vigilance of the supervisors.

## COMPETENCY MODEL

The CPSP has moved to competency-based medical education and has developed its own competency model shown below:


With patient or population care as the pivotal center, the inner leaves of the model represent the five major competencies directly related to patient care, while the three competencies in the outer circle are mega-competencies related to patient care and also incorporate education, professionalism, leadership, advocacy and population health.

By the end of the Residency Programme, residents are expected to acquire these competencies and their constituent learning outcomes, and provide promotive, preventive, curative and rehabilitative patient-centered (or population-centered) care.

**Inner Leaves:**

1. Knowledge and Critical Thinking
2. Technical Skills
3. Communication Skills
4. Teamwork
5. Research

**Outer Leaves:**

6. Professionalism
7. Pedagogy
8. Advocacy

1. **Knowledge and Critical Thinking**

- Demonstrate application of wide and current readings to critical thinking and problem solving
- Relate the alteration of body function to the presenting condition
- Interpret and integrate history and examination findings to arrive at an appropriate provisional and credible differential diagnoses
- Sequentially order, justify and interpret appropriate investigations
- Apply knowledge and reasoning skills to
    - Analyze data for problem identification and to rule in and rule out contending conditions
    - Synthesize and evaluate solutions for decision-making in solving familiar and less familiar problems based on best current evidence
    - Prioritize different problems within a time frame.
    - Select, outline and provide, with evidence-based justifications, appropriate pharmacological and non-pharmacological management strategies
    - Assess new medical knowledge and apply it to resolve patient problems (Evidence-based practice)
    - Apply quality assurance procedures in daily work. (Pro fessionalism)
    - Demonstrate shared-decision-making with the patient or family
    - Provide cost-effective care while ordering investigations and in management
    - Use resources appropriately
    - Demonstrate awareness of bio-psycho-social factors in assessment and management of a patient

2. **Technical Skills**

- Obtain an accurate history with sensitivity
- Perform an accurate physical and mental state examination, even in patients with complex health problems involving multiple systems
- Demonstrate International Patient Safety Goals (IPSG)
- Demonstrate competent performance of all required technical skills and procedures in their specialty, including:

- Obtaining informed consent
- Preoperative planning
- Pre-interventional care and preparation
- Intra-Intervention technique including exposure and closure, global and task specific items, and communication and team skills
- Post-interventional care
- Follow-up care

**3. Communication Skills**

- Written Communication Skills
  - Maintain clear, concise, accurate and updated medical records
  - Write clear, focused, evidence-based and logical management plans and discharge summaries
  - Write respectful, clear and focused letters and referrals to other colleagues
- Verbal Communication Skills: Demonstrate
  - Effective interpersonal communication skills: clear, considerate and sensitive towards patients, their relatives, other health professionals and the public, and towards students
  - Non-verbal communication skills:
  - Empathy and respect towards patients and their relatives
  - Effective counseling of the patient and the family with cultural sensitivity: explain options, educate them and promote joint decision-making
  - Appropriate verbal and body language on the campus and all work situations including seminars, bedside sessions, outpatient sessions and others
  - Respect and tolerance for all health care professionals, including peers, juniors and seniors
  - Clear, focused and logical presentation of cases

**4. Teamwork**

- Demonstrate constructive team-communication skills
- Facilitate collaborative group interaction as a team member to build strong teams demonstrating respect, tolerance and interdependence
- Support other team members to grow
- Demonstrate willingness to assume responsibility and leadership as needed.

**5. Research**

- Interpret and use results of various research studies (critical appraisal)
- Conduct a research study individually or in a group by using appropriate
- Selection of research question(s) and objectives
- Research design and statistical methods to answer the research question
- Ethical and R&RC approval of the synopsis
- Demonstrate competence in academic writing by writing an appropriate dissertation and/or publishing research article(s) as a step towards resolving issues or concerns in their specialty
- Guide others in conducting research by advising about research methodology including study designs and statistical methods
- Demonstrate clear, focused and logical presentations of their research

**6. Professionalism**

- Demonstrate the highest level of personal integrity: honesty, punctuality, regularity, timely task completion
- Deal with all patients in a non-discriminatory, prejudice- free manner, demonstrating the same level of care for every human being irrespective of gender, age, ethnic background, culture, socioeconomic status and religion
- Establish a trusting relationship with patients, their relatives and care-givers
- Deal with all patients with honesty, empathy and compassion, putting patients' needs first (altruism)

- Facilitate transfer of information important for promotion of health, prevention and management of disease
- Encourage questioning by the patient and be receptive to feedback
- Pursue self-directed and life-long learning. Keep abreast of medical literature and assess new knowledge and apply it to resolve patient problems
- Know one's limitations and ask for help as needed from colleagues, consultations or referrals
- Apply quality assurance procedures for improvement in daily work
- Be a role model for others

**Ethics**
- Maintain patient autonomy by demonstrating shared-decision-making with the patient and/or family
- Obtain informed consent, maintain patient confidentiality and do no harm
- Provide cost-effective care while ordering investigations and in management and use resources appropriately

**Leadership**
- Demonstrate accountability for their decisions and actions, and that of their team
- Demonstrate willingness to assume leadership role(s) when needed in given situations or events (rush call/code).
- Change and bring about change as necessary, as a leader or supportive leader

**7. Pedagogy**

Should be able to demonstrate competence in teaching skills:
- Effective clinical/community-based teaching
- Some evidence of acquisition of theory regarding learning and education
- Practice some of the best teaching methods

**8. Advocacy**

Advocacy is needed at multiple levels

- Advocacy for the Patient
  - Doctors and nurses are the advocates of the patients, otherwise patients are likely to be lost in the system All care should be timely, putting patients first

- Advocacy for the Practice
  - Working in a service or practice, doctors must highlight limitations and issues
  - They must identify solutions for the problems, and recommend and implement improvements for the practice(s) and institutional system(s)

- Advocacy for the Health System and Society
  - Know one's role in the Health System(s) and build strong referral systems
  - Keep patient and community interests paramount, above one's own personal or professional interest
  - Demonstrate advocacy for elimination of the social determinants of health
  - Demonstrate advocacy for prevention of serious illnesses of their specialty/sub-specialty

- For the Profession
  - Strive for building trust in the public for your profession
  - Demonstrate improvement and enhancement of profession, specialty and sub-specialty
  - Be conscientious gate-keepers of their profession, specialty and subspecialty
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## CURRICULUM: AIMS AND OBJECTIVES

The aim of the residency training programme in Diagnostic Radiology is to prepare mid-level radiologists to provide authentic radio-imaging facilities for our population and manage a radiology departments particularly in secondary care centers. The radiologists produced will be able to:

- Justify imaging protocols according to clinical presentation
- Manage the problem in a cost effective manner
- Be an effective team player, leading the team if necessary
- Communicate effectively with:
  - Patients and their attendants with empathy and compassion, in interviewing, counseling, breaking bad news, behavioural modification and shared decision making, recognizing the impact of the condition on the patients and their families
  - Seniors, peers, juniors, learners and other health professionals;
- Demonstrate risk analysis and emphasis on prevention
- Ensure patient safety
- Write appororiate reports of imaging, describing the pathology corelating it with clinical presentation and giving apporopriate diagnoses/differential diagnosis and recommend further steps and management
- Keep up to date and practice evidence based medicine
- Demonstrate putting patients first
- Demonstrate honesty, integrity and timeliness (punctuality and task completion)
- Establish, organise and plan teaching and research programmes as training supervisor

## SYLLABUS

### RADIOLOGICAL PHYSICS

By the end of two years the resident understands and is able to describe the following:

### STRUCTURE OF ATOM, ELECTROMAGNETIC RADIATION, AND PARTICULATE RADIATION

**Fundamental Knowledge:**

- Components of the atom.
- Energy levels, binding energy, and electron transitions in an atom.
- Nucleus of an atom, its properties, how these properties determine its energy characteristics, and how changes within the nucleus define its radioactive nature.
- Atom and how its electron/nuclear structure and associated energy levels define its radiation-associated properties.
- Different transformation ("decay") processes within the nucleus of an atom, determine the type of radiation produced and the classification of the nuclide.
- Wave and particle characteristics of electromagnetic (EM) radiation.
- EM radiation spectrum and the properties associated with energy and the ability to cause ionization.
- Different categories and properties of particulate radiation.

### INTERACTIONS OF IONIZING RADIATION WITH MATTER

**Fundamental Knowledge:**

- Charged particles interaction with matter and the resulting effects these interactions can have on the material.
- Processes by which x-ray and g-ray photons interact with individual atoms in a material and the characteristics that determine which processes are likely to occur.
- Photons and charged particles are attenuated within a material and the terms used to characterize the attenuation.

**Clinical Application:**

- Which photon interactions are dominant for each of the following imaging modalities:
  Mammography, projection radiography, fluoroscopy, CT, and various nuclear medicine radioactive isotopes
- How image quality and patient dose are affected by these interactions?
- Which x-ray beam energies are to be used with intravenous iodine and oral barium contrast agents?
- How the types of photon interactions change with energy and their associated clinical significance?
- Why charged particle interactions may result in a high localized dose?

## RADIATION UNITS

**Fundamental Knowledge:**

- Two different systems for units of measurement (i.e., SI and traditional) used to describe physical quantities.
- SI and traditional units for measuring the ionization resulting from radiation interactions in air (e.g., exposure-related quantities).
- Concepts of dose-related quantities and their SI and traditional units.

**Clinical Application:**

- Appropriate use or applicability of radiation quantities in the health care applications of imaging, therapy, and safety.

## X-RAY PRODUCTION

**Fundamental Knowledge:**

- Two mechanisms by which energetic electrons produce x-rays and the energy distribution for each mechanism of x-ray production.
- Function of the cathode and anode of an x-ray tube and how variations in their design influence x-ray production.
- Technique factors used in diagnostic imaging kV, mA, exposure time, mAs.

- Attributes of an x-ray beam, including the functions of filtration, spectrum of energies produced, and beam restriction.
- Heel effect and how it can be used to improve clinical radiographs.

**Clinical Application:**
- X-ray tube design, target material, tube voltage, beam filtration, and focal spot size are optimized for a specific imaging task (e.g., mammography, interventional imaging, or CT).

## BASIC IMAGING

**Fundamental Knowledge:**
- Common descriptive statistics (e.g., mean, variance, etc.) used in the radiology literature.
- Metrics and methods used to measure image quality and assess imaging systems.
- Characteristics of a display and how they interact with the human visual system to impact perceived image quality.
- Basic concepts of image processing and image archiving.

**Clinical Application:**
- Assess the validity of the type of statistical analysis used in the radiology literature.
- Evaluate how display, ambient lighting, and luminance affect reader performance.
- Develop custom hanging protocols for display of images.
- Display the understanding of quality control.
- Demonstrate the DICOM standard.

## BIOLOGICAL EFFECTS OF IONIZING RADIATION

**Fundamental Knowledge:**

- Describe the cell cycle, and discuss the radio-sensitivity of each phase.
- Discuss how the dependence of cell survival is related to LET.
- Define the principles of how radiation deposits energy that can cause biological effects.
- Explain the difference between direct and indirect effects, how radiation affects DNA, and how radiation damage can be repaired.
- Compare the radio-sensitivities of different organs in the body.
- Understand the thresholds for deterministic effects, ncluding cutaneous radiation injury, cataracts, sterility, and whole-body acute radiation syndromes.
- Explain the risk of carcinogenesis due to radiation.
- Understand the latencies for different cancers.
- Describe the effect of radiation on mutagenesis and teratogenesis.
- List the most probable in utero radiation effects at different stages of gestation.
- Describe the different dose response models for radiation effects.
- Recognize the risk vs. benefit in radiation uses, and recognize the information sources that can be used to assist in assessing these risks.

**Clinical Application:**

- The risks to patients from high-dose fluoroscopy regarding deterministic effects, such as cutaneous radiation injury and cataractogenesis, and the importance of applying radiation protection principles in clinical protocols to avoid damage.
- The risks to the female breast (including age dependence).
- And counsel a pregnant woman on the potential radiation risks to the fetus.
- The effects of massive whole-body irradiation and how it is managed.

## RADIATION PROTECTION AND ASSOCIATED REGULATIONS

**Fundamental Knowledge:**

- Understands the Statutory Requirements and Non-Statutory Recommendations-International Commission on Radiological Protection (ICRP) & Pakistan Nuclear Regulatory Authority (PNRA) regulations
- Identify the sources of background radiation and the contribution from each source.
- State the maximum permissible dose equivalent limits to the public and radiation workers.
- Identify the advisory bodies, accrediting organizations, and regulatory organizations for radioactive materials and radiation-generating equipment, and recognize their respective roles.
- Define the principles of time, distance, shielding, and contamination control in radiation protection.
- Define ALARA and its application in radiation protection.
- Identify the methods used to monitor occupational exposure.
- Discuss appropriate equipment used to monitor radiation areas or contamination.

**Clinical Application:**

- Understand the safety considerations for patients and staff, including pregnant staff.
- Use knowledge of radiation effects in triaging patients during a radiological emergency.
- Discuss the contributions of medical sources to the collective effective dose.
- Define the responsibilities and qualifications of an authorized user (all categories).
- Define the responsibilities and qualifications of a radiation safety officer.
- Explain the types of occupational radiation protection equipment available.
- Understand the importance of applying radiation protection principles in clinical protocols.
- Understand the best use of gonad shielding and breast shields for patients.

- Describe the requirements for wipe tests and contamination surveys.
- Provide clinical examples that demonstrate ALARA principles.
- Differentiate between controlled and uncontrolled areas.
- Discuss the appropriate written instructions provided to breast-feeding patients receiving a nuclear medicine study.

## X-RAY PROJECTION IMAGING CONCEPTS AND DETECTORS

**Fundamental Knowledge:**

- Describe the fundamental characteristics of all projection imaging systems that determine the capabilities and limitations in producing an x-ray image.
- Review the detector types used to acquire an x-ray image. Describe how radiation is detected by each detector type and the different attributes of each detector for recording information.

**Clinical Application:**

- Describe how variations in the projection imaging system affect the image.
- Describe how each detector type influences image quality.

## GENERAL RADIOGRAPHY

**Fundamental Knowledge:**

- The components of a radiographic imaging system.
- And list the factors affecting radiographic image quality.
- How the geometric features of a general radiographic system affect the resulting image
- the different types of acquisition systems used in general radiography
- The basic imaging requirements for specific body parts or views acquired in general radiography
- The entrance skin exposure and how it relates to patient dose.

**Clinical Application:**

- Develop appropriate technique factors used in common radiographic procedures.
- Analyze the radiation dose from a medical procedure, and communicate the benefits and risks to the referring physician.
- Understands the impact of collimation on image processing
- Understands the factors determining the appropriate use of grids for different radiographic exams

## MAMMOGRAPHY

**Fundamental Knowledge:**

- The unique features of mammography tubes and how they affect the x-ray spectrum produced.
- The automatic exposure control (AEC) performance
- The benefits of breast compression
- The magnification techniques
- The characteristics of the different detectors used in digital mammography.
- The breast radiation dosimetry.
- The requirement for facility and physician certification under Mammography Quality Standards Act (MQSA), accreditation, and their effects on image quality and dose.

**Clinical Application:**

- Describe appropriate uses of the different targets and filters available in mammography systems.
- Associate image quality changes with radiation dose changes (with and without magnification).
- Be familiar with the QA/QC requirements of MQSA for digital mammography
- Understand the mechanism of breast tomosynthesis.
- Discuss risk-benefits analysis of mammography with referring physicians and patients.

## FLUOROSCOPY AND INTERVENTIONAL IMAGING

**Fundamental Knowledge:**

- Basic components of a fluoroscopic system
- How the geometric features of a fluoroscopic system contribute to the resulting image
- Features of image intensifier (II) systems used for fluoroscopy
- Features of flat-panel detector systems used for fluoroscopy
- Different operating modes used in fluoroscopy imaging
- Components that determine image quality in a fluoroscopy system
- Basic image processing methods used in fluoroscopy, and describe how they are used clinically
- Various clinical applications of fluoroscopic and interventional radiology systems
- Factors that affect patient dose during a fluoroscopic or interventional procedure
- Concepts of exposure and how patient radiation dose is estimated in fluoroscopy and interventional procedures
- Artifacts that can occur with image-intensified and flat-panel fluoroscopy systems
- PNRA regulations regarding fluoroscopy output rate and potential skin injury

**Clinical Application:**

- Differentiate among the various image acquisition parameters used in specific clinical applications of fluoroscopy and interventional radiology.
- Describe where the operator should stand to minimize personnel dose when performing an interventional fluoroscopy procedure with the C-arm positioned laterally.
- Describe optimal geometry when positioning patients for fluoroscopy procedure.
- Discuss radiation safety considerations and methods to modify a procedure to minimize the dose for operators.
- Describe the clinical equipment settings which can be implemented to minimize patient peak skin dose in fluoroscopy and interventional radiology.

- Describe how peak skin dose varies from pediatric to bariatric patient sizes.

## COMPUTERIZED TOMOGRAPHY (CT)

**Fundamental Knowledge:**

- Major components of a CT system
- Differences between axial and helical scanning
- Difference between reconstructing and reformatting an image
- How dose modulation affects patient dose
- Image acquisition parameters, and explain how each affects CT image quality
- How a CT image is formed
- Hounsfield unit
- Image characteristics of CT to projection radiography
- The concepts of CT dose index (CTDI), dose-length product (DLP), and Size-specific dose estimate (SSDE)
- Reconstruction kernel selected affects image quality
- Common artifacts, their causes, and methods to minimize these
- Relationship between contrast resolution and radiation dose and the effect of imaging parameters on both
- Over-beaming and over-ranging and how each affects patient dose
- Advantages and disadvantages of iterative reconstruction
- Differences between prospective and retrospective cardiac CT
- Dual-energy CT and its application

**Clinical Application:**

- Typical CT numbers for tissues such as air, water, fat, blood, brain, and bone
- Modes of CT operation and their clinical applications
- Retrospective versus prospective CT gating would be used
- How iterative reconstruction affects image quality and the potential implications for acquisition technique
- Radiation dose to patients and personnel during CT procedures

## ULTRASOUND

**Fundamental Knowledge:**

- Common terms of sound wave propagation and ultrasound interactions with matter
- Basic design of ultrasound transducers, and explain the principles of beam formation
- Different types of array transducers
- Function of commonly used settings on an ultrasound system
- Principle of real-time pulse-echo imaging
- Definitions of axial, lateral, and elevational (along Y-axis) resolution, the factors affecting spatial and temporal resolution, including multiple focal zones
- Identify common artifacts seen in ultrasound
- The Doppler principle and its applications in various Doppler imaging modes
- Aliasing and other Doppler-related artifacts
- Principles of advanced ultrasound technologies, such as harmonic imaging, extended field of view, compound imaging, and 3D/4D ultrasound
- Mechanisms for producing ultrasound bio effects, and describe the significance of the parameters mechanical index and thermal index

**Clinical Application:**

- Discuss the appropriate use of different type and frequency transducers for clinical applications.
- Describe how to adjust scan parameters to optimize image quality for different clinical applications.
- Describe the advantages and disadvantages of using advanced ultrasound technologies, such as harmonic imaging, extended field of view, compound imaging, and 3D/4D ultrasound.
- Identify common artifacts in ultrasound and their causes.
- Discuss the different modes of Doppler ultrasound and when they can be appropriately used.
- Discuss risks versus benefits of using ultrasound in various clinical areas, especially in obstetrics.

## NUCLEAR MEDICINE

**Fundamental Knowledge:**

- Structure of matter, modes of radioactive decay, particle and photon emissions, and interactions of radiation with matter
- Instrumentation, major components, and principles of operation for instruments commonly used for detecting, measuring, and imaging radioactivity
- Radionuclide production and the principles of radiochemistry
- Common radionuclides and their characteristics, such as energy, half-life, and modes of decay
- Commonly used radiopharmaceuticals, indications for use, and appropriate adult and pediatric dosages
- The methods of determining organ dose and whole body dose to patients
- Radiopharmaceutical bio-distribution and the impact on radiation dose and risk
- Required radiation protection practices for implementing laboratory tests, diagnostic imaging procedures, and therapeutic applications of radiopharmaceuticals

**Clinical Application:**

- Compare ideal characteristics of imaging versus therapeutic radiopharmaceuticals.
- Determine the radiopharmaceutical activity administered to adults and pediatric patients for various imaging procedures.
- Describe common nuclear medicine image artifacts, and methods to minimize them.
- Describe the types and uses of common nuclear medicine instrumentation.

## CONTRAST MEDIA

The contrast media to be studied are those which relate to the practical procedures mentioned above for each contrast substanc. Following attributes are expected where relevant:

- Generic name
- Composition
- Modes of administration and clinical uses
- Routes of elimination
- Relative advantages of different types of media
- Side effects and treatment of reactions
- Contraindications to their usage

## PHARMACOLOGY

- Knowledge of the pharmacological agents commonly used in radiological practice including their pharmacology and dosage.
- Preparation of the bowels: purgatives and colonic activators.
- Sedation before radiological procedures.
- Prophylaxis and treatment of reactions to contrast media.

## IMAGING

### BREAST IMAGING

**Core Knowledge and Critical Thinking:**
At the end of two years of training, the resident understands and is able to describe:

- **Anatomy** of the female breast, axilla and associated structures and how they change with age (Alteration with age, pregnancy, menstrual cycle and hormonal effects)
- **Normal variants** and Pathologies of the female breast
- Difference between normal, benign and malignant disease on mammograms and ultrasounds
- Radiographic techniques employed in diagnostic mammography, the principles of digital imaging and image processing pertinent to mammography, including standard cranio-caudal and medio-lateral oblique views, additional views, and tomosynthesis
- Features of dedicated mammography unit including target, filtration, photo timing and grids,
- Assessment of proper positioning, compression, exposure, contrast, sharpness, noise
- Breast compression: Rationale, selection of technical factors, including effects of mAs, KVp and density settings on image quality
- Factors affecting contrast, density, noise, sharpness
- Need for dedicated height intensity view box, view box masking and magnifying glass
- Physics of image production in mammography, particularly how they affect image quality
- Mammographic appearance of artifact such as gridlines, motion unsharpness, noise, dust, poor screen film contact, pickoff and scratches
- Digital (DR), computed radiography (CR) & screen-film mammography differences
- Principles of current practice in breast imaging and breast cancer screening

The principles and basic application of a standardized diagnostic categorization systems i.e. the ACR Breast Imaging Reporting and Data System (BI-RADS®) with reference to mammography and ultrasound
- Plan for follow-up protocol for probably benign lesions.
- Radiation Protection, International & PNRA Regulations
- Principles of interventional procedures, indications and contraindications, knowledge of equipment, technique of needle localization and stereotactic localization
- Knowledge to perform and interpret breast ultrasound.

**Common Clinical Presentations**
- Breast Lump
- Breast pain
- Nipple inversion
- Nipple discharge
- Paget's disease of the nipple
- Trauma to breast (hematoma, fat necrosis)
- Breast abscesses
- Fibrocystic breast changes
- Fibroadenoma
- Lipoma
- Hamartoma
- Radial scar
- Complex sclerosing lesion
- Cystosarcoma phylloides
- Micro and macrocalcifications
- Gynecomastia
- Intraductal papillomas
- Malignant Diseases
- Tumor-in-situ, invasive and metastatic tumor

## CARDIOVASCULAR SYSTEM

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**The Cardiac Anatomy and Normal Variations:**
- Heart and great vessels including lymphatic, normal anatomy and variations of coronary arteries, normal dimensions of the thoracic aorta, peripheral veins and arteries
- Pulmonary arteries - main, right, left, interlobar, Veins, superior and inferior vena cava, azygos and hemiazygos

**Pathologies**
- Understand on CT and plain x-ray the common pathologies of CVS

**Techniques in Cardiac Imaging**
- Role of ventilation-perfusion scintigraphy in the evaluation of a patient with suspected venous thromboembolic disease, including the advantages and limitations
- Proper application of imaging techniques of Echocardiography, plain x-ray and CT, grey scale and Doppler ultrasound required in diagnosing adult and congenital heart diseases and peripheral vascular diseases

**Common Clinical Presentations and Diseases**
- Chest Pain
- Shortness of Breath
- Cyanosis
- Syncope
- Chest Trauma
- Claudication
- Hypertension and hypotension
- Leg swelling
- Gangrene
- Aortic aneurysm
- Aortic dissection

- Coarctation of aorta
- Ischemic Heart Disease
- Cardiac Valvular Diseases
- Chamber enlargement of heart on plain x-ray
- Congenital Heart Disease in the Adult: Left-to-right shunts (Atrial septal defect, Ventricular septal defect and Patent ductus arteriosus) TOF
- Heart failure, pulmonary edema
- Eisenmenger physiology
- Pericardial Effusion, calcification in pericarditis
- Enlarged pulmonary arteries on a chest radiograph and distinguish them from enlarged hilar lymph nodes and common causes of pulmonary artery hypertension
- Heart failure
- Coronary artery disease
- Myocardial infarction, ventricular aneurysm, coronary artery aneurysm, Dressler syndrome
- Myocardial Diseases
  Acute myocarditis, obstructive and restrictive myocarditis, Pericardial Effusion, calcification in pericarditis

## RESPIRATORY SYSTEM

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**Anatomy and Normal Variants of the Respiratory System**
- Mediastinum and the chest wall on radiographs, CT
- Lobes of the lungs and fissures, airways, bony cage, paratracheal stripe, junctional lines, aortopulmonary window and paraspinal lines
- Secondary pulmonary lobule, an acinus
- Normal anatomy on the lateral chest radiograph

**Pathologies**
- Common pathologies on plain x-ray chest, CT scan, HRCT

**Techniques**

- Mean exposure doses of chest radiographs and of chest CT examinations
- Techniques to reduce exposure doses of chest radiographs and chest CT examinations
- Principles of digital imaging and image processing pertinent to chest radiology
- Application of radionuclide investigations to chest pathology with particular reference to radionuclide lung scintigrams

**Common Clinical Presentations**

- Cough
- Shortness of Breath
- Hemoptysis
- Febrile neutropenia
- Hoarseness/stridor
- Chest Trauma
- Fever
- Wheeze
- Trauma

**Common Diseases and Signs**

- Air bronchogram, Air crescent sign, Deep sulcus sign, Continuous diaphragm sign, Flat waist sign, Gloved finger sign, Hampton's hump, Silhouette sign, Figure 3 sign, Scimitar sign, Double density sign, Hilum overlay sign and hilum convergence sign, migration of fissure and diaphragm (plain x-ray)
- Chest Trauma: widened mediastinum, rib fractures, pneumothorax and pneumomediastinum, pulmonary contusion, laceration and aspiration (plain x-ray, CT)
- Aortic injury on contrast- enhanced chest CT scan
- Consolidation, empyema, pleural effusion, collapse, bronchiectasis, (plain x-ray)
- Asthma
- TB
- Compartment localization of mediastinal masses on CT
- Foreign body
- ARDS

- Lines tubes and devices
  - Endotracheal tube
  - Central venous catheter
  - Feeding tube
  - Nasogastric tube
  - Chest tube
  - Pacemaker and pacemaker leads
  - Pericardial drain
- Pulmonary embolism on plain CXR and CT scan and its correlation with nuclear studies
- Identify septal /Kerley A and B lines on a chest radiograph and explain their etiology
- Recognize the changes of congestive heart failure
- Pleural effusion on CXR and CT scan
- Unilateral elevation of the diaphragm on a chest radiograph and suggest a specific etiology like sub diaphragmatic abscess, diaphragm rupture after trauma, and phrenic nerve involvement with lung cancer
- Tension pneumothorax and understand the acute clinical implications
- Idiopathic interstitial pneumonias
- Usual Interstitial Pneumonitis/ Idiopathic pulmonary fibrosis
- Nonspecific interstitial pneumonia
- Cryptogenic organizing pneumonia
- Mediastinal Masses and Mediastinal / Hilar Lymph Node Enlargement
- Common malignant and benign tumors

## GASTROINTESTINAL (INCLUDING LIVER, PANCREAS AND SPLEEN) (GIT)

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**Normal Anatomy**
- Salivary glands, abdomen and the main variants including the internal viscera, abdominal organs, omentum, mesentery and peritoneum on conventional radiology, CT, ultrasound

**Pathologies**
- Trauma and common pathologies of GIT system

**Techniques**
- Understand the mean exposure doses of abdominal CT examinations
- Understand techniques to reduce exposure doses of abdominal radiographs and CT examinations
- Understand imaging features of abdominal trauma and acute conditions
- Radiological manifestations of disease within the abdomen on conventional radiography, contrast studies, ultrasound
- Applications, contraindications and complications of relevant interventional procedures
- Discuss the proper clinical and radiologic indications for the following studies:
  - Barium swallow
  - Upper GI series
  - Barium enema, single contrast and double contrast
  - Small bowel follow-through
  - Enteroclysis
  - ERCP
  - Fistulogram
- Physiologic properties, proper concentrations and proper indications for the use of the following contrast material
  - Barium
  - Water soluble contrast media used in GI radiology

- Discuss the pharmacokinetics of glucagon/Buscopan
- Techniques of relevant entergraphy/enteroclysis in cross sectional imaging

**Common Clinical Presentations**
- Dysphagia
- Dyspepsia
- Abdominal pain (Acute, Chronic and Acute on chronic)
- Change in Bowel habits, acute and chronic (diarrhea and constipation)
- Vomiting
- Anemia GI bleeding
- Weight loss
- Steatorrhoea
- Jaundice
- Trauma

**Common Diseases**
**Oropharynx:**
- Congenital conditions
- Strictures
- Pharyngeal Pouch

**Esophagus:**
- Strictures
- Reflux
- Trauma
- Inflammatory/infections
- Achalasia
- Vascular rings
- Foreign body

**Stomach Small and Large Bowel**
- Hiatus hernia
- Gastro-esophageal reflux and reflux esophagitis
- Ulcers
- Post-operative stomach
- Small and large bowel obstruction
- Small and large bowel ischemia
- Trauma to bowel

- Appendicitis
- Gallstone ileus
- Pneumoperitoneum (bowel perforation)
- Acute appendicitis and its complications on plain x-ray, ultrasound and CT (FACT)
- Thrombosis or embolism of the superior mesenteric artery
- Intussusception
- Diverticular disease and diverticulitis of colon
- Sigmoid and cecal volvulus
- Ischemic bowel on CT scan
- Paralytic ileus

**Pancreas:**
- Pancreatitis + Calcifications on plain film and CT scan abdomen and differential diagnosis
- Trauma to pancreas, appearance on CT scan and staging

**Liver, Gall Bladder and Spleen**
- Liver abscess
- Portal Hypertension
- Trauma to liver and staging
- Acute and Chronic Cholecystitis
- Cholelithiasis
- Injury to spleen and its staging on CT scan
- Splenic abscess appearance on ultrasound and CT

Common benign and malignant Tumors of gastrointestinal tract, liver, pancreas and spleen

## MUSCULOSKELETAL (MSK) INCLUDING TRAUMA

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**Anatomy**
- Musculoskeletal anatomy and clinical practice relevant to clinical radiology
- Normal variants of normal anatomy, which may mimic trauma

**Techniques and Indications**

- Routine and specialized views
- Computed tomography
- Magnetic resonance imaging
- Conventional tomography
- Ultrasonography
- Densitometry
- Bone age determination

**Variants and Pathologies**

- Sequence of ossification at joints (e.g., elbow)
- Physiologic radiolucency
- Bone island (enostosis)
- Vascular channels
- Chronic infections, Brodie's Abscess
- Sclerosing osteomyelitis
- Rickets and osteomalacia

**Common Clinical Presentations and Diseases**

- Trauma
- Bone and joint pain
- Fever
- Limping
- Gait problems
- Cord compression symptoms
- Cauda Equina Syndrome
- Bone and joint swelling
- Redness of skin and swelling
- Sciatica
- Periosteal reaction of infancy
- Spinal dysraphism, meningomyelocele
- Scheuermann disease
- Congenital Anomalies and Dysplasia (Basic)
- Trauma including Salter Harris classification, fractures of non-ossified skeleton
- Adult population fracture/dislocation
- Complications of fractures: non-healing, mal-alignment, infections
- Infections acute and chronic (Bacterial & Tuberculous acute + chronic infections, Brodie's Abscess, Sclerosing osteomyelitis

- Rickets and osteomalacia
- Hyperparathyroidism/ renal osteodystrophy
- Common benign and malignant bone tumors

## NEURO-RADIOLOGY / HEAD AND NECK IMAGING INCLUDING ENT/ EYE & DENTAL

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**The Anatomy and Normal Variants of the Head and Neck**
- On plain radiographs, ultrasound, CT and MRI

**Techniques and Indications**
- CT and MRI spine
- Applications, contraindications and complications of invasive neuro-radiological procedures
- Application of ultrasound with particular reference to the thyroid and salivary glands and other neck structures
- Application of radionuclide investigations in particular reference to the thyroid and parathyroid glands
- Vascular anatomy of the central nervous system on a given appropriate film
- Basic principles of CT and MRI physics
- Describe in considerable detail, CT and MR imaging protocols

**Pathologies**
- Trauma and CNS head and neck pathologies

**Common Diseases**
- Otitis Media
- Orbital cellulitis
- Acute sinusitis
- Trauma: Leforte classification, Tripod fracture, Blow-out fractures
- Intracranial hemorrhage (epidural, subdural, intraparenchymal, subarachnoid)
- Cerebral edema

- Uncal and tonsillar herniation
- Brain infarct
- Meningitis
- Hydrocephalus
- Sialadenitis
- Venous sinus thrombosis on CT and MRI
- Retinal/choroidal detachment on ultrasound
- Common benign and malignant tumors of the head and neck, ENT, eye
- Infective, cyst and tumors of jaw

## OBSTETRICS AND GYNAECOLOGY

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**Anatomy and Pathology**
- Female reproductive organs
- Physiological changes affecting imaging of the female reproductive organs
- Physiological changes of the female reproductive organs during pregnancy
- Fetal anatomy during gestation and the imaging appearances of fetal abnormalities on ultrasound
- Common clinical presentations of acute conditions of obstetrics and gynecology

**Techniques and Indications**
- Mean exposure doses and the techniques to reduce exposure doses in radiographs, hysterosalpingography and CT examinations of the female reproductive organs
- Principles of imaging acute abdomen in a pregnant lady

**Attitudes**
Towards Patients:
- Internalize and always adhere to the Rule of TEN and principles of ALARA in imaging reproductive age group ladies

Towards Society:

- Understand the social and governmental policies of health care provision in pregnancy, abortion and pelvic inflammatory diseases (sexually transmitted diseases)

**Common Clinical Presentations**

- Per-vaginal bleeding in a pregnant female
- Menorrhagia
- Amenorrhea (primary and secondary)
- Dysmenorrhea
- Vaginal discharge
- Anuria
- Lower abdominal pain
- Incontinence of urine
- Dysuria

**Common Diseases**

**Uterus:**

- Uterine agenesis, arcuate uterus, unicornuate uterus, uterus didelphys and bicornuate and septate uterus
- Ectopic pregnancy, placenta previa and abruptio placenta
- Threatened, inevitable, incomplete and missed abortion
- ovarian torsion

**Fetus:**

- Spina bifida
- Small posterior fossa
- Anencephaly
- Hydronephrosis
- Sacral agenesis
- Absent four chamber view of heart
- Polycystic kidney disease
- Cystic lesions of abdomen
- Hydrops
- Trauma
- common benign and malignant tumors of the female genital tract

## URO-RADIOLOGY

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**Anatomy and Normal Variants**
- Kidneys, ureters, bladder and urethra

**Techniques and Indications**
- Principles of renal function
- Typical imaging features of renal parenchymal diseases, including infection and renovascular diseases
- Contrast medium management in renal failure
- Typical imaging features and appropriate imaging investigation algorithm of calculus disease
- Imaging features of urinary tract obstruction and reflux
- Proper clinical and radiologic indications for the following studies:
  - IVU
  - Cystogram
  - voiding cystourethrogram
  - Ultrasonography
  - CT KUB
- Physiological properties, proper concentrations and proper indications for the use of the contrast material (ionic intravenous contrast media and non-ionic intravenous contrast media)
- High-risk factors for the allergic reactions to intravenous contrast media
- Proper assessment and treatment for allergic reactions to contrast media
- Principles and indications of Doppler ultrasound in kidney diseases (waveform, color, resistive indices and pulsatility index and ureteral-ureteral jets

**Pathologies**
- Trauma and common presentations of urinary system and male reproductive system

**Attitudes**

- Understand the social and governmental policies of health care provision in diseases of kidneys, ureters, bladder and urethra especially during pregnancy
- Understands how to investigate and refer patients suffering from sexually transmitted diseases

**Common Clinical Presentations and Diseases**

- Trauma
- Hematuria
- Lumbar pain
- Loin pain
- Dysuria/nocturia/anuria
- Scrotal pain/mass
- Raised PSA
- Male infertility
- Poor stream
- Retention of urine
- Nephrolithiasis
- Ureterocele
- Vesicoureteral reflux
- Stress incontinence
- Bladder outlet obstruction
- Neurogenic bladder
- Infertility
- Testicular torsion/ Epididymo-orchitis
- Bladder injury
- Renal injury and grading system
- Pyelonephritis, Renal abscess
- Epispadias and hypospadias
- Posterior urethral valves
- Common benign and malignant tumors of urinary tract and male reproductive system

## PAEDIATRIC RADIOLOGY

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

**Normal Pediatric Anatomy and Normal Variants**
- Normal anatomy
- Common congenital disorders of the different body regions and their respective relevance for the child´s further development
- Methods to establish bone age based on radiographic findings
- Significance of normal maturation and growth

**Techniques and Indications**
- Principles of establishing a child-friendly environment
- Relative indications of ultrasound, CT and MRI in children
- Knowledge of increased vulnerability of children to ionizing radiation
- The ALARA principle and the special requirements for radiation safety and contrast material dosage in relation to body mass for the pediatric population
- High-risk factors for the allergic reactions to intravenous contrast media in pediatric population
- Proper clinical and radiologic indications in pediatric population for the following studies:
  - IVU
  - Cystogram
  - Voiding cystourethrogram
  - Ultrasonography
  - Upper and lower GI contrast studies
  - Radionuclide studies
  - CT

**Common Pathologies**
- Imaging features of common disease entities specific to the pediatric age group

**Attitudes:**

- Understand the social and governmental policies of health care provision in diseases of pediatric age group

**Common Clinical Presentations**

- Failure to thrive
- Irritability
- Cough, running nose and fever
- Tachypnea/intercostal recession
- Fever of unknown origin
- Abdominal pain
- Projectile vomiting/bilious vomiting
- Currant jelly stools
- Drooling
- Inability to pass meconium
- Poor urine stream
- Urine infection
- Testicular pain
- Loss of consciousness
- Trauma
- Bone and joint pain

**Common Diseases**

**Chest**:

Bronchiolitis, pneumonia, pleural effusion, pneumothorax, foreign body aspiration, thymus and variants, Trauma to chest

**GIT:**

Intestinal obstruction, necrotizing enterocolitis, blunt trauma, pneumoperitoneum, gastro-esophageal reflux, hypertrophic pyloric stenosis, malrotation, Hirschsprung's disease, anal imperforation and esophageal atresia

**GUT:**

Vesico-ureteral reflux and urethral anomalies, imperforate hymen, posterior urethral valves, hydronephrosis, testicular/ ovarian torsion

**CNS:**
Traumatic brain injury (accidental and non-accidental), congenital disorders of the brain and spine, hypoxic injury to the brain, intracranial hemorrhage

**MSK:**
Salter Harris fractures, non-accidental injury, osteomyelitis, joint effusion, Legg–Calvé–Perthes disease and slipped capital femoral epiphysis.
Common Pediatric benign and malignant tumors.

## RADIONUCLIDE RADIOLOGY

**Core Knowledge and Critical Thinking**
At the end of two years of training, the resident understands and is able to describe:

- Relevant aspects of current legislation regarding the administration of radiopharmaceuticals under PNRA
- Technical aspects of radionuclide radiology relevant to optimizing image quality
- Radiopharmaceuticals currently available for the purposes of imaging organs and locating inflammatory collections, tumors and sites of hemorrhage
- Relevant patient preparation, precautions (including drug effects), and complications of the more commonly performed radionuclide investigations
- Strengths and weaknesses of radionuclide investigations to other imaging modalities
- Basic principles of physics including the basic atomic structure, principles of radioactivity and basic of radioactive decay
- Desirable characteristics and physiological clearance of radiopharmaceuticals
- Principles of biological and effective half-life
- Basic physical principles of nuclear medicine imaging technology, including gamma cameras
- Safety aspects in nuclear medicine and hybrid imaging, including patient dosimetry, staff dosimetry, contamination, monitoring, choice of equipment, quality control and safety/risk management

**Common Clinical Conditions and Their Interpretation**

- Bone metastasis/ metabolic bone disease, osteomyelitis, primary bone tumors
- Function of kidneys, PUJ obstruction, vesico-ureteric reflux, cortical scarring
- **CNS:** (cerebral metabolism and perfusion studies)
- Endocrine: (adrenal, thyroid and parathyroid uptake studies)
- **GIT:** (GI transit studies, GI bleeding, Meckel's diverticulum, Hepatobiliary studies)
- Infections and Inflammation: (basic mechanism of infection and occult sepsis)
- **Lymphoscintigraphy:** (sentinel node localization and knowledge of spread of cancer)
- Respiratory System: Pulmonary embolism studies, Ventilation perfusion studies
- **CVS:** myocardial perfusion studies
- Pediatrics: use of radionuclide in pediatric population and understanding of growing skeleton

## HEALTH INFORMATICS

The resident will be able to:

- Develop core skills in information technology, especially the ability to perform basic word-processing, and to access computerized medical databases, electronic mail systems and the internet
- Keep abreast of developments in information management relevant to radiology departments

## CORE COMPETENCIES

The Level of competence to be achieved is indicated as follows:

Key to competency levels in clinical skills:
1. Observer status
2. Assistant status
3. Performed under supervision
4. Performed independently.

| COMPETENCIES | FIRST YEAR | | | | | | | | Total # of Cases |
|---|---|---|---|---|---|---|---|---|---|
| | 3 MONTHS | | 6 MONTHS | | 9 MONTHS | | 12 MONTHS | | |
| | Level | Cases | Level | Cases | Level | Cases | Level | Cases | |
| **PATIENT MANAGEMENT** | | | | | | | | | |
| GENERAL X-RAY REPORTING | 1<br>2 | 25<br>25 | 2 | 50 | 2<br>3 | 50<br>50 | 3 | 40 | 240 |
| ULTRASOUND OF ABDOMEN | 1<br>2 | 20<br>20 | 2 | 20 | 2<br>3 | 25<br>25 | 3 | 40 | 150 |
| ULTRASOUND, PELVIS AND OBS & GYN | 1<br>2 | 20<br>20 | 2 | 20 | 2<br>3 | 50<br>50 | 3 | 40 | 200 |
| DOPPLER ULTRASOUND | 1 | 10 | 2 | 10 | 1 | 10 | 2 | 20 | 50 |
| CT, U/S, GUIDED PROCEDURES | 1 | 2 | 1 | 4 | 2 | 4 | 2 | 5 | 15 |
| **CT SCAN** | | | | | | | | | |
| HEAD AND NECK | 1 | 5 | 1 | 10 | 2 | 10 | 2 | 15 | 40 |
| CHEST. ABD AND PELVIS | 1 | 5 | 1 | 10 | 2 | 10 | 2 | 15 | 40 |
| MSK | 1 | 5 | 1 | 5 | 2 | 5 | 2 | 10 | 25 |

| COMPETENCIES | SECOND YEAR | | | | | | | | Total # of Cases |
|---|---|---|---|---|---|---|---|---|---|
| | 3 MONTHS | | 6 MONTHS | | 9 MONTHS | | 12 MONTHS | | |
| | Level | Cases | Level | Cases | Level | Cases | Level | Cases | |
| **PATIENT MANAGEMENT** | | | | | | | | | |
| GENERAL X-RAY REPORTING | 3 | 100 | 3 | 100 | 3<br>4 | 100<br>50 | 4 | 100 | 450 |
| ULTRASOUND OF ABDOMEN | 3 | 30 | 3 | 40 | 3<br>4 | 40 | 4 | 40 | 150 |
| ULTRASOUND, PELVIS AND OBS & GYN | 3 | 30 | 3 | 20 | 3<br>4 | 40 | 4 | 40 | 130 |
| DOPPLER ULTRASOUND | 3 | 20 | 3 | 20 | 3<br>4 | 20<br>10 | 4 | 30 | 100 |
| CT, U/S, GUIDED PROCEDURES | 3 | 4 | 3 | 4 | 3<br>4 | 2<br>2 | 4 | 3 | 15 |
| **CT SCAN** | | | | | | | | | |
| HEAD AND NECK | 2<br>3 | 10<br>5 | 3 | 15 | 3<br>4 | 10 | 4 | 15 | 55 |
| CHEST. ABD AND PELVIS | 2<br>3 | 10<br>5 | 3 | 15 | 3<br>4 | 10 | 4 | 15 | 55 |
| MSK | 2<br>3 | 5<br>5 | 3 | 10 | 3<br>4 | 5 | 4 | 5 | 30 |

## ASSESSMENT

### ELIGIBILITY REQUIREMENTS FOR MCPS EXAMINATION

- MBBS or equivalent qualification registered with the PMDC.
- One year house job in an institution recognized by the CPSP, out of which six months should be in Diagnostic Radiology. Deficiency in the house job period could be compensated by equal time in residency.
- Completed two years of registered training on whole time basis under an approved supervisor in an institution recognized by the CPSP.
- To have made regular entries and completed e-logbook.
- Submitted certificates of attendance of mandatory workshops.

### EXAMINATION SCHEDULE

- The MCPS theory examination in Diagnostic Radiology shall be held twice a year.
- Theory examinations are held in various cities of the country depending on the number of candidates at a center. Presently the centres are Abbottabad, Bahawalpur, Rawalpindi, Faisalabad, Hyderabad, Islamabad, Karachi, Lahore, Larkana, Nawabshah, Multan, Peshawar and Quetta. The College shall decide where to hold theory/ clinical examinations depends on the number of candidates in a city and candidates will be informed accordingly.
- Clinical examination shall be held for those candidates who have qualified in theory.
- English shall be the medium of examination for the theory/ practical/clinical and viva examinations.
- Any change in the centres, dates and format of the examination will be notified by the College before the examination.
- A competent authority appointed by the College has the power to debar any candidate from any examination if it is satisfied that such a candidate has indulged in unfair practices in College Examination, misconduct or because of any other disciplinary reason.

**EXAMINATION FEE**

- Application along with the prescribed examination fee and required documents should be submitted latest by the last date notifed for the purpose before each examination.
- The details of examination fee and fee for change of centre, subject, etc. shall be notified before each examination.
- Fees deposited for a particular examination shall not be carried over to the next examination in case of withdrawal/ absence/exclusion.

**REFUND OF FEE**

If, after submitting an application for examination, a candidate decides not to appear, a written request for a refund must be submitted before the last date for withdrawal with the receipt of applications. In such cases a refund is admissible to the extent of 75% of fees only. No request for refund will be accepted after the closing date for receipt of applications. If an application is rejected by the CPSP, 75% of the examination fee will be refunded, the remaining 25% being retained as a processing charge. No refund will be made for fees paid for any other reason, e.g. late fee, change of centre/subject fee, etc.

**FORMAT OF EXAMINATION**

The MCPS examination in Diagnostic Radiology comprises of:

- **THEORY**
  Two written papers:
  **Paper-I:** 100 Single Best Type of MCQs
  **Paper-II:** 100 Single Best Type of MCQs
  Physics will be covered in Paper One.

- **CLINICAL**
  Film reporting session:
  20 stations to be reported in 100 minutes
  ***Table viva:***
  02 Stations (two examiners on station)
  30 minutes on each station (15 minutes for each examiner)
  Total viva time one hour.

Only those candidates who qualify in theory and film reporting session will be called for viva examination.

**THE COLLEGE RESERVES THE RIGHT TO ALTER/AMEND ANY RULES/REGULATIONS.**
Any decision taken by the College on the interpretation of these regulations will be binding on the applicant.

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