

# **GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME FOR DIPLOMA IN RADIODIAGNOSIS**

## **Preamble:**

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

**The Goal** of this program is to standardize Radiodiagnosis teaching at post graduate diploma (DMRD) level throughout the country so that it will benefit in achieving competent radiologist with appropriate expertise.

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

## ***SUBJECT SPECIFIC LEARNING OBJECTIVES***

The objective is to train a student to become a skilled and competent radiologist to conduct and interpret various diagnostic/interventional imaging studies (both conventional and advanced imaging) and be versed with medical ethics and legal aspects of imaging/intervention. The course will impart training in both conventional radiology and modern imaging techniques so that the post graduate student is competent to practice in the broad discipline of radiology including ultrasound, Computed Tomography and Magnetic Resonance Imaging.

## ***SUBJECT SPECIFIC COMPETENCIES***

### **A. Cognitive Domain**

The post graduate student, on completing her/his Diploma in Radiodiagnosis (DMRD), should be able to:

1. Acquire basic knowledge in the various sub-specialties of radiology such as Chest radiology, Neuro-radiology, GI-radiology, GU-radiology, cardio-vascular-radiology, musculoskeletal, Interventional radiology, emergency radiology, Pediatric radiology and Mammography.
2. Independently conduct and interpret routine and special imaging investigations.
3. Provide radiological services in acute emergency and trauma including its medico- legal aspects.

4. Elicit indications, diagnostic features and limitation of applications of ultrasonography, CT and MRI and should be able to describe proper cost-effective algorithm of various imaging techniques in a given problem setting.
5. Able to decide on the various image-guided interventional procedures to be done for diagnosis and therapeutic management.
6. Decide on further specialization in any of the above mentioned branches in Radiodiagnosis such as Gastrointestinal radiology, Uro-radiology, Neuro-radiology, Vascular radiology, musculoskeletal radiology, Interventional Radiology etc, to be undertaken.

## **B. Affective Domain:**

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

## **C. Psychomotor domain**

Practical training will include two major aspects:

- A) Interpretation of images, and
- B) Skill in performing a procedure.

### **A) Interpretation of images:**

B) The student should be able to interpret images on all imaging modalities of diseases of following organs :

1. **Musculo-skeletal System** - Interpretation of diseases of muscles, soft tissue, bones and joints including congenital, inflammatory, traumatic, endocrine and metabolic, neoplastic and miscellaneous conditions.
2. **Respiratory System** – Interpretation of diseases of the chest wall, diaphragm, pleura and airway; pulmonary infections, pulmonary vasculature; pulmonary neoplasm; diffuse lung disease; mediastinal disease, chest trauma; post-operative lung and X-ray in intensive care.
3. **Cardiovascular System** - Interpretation of diseases and disorders of cardiovascular system (congenital and acquired conditions) and the role of iaging by conventional radiology, ultrasound, colour Doppler, CT, MRI, Angiography and isotope studies.

4. **Gastro-intestinal tract and hepato-biliary pancreatic system** - Interpretation of diseases and disorders of mouth, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, diseases of omentum, peritoneum and mesentery: acute abdomen, abdominal trauma, diseases and disorders of liver, biliary system and pancreas.
5. **Urogenital System** - Interpretation of various diseases and disorders of genito-urinary system. These include: congenital, inflammatory, traumatic, neoplastic, calculus disease and miscellaneous conditions.
6. **Central Nervous System (C.N.S.)** - Interpretation of diseases and disorders of the head, neck and spine covering, congenital, infective, vascular, traumatic neoplastic degeneration metabolic and miscellaneous condition.
7. Imaging in Emergency Medicine.
8. Imaging in Obstetrics and Gynecology.
9. Imaging of Breast and interventional procedures.
10. ENT, eye and dental Imaging.
11. Imaging of endocrine glands and those involved with metabolic diseases.
12. Clinical applied radionuclide imaging.
13. Interventional radiology.

**The student should be able to perform the following procedures:**

- 1) **GIT contrast studies** : Barium studies (swallow, upper GI, Follow through, enema); fistulogram; sialogram; cologram/ileostogram
- 2) **GU:** Excretory urography, MCU, RGU, nephrostogram, genitogram
- 3) **Ultrasound:** Studies of whole body including neonatal transfontanell studies, Doppler studies
- 4) **CT scan:** should be able to position a patient, plan study as per the clinical indication, do reconstruction of images, perform triple phase study
- 5) **MRI:** plan and perform MRI studies of whole body
- 6) **DSA:** should be able to describe the techniques, do (if available to student) transfemoral puncture and insert catheter, help in angiographic procedures both diagnostic and interventional
- 7) **Radiography:** should be able to independently do radiography of common and some important uncommon views of different body parts. This includes positioning, centering of X ray beam, setting of exposure parameters, exposing and developing the films. He / She should be familiar with not only conventional radiography but with CR and DR systems.
- 8) **Interventional radiology:** The student should be able to perform simple, common non- vascular procedures under ultrasound and fluoroscopy guidance e.g. abscess drainage, drainage catheter placement, nephrostomy, biliary drainage etc. The student should have knowledge of common vascular interventions e.g stricture dilatation using balloon catheters, embolization with gel foam and other agents, names of

common catheters, handling of intravenous contrast reactions; techniques, indications and contraindications for various procedures.

## ***Syllabus***

### **Course contents**

The broad syllabus is given below:

#### **Anatomy**

Gross and cross sectional Anatomy of all the body systems.

#### **Pathology**

Gross morphology of pathological conditions of systemic diseases affecting all organ systems.

#### **Radiology Course**

This would cover imaging and interventions of diseases affecting all the body systems:

- Chest
- Cardiovascular system
- Musculoskeletal including soft tissue
- Gastrointestinal system
- Hepato-biliary-pancreatic system
- Urogenital (Genito-urinary) system
- CNS including head and neck
- Obstetrics and Gynaecology
- ENT, Eye, Dental, Breast
- Endocrine and metabolic system
- Clinically applied radionuclide imaging

#### **Radiological Physics:**

1. Introduction of general properties of radiation and matter; fundamentals of nuclear physics and radioactivity.
2. Interaction of x-rays and gamma rays with matter and their effects on irradiated materials.
3. X-ray Generating Apparatus
4. Screen-film radiography
5. Film processing: Dark room, dry processing, laser/dry chemistry cameras, artifacts.
6. Fluoroscopy: Digital including flat panel units, fluoroscopy cum radiography units
7. Digital radiography: Computed Radiography, Flat panel radiography
8. Other equipments: Ultrasound including Doppler, CT, MRI and DSA



9. Contrast Media (Iodinated, MR, Ultrasound) - types, chemical composition, mechanism of action, dose schedule, route of administration, adverse reactions and their management.
10. Nuclear Medicine: Equipments and isotopes in various organ systems and recent advances.
11. Picture Archiving and Communication System (PACS) and Radiology Information System (RIS) to make a film-less department and for Teleradiology.
12. Radiation protection, dosimeters and radiation biology.
13. Image quality and Quality Assurance (QA).

He/She should have knowledge of the following:

- Check accuracy of kVp and timer of an X ray unit
- Check accuracy of congruence of optical radiation field
- Check perpendicularity of x ray beam
- Determine focal spot size
- Check linearity of timer of x ray unit
- Check linearity of mA
- Verification of inverse square law for radiation
- Check film screen contact
- Check film screen resolution
- Determine total filtration of an x ray unit
- Processor quality assurance test.
- Radiological protection survey of an x ray unit.
- Check compatibility of safe light.
- Check performance of view box.
- Effect of kVp on x ray output

#### **Recent advances in radiology and imaging.**

#### **Radiography and Processing Techniques**

1. Processing techniques: includes dark room and dry processing.
2. Radiography of the musculo - skeletal system including extremities
3. Radiography of the chest, spine, abdomen and pelvic girdle.
4. Radiography of the skull, orbit, sinuses.
5. Contrast techniques and interpretation of GI tract, hepato-biliary tract, pancreas etc.
6. Contrast techniques and interpretation of the Central Nervous system.
7. Contrast techniques and interpretation of the cardiovascular system including chest.
8. Contrast techniques and interpretation of the genito-urinary system including Obstetrics and Gynaecology.

9. Paediatric radiology including MCU, genitogram, bone age.
10. Dental, portable and emergency (casualty) radiography.

## ***TEACHING AND LEARNING METHODS***

**The training is spread over 2 years and includes following components:**

1. Physics related to imaging
2. Rotational posting in various sub-specialties.
3. Seminars, case discussion, journal club.
4. Research methodology and statistics.
5. A log book will be maintained by the student and should be checked by the faculty-in-charge during the training program.
6. The postgraduate students shall be required to participate in the teaching and training program of undergraduate students and interns.
7. The postgraduate student would be required to present one poster presentation, to read one paper at a national/state conference and to submit one research paper which should be published or accepted for publication or sent for publication to a peer reviewed journal, during the period of his/her postgraduate studies so as to make him/her eligible to appear at the postgraduate degree examination.
7. Department should encourage e-learning activities.

**During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, provision of skills laboratories in medical colleges is mandatory.**

### **Rotations**

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

- |  |          |
|--|----------|
| 1. Conventional chest, abdomen, Musculoskeletal including skull, spine, PNS and mammography etc              | 5 months |
| 2. Contrast studies: G.U., GIT, hepato-biliary, angiography etc. including fluoroscopic guided interventions | 5 months |
| 3. US, Doppler and US-guided interventions   | 5 months |
| 4. CT and CT-guided interventions  | 4 months |
| 5. Emergency Radiology   | 2 months |
| 6. M.R.I.  | 1 month  |
| 7. Elective posting  | 2 months |

**Total 24 months**

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

**Proposed schedule for rotation of residents**

<b>1<sup>ST</sup>Year (1/4)</b>	Conventional Chest and abdomen	Conventional skull, spine, musculo-skeletal etc	US	Contrast studies -- GIT and other fluoroscopic investigations	Contrast studies -G.U. tract	US and Doppler
<b>(2/4)</b>	US and interventions	Conventional skull, spine , musculoskeletal etc	CT	Contrast studies -- GIT and other fluoroscopic investigations	Emergency	CT

<b>2<sup>nd</sup> Year (3/4)</b>	Conventional: Chest and abdomen	Elective	Contrast studies - G.U. tract including pediatric MCU/gen- itogram	US and Doppler	Emergency	CT and interventions
<b>(4/4)</b>	Conventional: Musculo-skeletal, mammo-graphy	Contrast studies - GIT and other fluoroscopic investigations including angiography	US and interventions	MRI	CT and interventions	Elective

**ASSESSMENT**

**FORMATIVE ASSESSMENT, during the training programme**

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

**General Principles**

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

**Quarterly assessment during the Diploma training should be based on:**

- 1. Journal based / recent advances learning**
- 2. Patient based /Laboratory or Skill based learning**
- 3. Self directed learning and teaching**
- 4. Departmental and interdepartmental learning activity**
- 5. External and Outreach Activities / CMEs**

**The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I).**

### **SUMMATIVE ASSESSMENT, ie., at the end of the training**

The summative examination would be carried out as per the Rules given in **POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.**

The Post Graduate Examination shall be conducted in two parts.

#### **1. Theory Examination**

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for Diploma shall be held at the end of 2<sup>nd</sup> academic year. An academic term shall mean six month's training period.

There shall be three theory papers:

**Paper I:** Basic sciences related to Radiology (consists of Anatomy, Pathology, Basic and Radiation Physics, Imaging Techniques, and Film processing).

**Paper II:** Chest, CVS, CNS including Head and Neck, Eye, ENT, musculo-skeletal, pediatric and Mammography.

**Paper III:** Abdominal Imaging including GI, GU, Hepatobiliary, endocrine and metabolic, Interventional radiology, Obstetrics and Gynaecology, and recent advances

All papers would consist of short answer questions (minimum 10) covering all aspects of the course.

#### **2. Practical/clinical and oral Examination**

Practical Examination will have:

1. 2-3 Cases
2. Film Quiz (50 -60 spots)
3. To perform Ultrasound on a patient (optional)

Oral/Viva voce Examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject including:

- Radiation Physics and quality assurance
- Implements, Catheters and contrast
- Cassettes, films, dark room, equipment
- Radiographic techniques, Radiological procedures
- Gross pathology

#### **Recommended Reading:**



**Books (latest edition)**

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

**Journals**

03-05 international Journals and 02 national (all indexed) journals



**Postgraduate Students Appraisal Form  
Pre / Para /Clinical Disciplines**

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory			Satisfactory			More Than Satisfactory			Remarks
		1	2	3	4	5	6	7	8	9	
1.	Journal based / recent advances learning										
2.	Patient based /Laboratory or Skill based learning										
3.	Self directed learning and teaching										
4.	Departmental and interdepartmental learning activity										
5.	External and Outreach Activities / CMEs										
6.	Thesis / Research work										
7.	Log Book Maintenance										

Publications

Yes/ No

Remarks\* \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\*REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HOD