

GOPAL NARAYAN SINGH UNIVERSITY
JAMUHAR, SASARAM, ROHTAS-821305



NARAYAN MEDICAL COLLEGE & HOSPITAL

**GUIDELINES FOR COMPETENCY BASED
POSTGRADUATE TRAINING PROGRAMME FOR**

MD 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 impart training in conventional and modern radiology and imaging techniques so that the post graduate student becomes well versed and competent to practice, teach and conduct research in the discipline of radiology. The student should also acquire basic knowledge in the various sub-specialities of radiology. These Guidelines also would also help 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”.

SPECIFIC LEARNING OBJECTIVES

The objective of the program 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), to organize and conduct research and teaching activities and be well versed with medical ethics and legal aspects of imaging/ intervention.

SUBJECT SPECIFIC COMPETENCIES

A. COGNITIVE DOMAIN

A post graduate student on completing MD (Radiodiagnosis) should acquire knowledge in the following areas, and be able to:

1. Acquire good basic knowledge in the various sub-specialties of radiology such as chest radiology, neuro-radiology, GI-radiology, uro-radiology, cardio-vascular radiology, musculoskeletal, interventional radiology, emergency radiology, pediatric radiology and women’s imaging.
2. Independently conduct and interpret all routine and special radiologic and imaging investigations.
3. Provide radiological services in acute emergency and trauma including its medicolegal 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. Decide on the various image-guided interventional procedures to be done for diagnosis and therapeutic management.

6. Able to decide on further specialization to be undertaken in any of the branches in Radiodiagnosis such as gastrointestinal radiology, uro-radiology, neuro-radiology, vascular radiology, musculoskeletal radiology, interventional radiology etc.
7. Able to formulate basic research protocols and carry out research in the field of radiology-related clinical problems.
8. Acquire knowledge and teaching capabilities to work as a post graduate student /consultant in Radiodiagnosis and conduct teaching programmes for undergraduates, post graduates as well as paramedical and technical personnel.
9. Interact with other specialists and super-specialists so that maximum benefit accrues to the patient.
10. Should be able to organize CME activities in the specialty utilizing modern methods of teaching and evaluation.
11. Acquire knowledge to impart training in both conventional radiology and modern imaging techniques so that the post graduate student is fully competent to practice, teach and do research in the broad discipline of radiology including ultrasound, Computed Tomography and Magnetic Resonance Imaging.
12. Acquire knowledge of interventional radiology.

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:

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

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

4. **Gastro-intestinal tract and hepato-biliary pancreatic system** - Interpretation of diseases and disorders of mouth, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, diseases of omentum, peritoneum and mesentery: acute abdomen, abdominal trauma. Diseases and disorders of liver, biliary system and pancreas.
5. **Urogenital System** - Interpretation of various diseases and disorders of genitorurinary 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

B) SKILLS IN PERFORMING A PROCEDURE

The student should be able to perform the following procedures:

1. **GIT contrast studies:** Barium studies (swallow, upper GI, Follow through, enema); fistulogram; sialogram; cologram/ileostogram,
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, perform & interpret advanced applications like CT enterography, CT angiography etc.
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. The student 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:

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

- Introduction of general properties of radiation and matter: Fundamentals of nuclear physics and radioactivity
- Interaction of x-rays and gamma rays with matter and their effects on irradiated materials
- X-ray Generating Apparatus⁴. Screen-film radiography
- Film processing: Dark room, dry processing, laser /dry chemistry cameras, artifacts.
- Fluoroscopy: Digital including flat panel units, fluoroscopy cum radiography units
- Digital radiography: Computed Radiography, Flat panel radiography
- Other equipments: Ultrasound including Doppler, CT, MRI and DSA
- Contrast Media (Iodinated, MR & Ultrasound) - types, chemical composition, mechanism of action, dose schedule, route of administration, adverse reaction and their management
- Nuclear Medicine: Equipments and isotopes in various organ systems and recent advances
- Picture Archiving and Communication System (PACS) and Radiology Information System (RIS) to make a film-less department and for Tele radiology
- Radiation protection, dosimetry and radiation biology
- Image quality and Quality Assurance (QA)
- Recent advances in radiology and imaging

THE STUDENT SHOULD HAVE KNOWLEDGE OF THE FOLLOWING PHYSICS EXPERIMENTS:

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

- Determine total filtration of an x ray unit
- Processor quality assurance test
- Radiological protection survey of an x ray unit
- Check compatibility of safe light
- Check performance of view box
- Effect of kVp on x ray output

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 3 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 should be maintained by the student and will be checked and signed regularly 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.
8. Department should encourage e-learning activities.

ROTATIONS:

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

1. Conventional chest, abdomen, musculoskeletal including skull, spine, PNS and mammography etc ----- 8 months
2. Contrast studies: G.U., GIT, Hepato-biliary, angiography etc including fluoroscopic guided interventions ----- 8 months
3. US, Doppler and US guided interventions ----- 8 Months
4. CT and CT guided interventions ----- 6 Months
5. Emergency radiology -----2 Months
6. M.R.I. -----2 Month
7. Elective posting ----- 2 Months

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

PROPOSED SCHEDULE FOR ROTATION

1st Year (1/6)	Conventional Chest & abdomen	Conventional skull, spine, musculo- skeletal etc.	US	Contrast studies – GIT & other fluoroscopic investigations	Contrast studies - G.U. tract	US
(2/6)	US & interventions	Conventional skull, spine, musculo- skeletal etc.	CT	Contrast studies -- GIT & other fluoroscopic investigations	Contrast studies - G.U. tract	US & interventions
2nd Year (3/6)	Conventional Chest & abdomen	Contrast studies – GIT & other Fluoroscopic investigations Including angiography	Contrast studies - G.U. tract	US & interventions	Emergency	CT
(4/6)	Conventional skull, spine, musculo- skeletal etc.	Contrast studies - G.U. tract including pediatric MCU/genito- gram	US & interventions	US & Doppler	Emergency	MRI
3rd year (5/6)	Conventional Chest & mammography	Contrast studies - GIT & other fluoroscopic investigations including angiography	US & Doppler	Emergency	CT & interventions	Elective
(6/6)	Conventional Musculoskeletal & mammography	Contrast studies - G.U. tract including pediatric MCU/genitogram	CT& interventions	CT & interventions	MRI	Elective

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

ASSESSMENT

FORMATIVE ASSESSMENT, during the training 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 practical/clinical examination.

Quarterly assessment during the MD 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 /CME

INTERNAL ASSESSMENT

The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student. Marks should be allotted out of 100 as followed.

S. No	Items	Marks
1	Personal Attributes	20
2	Clinical Work	20
3	Academic activities	20
4	End of term theory examination	20
5	End of term practical examination	20

1. PERSONAL ATTRIBUTES:

- **Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.
- **Motivation and Initiative:** Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.
- **Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.
- **Interpersonal Skills and Leadership Quality:** Has compassionate attitude towards patients and attendants, gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

2. Clinical Work:

- **Availability:** Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.
- **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in clinical case work up and management.

- **Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.
 - **Clinical Performance:** Proficient in clinical presentations and case discussion during rounds and OPD work up. Preparing Documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.
3. **Academic Activity:** Performance during presentation at Journal club/ Seminar/Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.
4. **End of term theory examination** conducted at end of 1st, 2nd year and after 2 years 9 months
5. **End of term practical/oral examinations** after 2 years 9 months.
- ◆ Marks for personal attributes and clinical work should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.
 - ◆ Marks for academic activity should be given by the all consultants who have attended the session presented by the resident.
 - ◆ The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examinations.

SUMMATIVE ASSESSMENT, i.e., at the end of training

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

- Ratio of marks in theory and practical will be equal.
- The pass percentage will be 50%.
- Candidate will have to pass theory and practical examination separately

THE EXAMINATION SHALL BE IN THREE PARTS:

1. THESIS

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

2. Theory Examination:

There shall be four papers each of three hours duration.

Paper I	Basic Science related to Radiology (consists of Anatomy, Pathology, Basic & Radiation Physics, Imaging Techniques and film processing	100 marks*
Paper II	Chest, CVS, CNS including Head & Neck, Eye, ENT, Musculoskeletal, Paediatric radiology and Mammography	100 marks*
Paper III	Abdominal Imaging including GI, GU, Hepatobiliary, endocrine and metabolic, Obstetrics and Gynaecology and Interventional radiology	100 marks*
Paper IV	Recent advances, nuclear medicine; Radiology related to clinical specialties	100 marks*

***10 question carrying 10 marks each**

3. Clinical / Practical and viva voce Examination

Practical examination should be taken to assess competence and skills of techniques and procedures and should consist of following:

1 Long cases	100 marks	100
2 Short cases	40 marks each	80
40 spotters	2 marks each	80
Perform Ultrasound on a patient	40 marks	40
Total		300

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

Radiation Physics & quality assurance	20 marks
Implements, catheters & contrast	20 marks
Cassette, Films, dark room, equipment	20 marks
Radiographic techniques, radiological procedures	20 marks
Gross pathology & Log book	20 marks
Total	100 marks

SUGGESTED READING:

Books (latest edition)

1. Grainger & Allison's Text book of Diagnostic Radiology (Churchill Livingstone)
2. Textbook of Gastrointestinal Radiology- Gore and Levine (Saunders)
3. MRI of Brain and Spine - Scott Atlas (LWW)
4. Diagnosis of Diseases of the Chest -Fraser
5. Diagnostic Imaging Series: (Amirsys, Elsevier) Abdominal Imaging, Orthopedics, Head and Neck, Neuroradiology, Pediatric Radiology Chest, Obstetrics, Breast
6. MRI in Orthopedics and Sport Injuries - Stoller
7. Skeletal Radiology - Greenspan
8. Abdominal-Pelvic MRI - Semelka (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 sulton
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

SENT UP CRITERIA

- The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student.
- Marks should be allotted out of 100 as followed.

S. No	Items	Marks
1	Personal Attributes	20
2	Clinical Work	20
3	Academic activities	20
4	End of term theory examination	20
5	End of term practical examination	20

Note: MINIMUM 75% MARKS WILL BE COMPULSORY

- ◆ Postgraduate student appraisal form (Annexure I) duly signed by HOD of Department.

ANNEXURE I

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



GOPAL NARAYAN SINGH UNIVERSITY
JAMUHAR, SASARAM, ROHTAS-821305