

# COMPETENCY BASED TRAINING PROGRAM AND CURRICULUM FOR DM IN INTERVENTIONAL RADIOLOGY

## **Preamble:**

The DM (Interventional Radiology henceforth referred to as IR) program is designed to provide the students with an organized, comprehensive and supervised education in the principles and practice of neuro, body, chest, musculoskeletal and cardiovascular radiology and the interventional techniques in the use of image-guided techniques in the above body systems. The course will also include in-depth training in the physical aspects of imaging, hazards of radiation and measures of protection.

## **Essential Requirements:**

MD or DNB in Radiodiagnosis from an institution/university recognized by the National Medical Council of India.

Upper Age limit: 35 years with relaxations as per the Govt. of India rules

## **Selection Methodology:**

NEET Superspeciality Entrance Examination.

**Course Duration:** 3 years

## **Scope of Services**

The DM (IR) Program provides didactic and clinical experiences covering the full spectrum of neuro, body, chest, musculoskeletal and cardiovascular radiology and the interventional techniques in the use of image-guided techniques in the above body systems. The course will also include in-depth training in the physical aspects of imaging, hazards of radiation and measures of protection. Both diagnostic and interventional vascular & non-vascular procedures will be included in the training program. The candidates will be required to obtain an in depth knowledge of imaging of vascular as well as non-vascular diseases with computed tomography, magnetic resonance imaging, conventional radiological techniques and Color Doppler Ultrasound, vascular procedures including diagnostic arteriography, vascular recanalization techniques by angioplasty/stenting or clot lysis, embolization, endovascular stent grafts, embolotherapy, transcatheter infusion therapy, IVC filters, radiofrequency ablation, percutaneous procedures for osseous & soft tissue pathologies and venous access.

## **Objectives:**

The main objective of the course is to rationalize the DM (IR) candidate's clinical acumen and analytical abilities so as to make him capable of taking appropriate decisions with regards to the execution of all interventional therapeutic and diagnostic procedures. This includes performance and interpretation of imaging procedures relating to the vascular (venous and arterial) systems of the body, as well as invasive (interventional) procedures for vascular & non-vascular disorders exclusive of the neurologic system (brain and spinal cord). The opportunity and skills to become a provider of top quality patient care, be a knowledgeable and inspiring teacher, and to perform clinical and experimental research in the field of vascular and interventional radiology will also be provided.

Upon completion of his training, the DM (IR) candidate should be able to:

1. Become familiar with the signs and symptoms of vascular & non-vascular disorders amenable to diagnosis and/or treatment by percutaneous methods guided by radiologic imaging.
2. Gain experience in interpreting non-invasive evaluations of vascular diseases of the arterial and venous systems.
3. Become familiar with the medical and surgical therapeutic alternatives of these disorders.
4. Become familiar with the indications and contraindications for vascular and nonvascular interventional radiologic procedures.
5. Gain experience in performing preprocedural clinical evaluation of patients and providing post procedural follow-up care
6. Perform and interpret invasive vascular interventional techniques including endovascular recanalization, reconstruction and embolization.
7. Gain exposure to new and evolving interventional techniques & technology such as Radiofrequency ablative therapy and tumor chemo & particulate embolization.
8. Become familiar with the signs and symptoms of neuro, cardiac, body, chest, musculoskeletal and peripheral system disorders that would help him to perform and interpret non-invasive investigations tailored to the clinical question.
9. Obtain an in-depth training in the physical aspects of imaging, hazards of radiation and measures of protection.

The candidate will be encouraged to inculcate relevant knowledge in anatomy, pathology, biochemistry and physiology of vascular & non-vascular diseases, imbibe patient management skills through direct patient care, and update his skills and knowledge through attending academic conferences, CMEs and hands-on workshops.

## **Research**

Candidates will be required to participate in at least 2 research projects during the course. Clinical and experimental research oriented to understand, analyze and improve upon the existing knowledge of vascular and interventional radiological procedures should be the primary objective of this exercise.

The candidate will also be introduced to the ethical and moral aspects of human and animal research through the exercise.

He/she should make all efforts to publish the outcome of the projects in peer-reviewed/ NMC /UGC approved journals, with at least one project being published. A dedicated research time will be provided in the curriculum.

The candidate will be encouraged to become well versed in the techniques of research methodology by participating in the statistics courses organized at the institution.

## **Teaching**

The student should be exposed to the basic methodology of teaching and develop competence in teaching medical, paramedical & nursing students at the undergraduate and postgraduate levels. The student must acquire the skills to transfer his/her knowledge in a clear and succinct manner and be able to motivate students (when working as a teacher) to pursue further reading.

## **Research Skill - Writing research articles**

The students must gain basic skills and knowledge to function as investigators. The students should be exposed to state of the art basic, translational, and clinical research and through active participation; research skills needed to be acquired include:

- ⇒ developing appropriate scientific knowledge and critical evaluation of the relevant literature,
- ⇒ problem solving,
- ⇒ design and interpretation of experiments,
- ⇒ communication of progress and results in formal and informal settings,
- ⇒ understanding national and international systems for funding of research and learn to obtain their own funding, and
- ⇒ sharpen critical thinking,
- ⇒ Scientific professionalism would be stressed in clinical situations,
- ⇒ Basic knowledge of statistics, along with clinical epidemiologic principles like appropriate study designs, critical appraisal of data management and analysis.

## **Attitudes including interpersonal and communication skills**

The students should learn and practice communication skills through experience in counselling patients before imaging or intervention. The patients should be provided information about all imaging and interventional procedures, contrast reaction and possible complications of anaesthesia and interventions and how it may affect the overall outcome. In the CT, MR, or DSA room setting, they will learn the skill of working with different caregivers like anaesthetists, nurses, technicians and other paramedical staff. The interventional procedures in DSA or CT room environment also will give them the training for handling crisis situations like contrast reaction, anaphylaxis, aneurysm or AVM bleed, massive blood loss in various conditions, air embolism, cardiac arrhythmias and cardiovascular collapse. The students will learn the importance of working as a team and will develop the skills of getting the best out of paramedical and nursing staff. In the intensive care set-up, they will learn to develop communication skills to deal with sick patients and their anxious relatives. Students will also learn the art of working together with colleagues from other specialties. By getting the opportunity to make presentations and attending the seminars, journal club and case presentations, students will also learn the art of making good presentation and teaching.

## **Training in Research Methodology**

The students will attend seminars and workshops to get acquainted with research methodology and writing research project for funding with appropriate research methodologies, acquire further information interacting with others involved in research.

## **TEACHING AND LEARNING METHODS**

### **a) Journal Club:**

**One hour duration:** The trainee shall present weekly/or as per schedule Journal articles presentation in the academic forum over the 3 year period.

**Paper presentation/discussion:** once per week. The student should present at least two articles along with relevant case report, either an original article (Randomized Controlled Trial/Systematic review) or a short study along with a review article, relevant to **Interventional Radiology**, citing the relevance, background/context, study methods and statistical analysis, interpret the results and discuss, summarize, present limitations of the study and critically analyze the study methods and outcomes.

### **b) Subject Seminar:**

The student should make specified number of presentations on various topics over the three years period in the Departmental / Institutional academic Forum.

One seminar every week of one hour duration (morning or afternoon). The trainee will present a subject topic allocated after doing a comprehensive preparation, relevant

literature search and present the topic in detail covering all the relevant aspects, clinical applications and engage audience and answers questions.

The soft copy of all academic presentations will be stored in CD and submitted during final assessment and examination, as record.

**c) Didactic Lecture/discussion:**

Lectures may be held on new topics by faculty, in place of seminar, as per need. Invited didactic lectures on basic neurosciences, biostatistics, research methodology, teaching methodology, from external faculty of specialties related to the subject, medical ethics and legal issues related to **Interventional Radiology**, and trauma, intensive care practice, patient care and patient management should be conducted once or twice a week.

**d) Clinical Case presentation / Case conference** in the ward and the afternoon special clinic should be in place every week with the current final year students presenting the case (in rotation ) and remaining students will follow in the coming years ( when the 2nd year PG will take up that position). This should be horizontally integrated with all related clinical disciplines. The roster for the same will be prepared for the year with all details.

The trainee should critically analyze at least 2 case records noting details such as treatment delay/non-compliance/diagnostic dilemma/atypical presentation/Co-morbidity / treatment sequence/treatment interruption/etc. that has played a role in the outcome of that particular patient and what is the possible solution/intervention required for a favorable outcome, for similar patients in future.

The students must work up one long case and three short cases and present the same to a faculty member and discuss the management. The student will present a clinical case for discussion before faculty and discuss its management and decision to be recorded in case files. The student will present a clinical case, either from neuroimaging on diagnostic point of view or some Interventional Radiology case, after performing thorough history and physical examination, elicit all physical signs, formulate diagnosis/differential diagnosis and able to plan a comprehensive care plan for the patient.

The schedule of activities is given below:

**Day**

Monday - 1 hour - Journal Club

Tuesday – 1 hour - Didactic Lecture

Wednesday – 1 hour – Subject seminar

Friday - 1 hour – Clinical case presentation.

Saturday – 1 hour – Grand Interventional Rounds

On Thursday, academic programme can be planned as per requirement and need. However, timing of teaching and days of teaching would entirely depend upon the local arrangement at the teaching institute.

#### **e). Logbook:**

Log book serves as a document of the trainee's work. The trainee shall maintain Log book of the special procedures/ operations performed by him / her during the training period right from the point of entry and its authenticity should be regularly assessed by the faculty and certified by the concerned Postgraduate Teacher/Head of the Department. This shall be made available to the Board of Examiners for their perusal at the time of his / her appearing at the final exit Examination. The log book should record diagnostic and interventional cases (all done in US, CT, MRI and in the interventional neuroradiological/radiological DSA lab) seen and presented, procedures performed, seminars, journal club and other (case) presentations. Log book entries must be qualitative and not merely quantitative, focusing on learning points and recent advances in the area. It should also contain detailed documentation of a minimum of 5 interesting cases.

#### **f). Research**

A student shall be required to present at least one paper/one poster at conferences of state, national or international levels. The work must also be published or at least sent for publication in an Indexed journal before the completion of course. Publication in an indexed journal is desirable as the University would be considering, that also in case it decides to provide awards to the best student.

#### **Educational Curriculum**

The training program is designed to provide the candidate a closely supervised and comprehensive exposure of the clinical and radiological aspects of vascular and nonvascular diseases, through practical experience and supervised training. All aspects of image acquisition, physical aspects of the equipments and hazards of radiation & measures of protection will be taught.

The training in interventional vascular & non-vascular techniques will be provided in the angiography/fluoroscopy suites. The curriculum also includes rotations through the noninvasive imaging services to gain experience with performance and interpretation of imaging of different body parts (CT, MRI and Doppler) techniques. Special emphasis will be laid on recent advances in imaging and image-guided interventional techniques.

#### **1st Year:**

Basics of Clinical aspects:

- Clinical and Laboratory Considerations
- ⇒ Symptomatology and staging of vascular disease.

- ⇒ Laboratory data (including non-imaging aspects of noninvasive vascular testing; for example, ankle-brachial indices for lower extremity arterial disease, impedance plethysmography for lower extremity venous disease)
- Epidemiology of vascular & non-vascular diseases
- Natural history of vascular disorders
- Vascular anatomy: arterial and venous
  - ⇒ Embryology
  - ⇒ Normal anatomy
  - ⇒ Variant anatomy
  - ⇒ Anatomy of collateral pathways
- Vascular physiology, pathology and pathophysiology: arterial system
  - ⇒ Normal histology/physiology/morphology
  - ⇒ Hemodynamics: normal and abnormal flow
  - ⇒ Vasoactive extrinsic/pharmacologic agents
  - ⇒ Disorders related to pharmacologic/extrinsic agent exposure
- Atherosclerosis
- Medial sclerosis
- Pathophysiology of arterial ischemia
- Aneurysms
- Thromboembolic disorders
- Dissection
- Congenital vascular disorders
  - ⇒ Vascular malformations
  - ⇒ Other congenital disorders (eg. popliteal artery entrapment)
- Arterial effects of adjacent tissues/disorders
- Arterial infection
- Vascular alterations in neoplasia: vascular supply of neoplasms, primary vascular neoplasms, vascular invasion by neoplasms
- Vascular alterations in inflammatory diseases
- Systemic vascular disorders
  - ⇒ Primary systemic vascular disorders: vasculitides and others
  - ⇒ Altered vascular pathology in systemic disease states

- Vascular trauma: injuries and vascular response to injury
  - ⇒ Mechanical injury: acute and chronic
  - ⇒ Thermal injury
  
- Arterial endothelium
- Alterations in coagulation status
  - ⇒ Hypercoagulable states
  - ⇒ Impaired coagulation
  
- Post-operative or post-interventional disorders
  - ⇒ Synthetic and endogenous grafts
  - ⇒ Myointimal hyperplasia
  
- Other/unclassified
  
- Vascular physiology, pathology and pathophysiology: venous/pulmonary arterial system
  - ⇒ Normal histology/physiology/morphology
  - ⇒ Hemodynamics: normal and abnormal flow
  - ⇒ Vasoactive extrinsic/pharmacologic agents
    - ☒ Normal response
    - ☒ Disorders related to pharmacologic/extrinsic agent exposure
  
- ⇒ Thromboembolic disorders: acute and chronic
- ⇒ Venous aneurysms
- ⇒ Venous effects of adjacent tissues/disorders
- ⇒ Congenital vascular disorders
  - ☒ Vascular malformations
  - ☒ Other congenital disorders
- ⇒ Venous infection
- ⇒ Vascular alterations in neoplasia: vascular drainage of neoplasms, primary vascular neoplasms, vascular invasion by neoplasms
  
- Vascular alterations in inflammatory diseases
  
- Systemic vascular disorders
  - ☒ Primary systemic vascular disorders
  
- Altered vascular pathology in systemic disease states
  
- Vascular trauma: injuries and vascular response to injury
  - ☒ Mechanical injury—acute and chronic
  - ☒ Thermal injury
- ⇒ Venous endothelium
- ⇒ Alterations in coagulation status
  - ☒ Hypercoagulable states
  - ☒ Impaired coagulation



- ⇒ Post-operative or post-interventional disorders
  - ☒ Synthetic and endogenous grafts
  - ☒ Intimal hyperplasia
- ⇒ Other/unclassified
  
- Neuro, head and neck anatomy, physiology, pathology and pathophysiology
  - ⇒ Normal anatomy of the brain, head and neck
  - ⇒ Normal extracranial and intracranial vascular anatomy
  - ⇒ Neuroimaging, head and neck imaging
  
- Cardiac anatomy, physiology, pathology and pathophysiology
  - ⇒ Normal anatomy of the pericardium and myocardium
  - ⇒ Normal coronary anatomy
  - ⇒ Cardiac metabolism and function
  - ⇒ Cardiac hemodynamics
  
- Pulmonary arteries and veins
  - ⇒ Pulmonary artery hemodynamics (as related to pulmonary angiography)
  - ⇒ Pulmonary thromboembolic disease
  - ⇒ Pulmonary arteriovenous malformations
  - ⇒ Pulmonary venous disorders
  
- Cardiac disorders
  - ⇒ Congenital heart diseases
  - ⇒ Acquired heart diseases : ischemic heart diseases
  - ⇒ Acquired heart diseases : valvular, endocardial, myocardial, and pericardial
  - ⇒ Post-operative and post-interventional disorders including synthetic and endogenous valve prosthesis, pericardial and synthetic baffles, PTFE and endogenous shunt materials, bypass grafts, intimal hyperplasia in coronary stents

### **Basics of interventional vascular/non-vascular catheterization laboratory**

- Workplace considerations
  - ⇒ The vascular/interventional radiology suite
    - ☒ Equipment
    - ☒ Fluoroscopy
    - ☒ Standard angiography
    - ☒ Digital angiography
    - ☒ Image processing and recording
    - ☒ Other equipment (e.g. interventional ultrasound units)
    - ☒ Layout
  - ⇒ Noninvasive vascular laboratories
    - ☒ Equipment – Color Doppler, CT and MRI
    - ☒ Management
    - ☒ Occupational Safety Issues

- ⇒ Radiation safety and hygiene
- ⇒ Infection control
- ⇒ Others
- Patient Considerations
  - ⇒ Pre-procedural assessment and care
  - ⇒ Intra-procedural monitoring
  - ⇒ Post-procedural follow up and care
  - ⇒ General pharmacologic considerations
  - ⇒ Analgesia/anesthesia
  - ⇒ Conscious sedation
  - ⇒ Antibiotic therapy
  - ⇒ Anticoagulation
  - ⇒ Other
- Personnel Considerations
- The vascular/interventional radiology "team": role and relationship of nurses, technologists, trainees, other physicians

## **2nd Year:**

### **Imaging of the vascular & non-vascular system: general principles**

- Plain film
- Angiography: arteriography and venography
  - ⇒ Standard angiography
  - ⇒ Digital subtraction angiography
  - ⇒ Contrast agents
    - Iodinated agents
    - Carbon dioxide
- Vascular catheterization
  - ⇒ Equipment: needles, guide wires, catheters, etc.
  - ⇒ Vascular access
  - ⇒ Selective and subselective catheterization
- Risks and complications
  - ⇒ Contrast reactions, iodinated agents
    - Anaphylactoid reactions
    - Classification
    - Prevention
    - Ionic vs. nonionic agents
    - Premedication
    - Treatment
- Dose dependent reactions

- ⇒ Classification
  - Acute and chronic renal effects
  - Other
- ⇒ Prevention
- ⇒ Treatment
  
- Procedural complications
  - ⇒ Puncture site complications
  - ⇒ Catheterization-related complications (apart from puncture site)
  - ⇒ Systemic/generalized complications
  
- Pharmacangiography: agents and uses
  - ⇒ Vasodilatation
  - ⇒ Vasoconstriction
  - ⇒ Other
  
- Intravascular Ultrasound
  - ⇒ Ultrasonography
    - Gray scale
    - Duplex Doppler
    - Color flow
  
- Computed Tomography
  - ⇒ General
  - ⇒ Spiral and Multislice CT
  - ⇒ CT angiography
  
- Magnetic Resonance Imaging
  - ⇒ General-vascular & non-vascular
  - ⇒ Cardiac MRI protocols
  - ⇒ Blood flow evaluation and MR angiography

### **3rd Year:**

#### **Vascular Intervention: General**

- Common Topics: vascular interventional procedures
  - ⇒ Anatomic considerations
  - ⇒ Indications and contraindications
  - ⇒ Techniques, devices, materials
  - ⇒ Results, efficacy
  - ⇒ Risks and complications
  - ⇒ Alternate techniques (surgical and medical therapeutic options)
  
- Vascular canalization/recanalization: re-establishment of flow
  - ⇒ Thrombolytic therapy
    - Pharmacologic thrombolysis
      - General principles

- Specific agents: urokinase, streptokinase, tissue plasminogen activator, others
- Mechanical techniques
- Fogarty balloon
- Suction thromboembolectomy
- Other/newer devices
- ⇒ Balloon angioplasty
- ⇒ Atherectomy
- ⇒ Laser recanalization
- ⇒ Mechanical recanalization
- ⇒ Vascular stents
- ⇒ Endovascular grafts
- ⇒ Other
  
- Vascular blockade: obliteration of flow
- ⇒ Embolization
- Techniques
- Transcatheter
- Direct injection
- Agents
- ⇒ Other methods
- Ultrasound guided compression repair
  
- Re-routing of flow
- ⇒ Endovascular repair of aneurysms
- ⇒ Creation of new vascular channels (e.g.TIPS, fenestration of aortic dissection)
  
- Vascular filters
  
- Vascular foreign body removal
  
- Intravascular/transvascular biopsy
- ⇒ Transvenous liver biopsy
- ⇒ Other

### **Vascular Intervention: Specific territories**

- Neuroendovascular interventions
- ⇒ Stroke thrombectomy
- ⇒ Endovascular aneurysm management
- ⇒ Endovascular AVM management
- ⇒ Endovascular AVF management
- ⇒ Carotid and intracranial stenting
- ⇒ Extracranial and intracranial tumor embolization
  
- Lower extremity vascular disease
- ⇒ Arterial
- Occlusive atherosclerotic disease: recanalization

- Aortoiliac
- Femoropopliteal
- Tibioperoneal
- Intervention for peripheral arterial trauma
- Thromboembolic disorders: recanalization
- Peripheral arterial graft failure: recanalization
- Iatrogenic disorders: therapy for puncture site complications
- ⇒ Venous
- ⇒ Combined: vascular malformations: obliteration
  
- Upper extremity vascular disease
- ⇒ Arterial
- Thromboembolic disorders: recanalization
- Trauma
- ⇒ Venous
- Acute upper extremity venous thrombosis: recanalization
- Chronic upper extremity venous thrombosis: recanalization
- ⇒ Combined: vascular malformations: obliteration
- ⇒ Venous varicose-Radiofrequency ablation/ laser ablation / venaseal
  
- Thoracic vascular disease
- ⇒ Hemoptysis
- Bronchial artery embolization
- Other techniques
- ⇒ Pulmonary arteries and veins
- Pulmonary thromboembolic disease: thrombolytic therapy, thromboembolectomy
- Pulmonary arteriovenous malformations: embolization
  
- Aortic disorders
- ⇒ Aortic aneurysm: embolization, endovascular grafting
- ⇒ Aortic dissection: endovascular grafting, fenestration
- ⇒ Aortic trauma
  
- Central venous intervention (SVC, IVC)
- ⇒ Central venous occlusive disorders
- Thromboembolic disorders
- Congenital webs
- ⇒ Caval filtration and related techniques for thromboembolic disease
  
- Vascular diagnosis, abdominal and pelvic viscera
- ⇒ Genitourinary system
- Kidney
- Renovascular hypertension: recanalization techniques
- Renal trauma
- Varicocele / Ovarian Vein embolization
  
- ⇒ Uterine Fibroid embolization

- ⇒ GI Bleeds
- ⇒ TACE / TARE for HCC

### **Non-vascular Interventions**

- Hepatobiliary interventions
  - ⇒ Hepatic carcinomas-chemoembolization or RFA
  - ⇒ Common bile ducts abnormalities
  - ⇒ Liver cirrhosis
  - ⇒ Other miscellaneous conditions
- Pain management for neoplastic & non-neoplastic conditions by interventional techniques under image guidance (fluoroscopy, CT, USG, MRI)
- Breast imaging & Interventions
- Vertebroplasty-Using alcohol or bone cement
- Kyphoplasty
- HIFU
- GENITOURINARY INTERVENTIONS – ESWL, PCN, PCNL
- Ureteric stenting/ Ureteric occlusions/ Management of Ureteric leaks
- Radiofrequency/ Microwave ablations pf Renal tumors/ Prostate etc.
- RFA/ Microwave ablations of Lung tumors
- Fallopian tube recanalizations
- Transarterial chemo/ embolization of osteosarcomas/ retinoblastomas
- Biopsy and drainage procedures
- Newer techniques and applications of interventional radiology and Interventional Oncology.
  
- Quality Assurance Issues
  - ⇒ Outcomes analysis
  - ⇒ Practice guidelines
  - ⇒ Complications: classification, documentation
  
- Legal Aspects of Interventional Radiology
  - ⇒ Informed consent
  - ⇒ Malpractice
  
- Regulatory agencies
  - ⇒ Investigational devices and procedures
  
- Administrative Aspects
  - ⇒ Equipment purchase
  - ⇒ Inventory management

### **ASSESSMENT:**

Formative assessment will be continual and will 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 (IA) shall be conducted frequent, covering all domains of learning and will also include professional conduct and communication skills. IA will be used to provide feedback to improve learning. Each candidate will be required to maintain a logbook, wherein his clinical, teaching and research activities through the entire duration of the course will be entered. Evidence of having conducted research should be presented before the candidate is permitted to appear for the DM (final) examination.

**Quarterly assessment during the DM training will be done and will 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 DM student shall be assessed periodically as per categories listed in postgraduate student appraisal form approved by NMC & KAHER University - Annexure I.**

### **SUMMATIVE ASSESSMENT:**

**Summative assessment shall be done at the end of training**

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

The summative assessment examination shall include:

- A. Theory examination.
- B. Practical, Clinical examination and Viva-voce.

Theory examination and Practical/Clinical, Viva-voce shall be separate heads of passing.

Theory examination shall comprise of four papers. Passing percentage shall be cumulatively 50% with minimum of 40% marks in each theory paper.

Practical /Clinical examination consisting of at least one long case, three short cases and viva- voce. Passing percentage shall be 50%.

Passing shall be separate for each head and failing shall be common, meaning thereby that clearance at theory and failure at practical / clinical shall amount to failure at Summative examination and vice versa.

A total of 4 examiners, two of who shall be external examiners approved by NMC & KAHER, will conduct the DM examination. The general scheme of conducting the examination will be as follows:

The DM Post Graduate examination shall be in two parts: -

### **A. Theory**

There shall be **4 theory papers** of 3 hours each.

**Paper I:** Basic Sciences as applied to the subject including Imaging Physics, Biochemistry, Pathology, Pharmacology, epidemiology, Clinical trials

**Paper II:** All aspects of Whole-body imaging, Therapeutic and Interventional Radiology- clinical and applied

**Paper III:** Therapeutic and Interventional Radiology

**Paper IV:** Recent advances in Whole body imaging and Interventional radiology

### **B. Clinical/Practical and Oral examination:**

#### **Clinical/Practical Examination:**

The practical examination shall include evaluation of 01 long and 03 short cases and demonstration of clinical skills in evaluation and execution of at least one interventional radiologic procedure to reach a diagnosis.

#### **Oral Examination:**

- i. Oral examination shall be exhaustive, and every effort will be made to evaluate the student for his knowledge in relevant cross-sectional imaging including instrumentation, techniques, current concepts and future trends in clinical Interventional Radiology.
- ii. This examination shall include evaluation of the students knowledge in application of relevant anatomy, pathology, chemistry/ immunology pertinent to Interventional Radiology.
- iii. Discussion on research work carried out by the student and related presentations and publications will be included in the viva-voce.

***The trainee successfully completing the DM (IR) course will be eligible for the award of a degree in Interventional Radiology.***

## **Appendix**



## DM Postgraduate Student Appraisal Form

Name of the Department/Unit:

Name of the DM PG Student:

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

Sr.No	PARTICULARS	Not	Satisfactory	More Than	Remarks
		Satisfactory		Satisfactory	
		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 & Interdepartmental learning activities				
5	Externa and Outreach Activities/CMEs				
6	Thesis/Research work				
7	Log book Maintaince				

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