SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

MD Radio-Diagnosis

Curriculum and Syllabus 2015

Branch Code: 24

SRM Medical College Hospital & Research Centre

SRM University

SRM Nagar, Kattankulathur

Kancheepuram (Dt). 603 203

MD RADIO-DIAGNOSIS

1. A. GOAL:

1. To orient and train student in different aspects of diagnosis and intervention in radiology.
2. Special emphasis will be on new imaging techniques like USG, CT, MRI and interventional radiology.
3. Training will be oriented for technical aspects of clinical radiology and applied radiology and post treatment follow up in disease.
4. Ultimate goal will be to provide quality education for the post graduates and quality diagnostic and relevant therapeutic care for different sections of the society.

B. OBJECTIVES:

KNOWLEDGE:

1. To acquire thorough knowledge of principles of medicine, surgery, OG and allied Subjects.
2. Knowledge of basic sciences relevant to this speciality.
3. Update on self study, attending seminars, conference and workshops, for radio diagnosis.
4. Research oriented work with the aim of publishing papers in national & international forums.
5. Special emphasis will be of imaging in cancer.

SKILLS:

1. In addition to acquire skills in diagnosing the diseases, to acquire life saving support services in emergency situations.
2. To perform interventional procedures.
3. Developing skills in the art of discussing the case with clinicians and to maintain cordial relationship with other departments.
4. Radiology principles in legal medicine and trauma care.

ETHICAL:

1. Professional honesty and integrity to be fostered.
2. Respect patient's right to information and right to seek second opinion.
3. To apply radiation safe techniques to the patient.
4. To take into account social and economic, environmental aspects while planning diagnostic procedures.

2. COURSE OVERVIEW

DURATION OF THE COURSE

The period of certified study and training for the Post-Graduate MD RADIO - DIAGNOSIS shall be Three Academic years (six academic terms). The academic terms shall mean six months training period.

COMMENCEMENT OF ACADEMIC SESSION

The academic session for the Post-Graduate shall commence from May/June of the Academic Year.

DATE OF EXAMINATION

The candidates admitted up to May/June of the academic year shall be registered for that academic year and shall take up their Final Third Year regular examination in April /October of the academic year after completion of 3 years/36 months.

NUMBER OF EXAMINATIONS

The University shall conduct not more than two examinations in a year, for any subject, with an interval of not less than 4 and not more than 6 months between the two examinations.

ATTENDANCE

All candidates joining the postgraduate training programme shall work as full time residents during the period of training, attending not less than 80% (eighty percent) of the training during each calendar year, and will be given full time responsibility, assignments and participation in all facets of the educational process. The period of training for obtaining the degrees shall be three completed years including the period of examination.

TRAINING PROGRAMME

Three years Course:

First year :

Forenoon Session

General Radiology	– 6 Months
Ultrasound	– 2 Months
CT Scan	– 1 Month
MRI	– 1 Month
General Medicine	– 1 Month
General Surgery	– 1 Month

Afternoon Session

Basic Sciences	- 12 Months (First session)
Medical Physics	- 12 Months (Second session)

Second Year :

(**Both Forenoon & Afternoon session)**

General Radiology	- 4 Months
Ultrasound	- 2 Months
CT Scan	- 2 Months
MRI	- 1 Month
Nuclear Medicine	- 1 Month
Paediatric Radiology	- 1 Month
Cardiovascular Radiology	- 1 Month

Third Year:

General Radiology	- 3 Months
Ultrasound	- 3 Months
CT Scan	- 3 Months
MRI	- 3 Months

3.COURSE CONTENT:

THEORY:

PAPER – I: Radiological physics, Instrumentation, Contrast studies and Basic Sciences related to Radiology.

PAPER – II : Radio Diagnosis: Imaging of Respiratory System, Cardio Vascular System, Musculoskeletal system, Obstetrics and gynaecology, Oncology and Endocrine Radiology.

PAPER – III: Radio Diagnosis: Imaging of abdomen (G.I.T, Hepatobiliary and Genitourinary system), central nervous system, Orbit, otorhinolaryngology, Dental & Soft Tissues.

PAPER – IV: Recent Advances in Radiological imaging, vascular and nonvascular interventional Radiology and Nuclear Medicine.

CLINICAL

1. Long Case
2. Short Case
3. Spotters (Skiagrams)

   (Includes X- rays, M.R.I, C.T. Scan,
   Ultra sonogram, Nuclear Medicine
   Other investigative Procedures and recent advances).

4.DETAILED SYLLABUS

a) THEORY

BASIC SCIENCE RELATED TO RADIO-DIAGNOSIS

b) Radiological anatomy of various organ systems.
Radiological changes due to pathology of various organs systems.
Radiological Physics and Radio-Biology
Imaging Techniques
Radiography
Includes all aspects of:
Fundamentals of electromagnetic radiation, X-ray production, characteristic properties of X-Rays, units of radiation, radiation measurement, X-ray equipments, X-Ray films, intensifying screens, other X-Ray appliances, dark room equipments and procedures, II TV, cine fluorography, tomography.
Quality assurance
Radiation hazards and principle and methods of radiation protection.
Contrast media: types, chemistry, mechanisms of action, dose schedule, routes of administration, their potential adverse reactions and management.
Clinical applications of important isotopes and instrumentation in Nuclear medicine with advances in both.
Physics and applications of advanced imaging i.e., Ultrasound, Computed Tomography, Magnetic Resonance imaging, Angiography (Digital Subtraction Angiography), Positron Emission Tomography, Single Photon Emission Computed Tomography, Conventional Radiography, Digital Radiography, Digital Fluoroscopy, Flat panel detector system etc.
Picture archiving and communication system (PACS) and radiology information system (RIS) to make a film less department, Teleradiology and digital imaging.

RESPIRATORY SYSTEM

GOAL

At the completion of the course the resident should be able to interpret conventional and advanced (CT, MRI) chest examinations, differentiating normal from abnormal cases and be able to recognize specific imaging pattern of different diseases.

Content Coverage

Diseases of the chest wall, diaphragm, pleura and airways; pulmonary infections; pulmonary vasculature; pulmonary neoplasm; diffuse lung disease; mediastinal disease; chest trauma; post-operative lung and X-rays in intensive care.

Essential Objectives

1. Should be able to localize the chest pathology into one of the following compartments: pulmonary, pleural, mediastinal, extra-pleural, extra-thoracic, diaphragmatic, infradiaphragmatic.
2. Recognize chest pathology that requires urgent or emergency treatment and describe this in an adequate manner: Pneumothorax, traumatic aortic rupture, esophageal rupture, acute pulmonary embolism, CHF and trachea-bronchial foreign bodies.
3. Recognize acute and chronic patterns of bacterial and viral pneumonia's, occupational diseases, and allergic states.
4. Recognize acute and chronic cardiac failure patterns and non-cardiogenic edemas.
5. Understand the radiographic features and precipitating causes of adult and infant respiratory distress syndrome.
6. Recognize and describe appropriately various manifestations of benign and malignant neoplasms of the lung.

Evaluation

- Resident's progress through daily observation of work.
- At the end of the rotation an assessment by a small group of faculty.
- Maintain a log book showing techniques learnt during the rotation – to be supervised.

GASTROINTESTINAL (GIT) AND HEPATO-BILIARY-PANCREATIC SYSTEM

Goal

At the completion of this course, the resident should be able to interpret both the conventional and other newer (Ultrasound, CT, MRI, Angiography) examinations. This includes examination of GIT i.e., esophagus, upper gastrointestinal study, follow through for small bowel (including small bowel enterolysis) and enema (both conventional and double contrast) for colon. It alo includes examination of liver, biliary system and pancreas using all the imaging modalities available to a radiologist including specialized investigations like ERCP, PTC and interventional procedures like abscess drainage, percutaneous transhepatic biliary drainage (PTBD, internal and external), tumor embolization, radiofrequency (RF) ablation etc.

During this posting resident also performs other investigations done using fluoroscopic guidance e.g; hysterosalpingography (HSG); fistulogram, sonogram, T-Tube cholangiography, sialography etc, and he/she should be able to perform and interpret studies using these modalities.

Content Coverage

Diseases and disorders of mouth, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, diseases of omentum, peritoneum and mesentery, acute abdomen, abdominal trauma using conventional and newer imaging methods like CT, MRI, DSA, isotope studies.

Diseases and disorders of hepato-biliary-pancreatic system using conventional & newer imaging methods.

Essential Objectives

1. Learn to evaluate the clinical condition & needs of a patient and to decide the appropriate studies and approach for examining the GIT or hepato-biliary-pancreatic system f a patient.
2. Learn a proper approach to fluoroscopy; this includes developing proficiency in GIT fluoroscopy, mastering the equipment and using proper radiation protection measures (both for the patient and the operator).
3. Learn the basic pathology and patho-physiology of GIT/hepato-biliary-pancreatic diseases.

4. Learn to communicate the findings both at fluoroscopy and in films, in an accurate, succinct and meaningful way for evaluation.
5. Day to day observation of residents work including documentation and interpretation
6. Assessment by a group of faculty at the end of the rotation.
7. Log book will be maintained of the procedures learnt.

GENITO-URINARY SYSTEM

Goal

At the completion of this course resident should be able to perform, direct the radiography and interpret the conventional radiological examinations of the urinary tract. These includes: excretory urography (intravenous pyelography); cystograms, micturating cystourethrography (MCU) and retrograde urethrography (RGU).

[HSG is included under GIT rotation].

In addition the resident should be able to perform and interpret other diagnostic imaging modalities and procedures which are used to evaluate urinary tract pathology i.e. ultrasound, CT, MRI, angiography, as well as various interventional procedures like percutaneous nephrostomy, kidney biopsy, stent placement, antegrade pyelography, tumor embolization etc.

Obstetrics and gynaecology ultrasound: separate posting in III year.

Hysterosalpingography: already included with GIT posting.

Content Coverage

Imaging: conventional, ultrasound, CT, MRI, Angiography; of various diseases and disorders of genitourinary system. These includes: congenital, inflammatory, traumatic, neoplastic, calculus and miscellaneous conditions.

Essential Objectives

1. Recognize and evaluate emergency conditions involving the urinary tract including trauma, infection, vascular compromise and obstruction.
2. Recognize and understand the patho-physiology of stone disease.
3. Recognize patterns of infectious diseases and the modalities necessary for diagnostic evaluation.

4. Understand the complete evaluation of renal mass lesions and the evaluation of other urinary tract neoplasms, including the detection and staging of the tumor.
5. Recognize the difference between the pattern of diseases affecting the genitor-urinary tract of adults and that of children and understand and identify the common conditions affecting the pediatric genitor-urinary system on imaging.

Evaluation:

- Day to day, based on daily work assessment.
- By a group of faculty at the end of the posting.
- Maintain a log book.

MUSKULOSKELETAL SYSTEM

Goal

At the end of the course the resident should be able to correctly interpret all the common abnormalities of the bones and joints. He/she should have a good understanding of the common congenital abnormalities, arthritis, bone and joint trauma, neoplastic conditions, metabolic bone disease and inflammatory diseases. He/she should also have an understanding of the role of CT/MRI in all these conditions and should be able to perform and interpret CT/MRI in diseases of musculo-skeletal system.

Content Coverage

Imaging (Conventional, Ultrasound, CT, MRI, Angiography, Radio-isotope studies) and interpretation of diseases of muscles, soft tissue, bones and joints including congenital, inflammatory, traumatic, neoplastic and miscellaneous conditions.

Essential Objectives

1. Communicate precisely and cogently radiographic descriptions of bone and joint trauma.
2. Differentiate various forms of arthritis and know correlative laboratory and clinical findings.
3. Enumerate the radiographic features that differentiate benign and malignant bone tumors with a basic familiarity of more common tumors.
4. Know radiographic features of acute and chronic osteomyelitis and discitis (including tuberculosis).
5. Recognize differential features of osteoporosis (including Bone Mineral Density or BMD assessment techniques e.g.; USG, CT, DEXA) including various endocrine and metabolic diseases e.g.; osteomalacia, hyperparathyroidism etc.
6. Know the application and interpretation of Ultrasound/CT/MRI/Angiography in one or more of the above situations.

Evaluation

- Through daily sessions assessment
- By a small group of faculty at the end of posting
- Will maintain a log book

CARDIOVASCULAR RADIOLOGY/ECHO CARDIOGRAPHY

Goal

Goal is to provide adequate working knowledge in the role of imaging in cardiovascular diseases by different techniques including cardiac catheterization and cardiac angiography. Digital subtraction angiography (DSA) and interventional procedures in non cardiac arterial and venous diseases.

Content Coverage

Diseases and disorders of cardiovascular system including congenital conditions and the role of imaging by conventional ultrasound, Echo, Colour-Doppler, CT, MRI, Angiography (including DSA) and radionuclide studies. It also includes interventional procedures e.g. balloon angioplasty, embolization etc.

Essential Objectives

1. Understand the anatomy and common pathology of congenital an acquired cardiac conditions.
2. Correlate plain film findings of common congenital abnormalities with those shown by angiography and explain the pathophysiology including abnormal pressure measurements.
3. Correlate plain film findings and the echocardiographic studies of patients with acquired valvular diseases and other common pathologic conditions including pericardial pathology.
4. Understand the role of newer modalities like CT/MRI, in aortic diseases e.g., aorto-arteritis, aortic dissection and aortic aneurysm.
5. Should have the working knowledge of fluoroscopy on patients before and after valve replacement and identify those with complications after valve replacement.
6. Understand the principle and logic behind various interventional procedures carried out in the cardiovascular labs e.g.; PTCA, balloon dilatation of valvular lesions, septostomy etc.

Evaluation

- Day to day assessment
- By a small group of faculty
- Maintain a log book to be checked by faculty in charge.

NEURORADIOLOGY

Goal

At the end of the course the resident should be able to demonstrate reasonable proficiency in the assistance during performance as well as in the interpretation of all neuroradiological studies. This includes angiograms, both cerebral and non-cerebral studies, transluminal angioplasties, embolization procedures and myelography. They should also be able to perform and interpret CT and MRI of head and spine.

Content Coverage

Includes imaging (using conventional and newer methods) and interpretation of various diseases and disorders of the head, neck and spine covering congenital lesions, infective lesions, vascular lesions, traumatic conditions and neoplasia. It also includes number of interventional procedures carried out in the department of neuroradiology.

Essential Objectives

1. Know detailed normal neuro-imaging anatomy on different imaging modalities.
2. Identify pathologic conditions (listed under the content on images acquired using different techniques) and communicate the report in a concise manner.
3. Participate in neuroradiology conferences held with the neurosurgery or neurology units.

Evaluation

- Day to day based on reporting and procedures performed.
- By a small group of faculty.
- Will maintain a log book to be checked by faculty in neuroradiology.

GYNAECOLOGICAL & OBSTETRICS RADIOLOGY

Goal

At the completion of this rotation the resident should be able to perform and interpret all ultrasound studies. These studies include: abdomen, pelvis, small parts, neonatal head, colour-duplex imaging (including peripheral i.e; extremity arterial and venous studies), obstetrics/gynaecology (in the dept of Gyn/Obstet) and interventional procedures using ultrasound guidance. The resident should have a thorough knowledge of the common abnormalities of the abdominal/pelvic organs, retroperitoneal structures, neck, chest, extremities and small parts (thyroid/parathyroid, scrotum, orbit, and breasts).

Essential Objectives

1. Determine or select the appropriate diagnostic procedure for the clinical problem.

2. Demonstrate proficiency in patient scanning using appropriate techniques and instrumentations.
3. Modify the procedure, if required, based upon the observed abnormalities (Pathology).
4. Analyze the result of the diagnostic procedure, make diagnosis and record the findings.
5. Communicate findings, diagnostic and other relevant information to the referring physician.
6. Present interesting ultrasound cases in the departmental conferences / meetings.

Evaluation

- Ongoing basis using day to day work.
- Presentations in departmental meets.
- Maintain a log book.
- By a group of faculty at end of the rotation.

ANGIOGRAPHY AND INTERVENTIONAL RADIOLOGY

Goal

At the completion, the resident should be knowledgeable in most common non-cerebral angiographic studies. He/She should have a good basic understanding of both; the vascular interventional radiologic procedures such as angioplasty; embolization using various embolizing agents; as well as the various non vascular interventional procedures such as percutaneous nephrostomy, stenting, abscess drainage, PTC/PTBD, percutaneous biopsy, balloon dilatation of the esophagus etc. He/She should have a good understanding of the various equipment and available catheters and guidewires and other technical aspect of special procedures. In addition he/she should know all the potential risks and complications of these procedures and their management.

Essential Objectives

1. Evaluate the requisition for appropriate clinical information to determine if additional information is needed.
2. Determine or select appropriate diagnostic procedure for the clinical problem.

3. Assist and perform appropriate diagnostic procedure for the clinical problem.
4. Know normal vascular anatomy applicable to angiographic procedures performed and know normal anatomy and landmarks to perform other non – vascular procedures.
5. Know normal vascular anatomy applicable to angiographic procedures performed and know normal anatomy and landmarks to perform other non – vascular procedures.
6. Present interesting cases in the departmental meets.

Evaluation

- Day to day evaluation
- By a group of faculty
- Will maintain a log book

PAEDIATRIC RADIOLOGY

Goal

Intentional is to train residents to perform common radiologic procedures and to be able to interpret pediatric studies in order that they can appropriately deal with examinations of children in a non paediatric hospital environment.

At the completion the resident should be able to interpret most of the conventional and newer pediatric examinations which includes; upper airways, chest, geneto-urinary, gastro-intestinal and musculo – skeletal systems. Residents should be familiar with many of the neurologic conditions encountered in neonates and children. Resident should also be able to perform transfontanelle cranial ultrasound.

Content coverage:

Common diseases and disorders of different organ systems covering congenital inflammatory, traumatic, neoplastic and other miscellaneous conditions, using both conventional and newer imaging methods.

Essential Objectives

1. Understand the appropriate indications for various imaging procedures and determine that the patient has been properly prepared for the procedure.
2. Know the standard radiographic views for paediatric examinations.
3. Learn to recognize and evaluate imaging manifestations (on conventional and newer methods) of common paediatric conditions occurring in the head/neck, chest, abdomen/pelvis and in the musculo – skeleton.
4. Perform paediatric fluoroscopic examinations with skill and accuracy.
5. Understand and apply the knowledge and principle of radiation protection, both for the child and the operator.

RADIOLOGY IN EMERGENCY MEDICINE

Goal

At the end of the course, resident should be able to give an evaluation of the emergency radiographic examinations. He/She should also be familiar with Medico legal cases (MLC) procedures.

Essential Objectives

1. Determine and direct radiography in emergency patients and review and interpret the radiographs.
2. If study is incomplete then determine additional views or repeat views.
3. Know indications for a limitation of the common emergency imaging procedures.
4. Communicate findings, diagnosis and other relevant information to the emergency room physician.
5. He/She should be able to perform (Some under supervision) and interpret special imaging procedures needed in emergency room e.g.; barium studies, excretory urography, CT, Ultrasound, Doppler and Angiography.

ONCOLOGY RADIOLOGY

Goal

At the end of the rotation the resident should be able to interpret radiological investigations in patients with neoplastic diseases (both benign and malignant). He/She should have adequate working knowledge to interpret and diagnose these patients. The resident should be able to perform and interpret newer imaging technique like PET – CT, Elastography, RF ablation system etc.

Essential Objectives

1. Understand pathology and patho-physiology of common neoplasms.
2. Learn the algorithmic approach to image these patients based on the suspected disease, its biological behavior and potential and limitations of various imaging modalities.
3. Perform appropriate investigation (both conventional and newer methods), interpret the results and reach at a reasonable diagnosis/differential diagnosis based on the clinical and biochemical results.
4. Learn to communicate the results in a precise way in a report to the concerned unit.
5. Present interesting cases in the departmental meets.

NUCLEAR MEDICINE

Goal

At the completion of this rotation the resident should be able to interpret common nuclear medicine examinations (including cardiac cases). He/she should be able to evaluate the examinations for completion and determine what further images (including non nuclear medicine) need to be done. He/She should have a good understanding of the physical and biological properties of the commonly used radiopharmaceuticals and become familiar with safe handling of isotopes and basic radiation safety measures while dealing with isotopes.

Essential objectives

1. Review all cases performed each day.
2. Interpret the results of the procedure and give an appropriate diagnosis.
3. Observe and help in some common procedures performed in the department (e.g.: thyroid, kidney, bone, cardiac scans), understand the principle underlying the procedure and the basis for using a particular isotope in an investigation

Evaluation

- Day to day by nuclear medicine staff.
- By a group of faculty
- Will maintain a log book.

1. TEACHING SCHEDULE FOR POST GRADUATES

Post graduate Degree Course in M.D.

Radio – Diagnosis

TRAINING PROGRAMME

- All post graduate candidates shall work as full time residents during the period of training, attending not less than 80% of the training during each calendar year, and given full time responsibility, assignments and participation in all facets of the educational process.
- The structured training programme shall be written up and strictly followed to enable the examiners to determine the training undergone by the students.
- During the training for the degree to be awarded in clinical disciplines, there shall be proper training in basic medical sciences related to the disciplines concerned.
- Every post-graduate should also be required to participate in the teaching and training program of undergraduate and interns.
- Training in medical audit, management, health economics, health information system, basics of statistics, exposure to human behavior studies, knowledge of pharmaco-economics and introduction to non-linear mathematics shall be imparted to the post-graduate students.

Three years Course:

First year : Forenoon Session

General Radiology	– 6 Months
Ultrasound	– 2 Months
CT	– 1 Month
MRI	– 1 Month
General Medicine	– 1 Month
General Surgery	– 1 Month

Afternoon Session :

Basic Sciences	– 12 Months (First session)
Medical Physics	- 12 Months (Second session)

Second Year :

(Both Forenoon & Afternoon session)

General Radiology	- 4 Months
Ultrasound	- 2 Months
CT Scan	- 2 Months
MRI	- 1 Month
Nuclear Medicine	- 1 Month
Paediatric Radiology	- 1 Month
Cardiovascular Radiology	- 1 Month

Third Year:

General Radiology	- 3 Months
Ultrasound	- 3 Months
CT Scan	- 3 Months
MRI	- 3 Months

5.MAINTENANCE OF LOG BOOK

Each candidate should be required to maintain a log book of the work carried out by them and the training programme undergone during the period of training The Log Book should consist of the following details.

a) Investigation performed by them.
b) Presentations in journal clubs along with title , issue of journal and discussion of its contenets.
c) Cases presented in clinical meetings with other departments.
d) Presentations in departmental seminars.
e) Schedule of interdepartmental rotation.
f) Details of apprenticeship.
g) Conference attended national/international.
h) Papers presented at conferences with title name and name of the conference, date of presentation.
i) Paper published with title, name & issue of the journal.
j) Teaching and training programme conducted by them
k) At the end of the course, the candidate should summarise the contents and get the log book certified by the head of the department.
l) No marks will be allotted for the log book and should be submitted at the time of practical examination for the scrutiny by the board of examiners.

   Log book should be scrutinized by the assistant professors during their posting with them and certified by the associate professor/Professor atleast every week.

5.1 It is mandatory that a post graduate student during the course to present one poster presentation and/or to read one paper at a national / state conference and / or to present one research paper which can be published/accepted for publication/sent for publication during the period of his/her postgraduate studies.

Teaching Method:

The following methods are to be used for the teaching of the post-graduate students:

1. **Journal club:** one hour duration-paper presentation/discussion weekly.
2. **Seminar:** One seminar every month of one hour duration.
3. **Lecture/Discussion**: Lectures on theory topics by Faculty every day.
4. One Long Case Presentation: Once per week. Residents will present a clinical case for discussion before faculty and discussion made pertaining to its imaging approach.
5. One Short Case Presentation: One per day. Residents will present a clinical case for discussion before a faculty and discussion made pertaining to its imaging approach.
6. Research Methodology: Course and lectures are to be arranged for the residents for the languages proficiency by humanity teachers besides few lectures on human values and ethical issues in patient care.
7. Writing Thesis: Thesis progress is presented once in three months and discussion made in the department. Guides/Co-Guides is to hear the problems of the candidates; can provide assistance to the student.

TIME TABLE

Time	Classes
8.00 am– 9.30 am	Interesting case discussion – daily Case presentation /Journal club Discussion/ Symposium/ Seminars/ Thesis discussion – as scheduled.
9.00 am – 12.00 noon	Modalities Posting
12.00 noon – 1.30 pm	Departmental/Interdepartmental discussions
1.30 pm – 3.00 pm	Modalities Posting
3.00pm – 4.00 pm	Theory classes

6. Thesis

Every candidate registered as post graduate shall carry out work on an assigned research project under the guidance of a recognized post graduate teacher, the result of which shall be written up and submitted in the form of a thesis.

Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the candidate to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. Thesis shall be submitted at least six months before the theoretical and clinical / practical examination.

The thesis shall be a bound volume of a minimum of 50 pages and not exceeding 75 pages of typed matter (Double line spacing and on one side only) excluding certification, acknowledgements, annexure and bibliography.

Thesis should consist of

(a) Introduction
(b) Review of literature
(c) Aims and objectives
(d) Material and methods
(e) Results
(f) Discussion
(g) Summary and conclusion
(h) Tables
(i) Annexure
(j) Bibliography

Four copies of thesis shall be submitted six months prior to the commencement of the theory examinations on the date prescribed by the Controller of Examinations of this University. The thesis should be approved by the Professor of that branch and the same has to be forwarded to the Controller of Examinations, by the head of the department through the Dean of the college.

Two copies in addition are to be submitted as an electronic version of the entire thesis in a standard C.D. format by mentioning the details and technicalities used in the C.D. format.

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; and on the acceptance of the thesis by two examiners, the candidate shall appear for the final examination.

EVALUATION OF THESIS :

ACCEPTED / NOT ACCEPTED.

No marks will be given

7. SCHEME OF EXAMINATION

UNIVERSITY EXAMINATION PATTERN (At the end of third year)

No candidate shall be permitted to appear for the examination, unless he/she has put in a minimum of 80% attendance during each calendar year of study and training in the affiliated institution recognized by this university.

a) MARKS DISTRIBUTION

a) MARKS DISTRIBUTION

Theory	Title	Duration in Hours	Maximum Marks
PAPER – I	Radiological physics, Instrumentation, Contrast studies and Basic Sciences related to Radiology.	3	100
PAPER – II	Radio Diagnosis: Imaging of Respiratory System,Cardio Vascular System , Musculoskeleta system , Obstetrics and gynaecology, Oncology and Endocrine Radiology.	3	100
PAPER – III	Radio Diagnosis: Imaging of abdomen (G.I.T, Hepatobiliary and Genitourinary system), central nervous system, Orbit, otorhinolaryngology, Dental & Soft Tissues.	3	100
PAPER – IV	Recent Advances in Radiological imaging, vascular and nonvascular interventional Radiology and Nuclear Medicine.	3	100

CLINICAL/PRACTICAL

1. Long Case : 1 100 Marks
2. Short Case : 2 100 Marks
3. Spotters (Skiagrams) : 25 50 Marks

   (Includes X-rays, MRI, CT scan, Ultra sonogram, Nuclear Medicine Other investigative Procedures and recent advances)

Viva Voce : 50 Marks

Total : 300 Marks

MARKS QUALIFYING FOR A PASS

MARKS QUALIFYING FOR A PASS	MAXIMUM MARKS	QUALIFYING FOR A PASS 50% MARKS
Theory Examination	400	200
Practical Including clinical and Viva voce examination	300	150

A candidate shall secure not less than 50% marks in each head of passing which shall include 1.Theory 2.Practical including clinical and viva voce examination.

''The postgraduate medical students are required to pass theory and practical examinations separately. An examinee should obtain minimum 40 % marks in each theory paper and not less than 50% marks cumulatively in all the four papers for Degree examination to be cleared as ''Passed'' at the said degree examination''.

**As per medical council of India notification date 03-09.2014 and the same approved in the 28th academic council meet of SRM University held on 23/03/2015.*

8. EXAMINATION AND EVALUATION

(a) All the Post Graduate Examiners shall be recognised Post Graduate Teachers holding recognised Post Graduate qualifications in the subject concerned.

(b) For all Post Graduate Examinations, the minimum number of Examiners shall be four, out of which at least two (50%) shall be External Examiners, who shall be invited from other recognised universities from outside the State. Two sets of internal examiners may be appointed one for M.D./M.S. and one for diploma.

(c) Under exceptional circumstances, examinations may be held with 3 (three) examiners provided two of them are external and Medical Council of India is intimated the justification of such action prior to publication of result for approval. Under no circumstances, result shall be published in such cases without the approval of Medical Council of India.

(d) The guidelines regarding appointment of examiners are as follows:-

1. No person shall be appointed as an examiner in any subject unless he/she fulfills the minimum requirements for recognition as a Post Graduate teacher as laid down by the Medical Council of India. No person shall be appointed as an internal examiner in any subject unless he/she has three years experience as recognized PG teacher in the concerned subject. For external examiners, he/she should have minimum six years of experience as recognized PG teacher in the concerned subject. Out of internal examiners, one examiner shall be a Professor and Head of Department or Professor.

2. There shall be at least four examiners in each subject at an examination out of which at least 50% (Fifty percent) shall be external examiners. The external examiner who fulfils the condition laid down in clause – 1 above shall ordinarily be invited from another recognised university, from outside the State: provided that in exceptional circumstances examinations may be held with 3 (three) examiners if two of them are external and Medical council of India is intimated whit the justification of such examination and the result shall be published in such a case with the approval of Medical council of India.

3. An external examiner may be ordinarily been appointed for not more than three years consecutively. Thereafter he may be reappointed after an interval of two years.

4. The internal examiner in a subject shall not accept external examinership for a college from which external examiner is appointed in his subject.

5. The same set of examiners shall ordinarily be responsible for the written, practical or part of examination.

6. There shall be a Chairman of the Board of paper – setters who shall be an external examiner and shall moderate the question papers.

7. The Head of the Department of the institution concerned shall ordinarily be one of the internal examiners and second internal examiner shall rotate after every two year.

(2) Number of candidates

The maximum number of candidates to be examined in Clinical / practical and Oral on any day shall not exceed six for M.D./M.S. degree.

(3) Number of examinations

The university shall conduct not more than two examinations in a year, for any subject, with an interval of not less than 4 and not more than 6 months between the two examinations.

(4) Doctor of Medicine (M.D.)/Master of Surgery (M.S.)

M.D./M.S. examinations, in any subject shall consist of Thesis, Theory Papers, and clinical/Practical and Oral examinations.

(a) Thesis

Every candidate shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis.

Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the candidate to the techniques of research, critical

analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature. Thesis shall be submitted at least six months before the theoretical 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; and on the acceptance of the thesis by two examiners, the candidate shall appear for the final examination.

(b) Theory

(i) There shall be four theory papers.

(ii) Out of these one shall be of Basic Medical Sciences and one shall be of recent advances.

(iii) The theory examinations shall be held sufficiently earlier than the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the start of the Clinical/Practical and Oral examination.

Provided that after five years from the commencement of these regulations, there shall be one theory paper of 'multiple choice questions'; unless any institution wants to have such paper earlier.

(c) Clinical / Practical and Oral

(i) Clinical examination for the subjects in Clinical Sciences shall be conducted to test the knowledge and competence of the candidates for undertaking independent work as a specialist/Teacher, for which candidates shall examine a minimum one long case and two short cases.

(ii) The Oral examination shall be thorough and shall aim at assessing the candidate knowledge and competence about the subject, investigative procedures, therapeutic technique and other aspects of the speciality, which form a part of the examination.

A candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory, (2) Practical including clinical and viva voce examination.

Evaluation of Answer Scripts

The answer books will be valued by two examiners. One of the two examiners will be from this university and the other will be from any other university. The Average of the two marks secured by the candidate will be taken into account. If the difference between two marks exceeds 20%, the answer scripts shall be valued by the third examiner. The average of the nearest two marks shall be considered as the final mark.

8. MODEL QUESTION PAPERS

M.D. DEGREE EXAMINATION – RADIODIAGNOSIS

PAPER – I

Radiological physics, Instrumentation, Contrast studies and Basic Sciences related to Radiology.

Time: 3 hours Max.Marks: 100

Write briefly on: (10 × 10 = 100)

1. Development of the diaphragm
2. Sagittal anatomy of CNS
3. Classification of Pathology of bone tumours
4. Basic radiographic views of skull.
5. Principles of radiation Protection
6. Construction and working of Rotating Anode X- ray Tube
7. Classify intravenous contrast agents and describe about the management of adverse reactions to contrast media.
8. Window width & Level in CT
9. Spatial Encoding in MRI
10. Film processing in radiography and advantages of digital mammogram.

M.D. DEGREE EXAMINATION – RADIODIAGNOSIS

PAPER – II

Radio Diagnosis : Imaging of Respiratory System, Cardio Vascular System , Musculoskeletal system , Obstetrics and gynaecology, Oncology and Endocrine Radiology.

Time: 3 hours Max.Marks: 100

Answer all questions (2 x 20 = 40)

1. Classify congenital heart diseases. Give the radiological features in left to right shunt conditions as seen by various imaging investigations.

2. Classify mediastinal masses. Discuss the role of imaging in their diagnosis.

Write short notes on: (10 × 6 = 60)

1. Solitary pulmonary nodule
2. Aneurysmal bone cyst
3. Psoriatic arthritis
4. Pulmonary sarcoidosis
5. Perthe's disease
6. Role of Doppler in intrauterine growth retardation.
7. Synovial Sarcoma
8. Imaging in hyperparathyroidism.
9. Hydatidiform mole.
10. Staging of endometrial carcinoma and role of MRI.

M.D. DEGREE EXAMINATION – RADIODIAGNOSIS
PAPER – III

Radio Diagnosis : Imaging of abdomen (G.I.T, Hepatobiliary and Genitourinary system), central nervous system, Orbit, otorhinolaryngology, Dental & Soft Tissues.

Time: 3 hours Max.Marks: 100

Answer all questions (2 x 20 = 40)

1. Discuss the role of imaging modalities in the diagnosis of renal hypertension.

2. Discuss the radiological features of duodenal ulcers. Discuss barium meal study versus endoscopy in the diagnosis of duodenal ulcers.

Write short notes on: (10 x 6 = 60)

1. Imaging in intraconal lesions of orbit.
2. Imaging in cholesteotoma.
3. Cystic lesions of mandible.
4. Vesico-ureteric reflux
5. Colonic diverticular disease
6. Pseudo Pancreatic Cyst
7. Role of imaging in Renal Cyst.
8. Achalasia Cardia.
9. Imaging of gastrointestinal stromal cell tumours of abdomen.
10. Imaging of hepatocellular carcinoma.

M.D. DEGREE EXAMINATION – RADIODIAGNOSIS

PAPER – IV

Recent Advances in Radiological imaging, vascular and nonvascular interventional Radiology and Nuclear Medicine.

Time: 3 hours Max.Marks: 100

Answer all questions (2 x 20 = 40)

1. Role of PET-CT imaging in present scenario.

2. Role of digital substraction angiography in preoperative embolisation of various tumours.

Write short notes on: (10 x 6 = 60)

1. MR angiography
2. Interventional radiological techniques in urinary tract obstruction
3. Isotope imaging in hepatobiliary diseases
4. Gradient echo imaging.
5. MRCP.
6. Thyroid scintigraphy.
7. Elastography.
8. Isotope renogram.
9. Role of interventional radiology in extrahepatic biliary obstruction.
10. IVC Filter.

9. RECOMMENDED BOOKS AND JOURNALS

Recommended Text Books

1. Grainger & Allison's Diagnostic Radiology - A.Adam / A. Dixon. 2 volume 6th Edition Elsevier, 2014.
2. Text Book of Radiology & Imaging - David Sutton. 2 volume 7th Edition Elsevier, 2003.
3. Diagnostic Ultrasound - Carol M. Rumack, Stephanie R. Wilson et al. 2 volume, 4th Edition Elsevier – Mosby, 2014.
4. Clinical Doppler Ultra Sound - Paul L. Allen. 3rd Edition Elsevier, 2013.
5. Ultrasound in Obstetrics and Gynecology - Peter W. Callen. 5th Edition Saunders, 2008.
6. Introduction in vascular Ultrasonography – Zweibel WJ. 6th Edition Elseiver, 2012.
7. CT & MRI Imaging of the Whole Body - John Haaga et al. 5th Edition Mosby, 2009.
8. Diagnostic Neuroradiology - Anne G. Osborn. Mosby, 2003.
9. Clinical Magnetic Resonance Imaging - Edelman, Hesselink et al. 3 volume 3rd Edition Wb Saunder, 2006.
10. Clark's Positioning in Radiology - R.A. Swallow, E. Naylor et al. 13th Edition Hodder Arnold, 2015.
11. Merrill's Atlas of Radiographic Positioning & Procedure - Frank Long Smith. 3volume 12th Edition Mosby, 2011.
12. The physics of Diagnostic Imaging - Dowsett, Kerry et al. 2nd Edition Hodder Arnold, 2006.
13. Vascular & Interventional Radiology – Valji Karim. 2nd Edition, Saunders, 2006

Reference Books

1. Radiology Review Manual - Wolfgang Danhert. 7th Edition Lippincot , 2011.
2. Primer of Diagnostic Imaging - Ralf Weissleder. 5th Edition Elsevier, 2011.
3. USG Teaching Manual - Mathias Hoffer. 2nd Edition Thieme Publications, 2004.
4. CT and MRI Correlation - Joseph k.T.Lee. 4th Edition, Lippincott 2003
5. Atlas of Normal Variants that may stimulate Disease – Keats. 9th Edition Elsevier, 2013.
6. MRI of Normal Variants & Pitfalls - Bancroft & Bridges. Lippincott Williams and Wilkins, 2009.
7. A Guide to Radiological Procedures – Chappman. 6th Edition Saunders, 2013.
8. Introduction to Radiology Technology - Curley & Callaway. 7th Edition Elsevier, 2010.
9. Manual of Radiographic Technique - T.Holm. Churchill Livingston, 2002.
10. Principle of Chest X – Ray Diagnosis - George Simon. 4th Edition Jaypee Publishers, 1990.
11. Radiology of Chest & Related Conditions - Fred W Wright. Tayler & Francis. 2002
12. HRCT of the Lung - Richard Webb. 5th Edition Lippincot Williams Wilkins, 2011.
13. Diagnostic Imaging – Chest & Cardiovascular Imaging - Manorama Berry. 2nd Edition Jaypee Publishers, 2003.
14. Margulis – Alimentary Tract Radiology – Stevenson.5th edition, Mosby 1994.
15. Diagnostic Imaging – Orthopaedics – Stoller. Elsevier, 2004.

16. Diagnostic Imaging – Spine – Ross. 3rd edition, Elsevier 2015.
17. Musculoskeletal Sonography - Martino et al. Springer, 2011.
18. Musculoskeletal Imaging - Felix S Chew. 3rd edition, Lippincott Williams and Wilkins, 2012.
19. Orthopaedic imaging – Greenspan. 6th Edition Lippincott Williams and Wilkins, 2014.
20. Diagnostic Imaging – Breast - Berg & Birdwell. 2nd Edition Ewlseiver, 2013.
21. MRI of Brain & Spine – Atlas. 2 volume 4th Edition Lippincott Williams and Wilkins, 2009.
22. Diagnostic Imaging – Paediatrics – Donnelly. 2nd edition, Amirsyrs – Elseiver, 2011.
23. Fetal & Paediatric Diagnostic imaging – Cohen. Lippincott Williams and Wilkins.
24. Caffey's Paediatric Diagnostic Imaging - Kuhn, Solves et al. 2 volume 12th Edition Mosby, 2013.
25. Gray's Anatomy - Richard Drake. 3rd Edition Churchill Livingstone, 2014.
26. Clinically Oriented Anatomy - K.L.Moore. 7th Edition Lippincott Williams and Wilkins, 2013.
27. Applied Radiological Anatomy – Butler. 2nd edition, Cambridge University Publishers, 2012.
28. Antony's Text Book of Anatomy & Physiology – Thiboder. 18th Edition Mosby, 2007.
29. Review of Medical Physiology - William F Ganong. 24th Edition McGraw Hill, 2012.
30. Robbins Pathological Basis of Disease - Cotran R.S. 9th Edition WB Saunders, 2014.
31. Abram's – Interventional Radiology - Stanely A Braun. 2nd Edition Lippincot Williams and Wilkins, 2006.

List of Journals

1. The Indian Journal of Radiology and Imaging
2. Radiology Clinics of North America
3. Radiology
4. Radiographics
5. MRI Clinics of North America
6. Journals of US Medicine
7. Journal of Vascular Interventional Radiology

Ability to change is critical to success.
Theodore Roosevelt