

STUDY & EVALUATION SCHEME OF
MASTER OF SCIENCE
IN
RADIOLOGICAL IMAGING TECHNIQUES
(M.Sc. RIT)

[APPLICABLE W.E.F. ACADEMIC SESSION - 2019-20 TILL REVISED]
[As per CHOICE BASED CREDIT SYSTEM (CBCS) guidelines given by UGC]



TEERTHANKER MAHAVEER UNIVERSITY
COLLEGE OF PARAMEDICAL SCIENCES

Delhi Road, Moradabad, Uttar Pradesh-244001

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TEERTHANKER MAHAVEER UNIVERSITY

(Established Under Govt. of U.P. Act No.30, 2008) Delhi Road, Moradabad (U.P)

Study & Evaluation Scheme of

Master of Science in Radiological Imaging Techniques

<i>Institute Name</i>	Teerthanker Mahaveer University College of Paramedical Sciences
<i>Programme</i>	Master of Science in Radiological Imaging Techniques
<i>Duration</i>	Two year (04 Semester) Full time programme.
<i>Medium</i>	English
<i>Minimum Attendance Required</i>	75%
<i>Total credits</i>	85

➤ **Eligibility for admissions:**

A candidate seeking admission to M.Sc. RIT course must have passed bachelors degree of minimum 3 years duration in Medical Imaging Technology/ Radiography and Imaging Technology/ Radiological Imaging Techniques with six months internship, recognized as equivalent by Teerthanker Mahaveer University, with not less than 50 % marks in aggregate.

➤ **Selection of eligible candidates:**

Selection to the M.Sc. RIT course shall be on the performance in written exam or interview conducted by Teerthanker Mahaveer University. Medical fitness certificate needs to be submitted by the candidate on the day of Admission.

➤ **Conduct and Discipline:**

●	Candidates shall conduct themselves within and outside premises of the Institution in a manner defecting professional institution. As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.
1.	As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.
●	The following acts of omission and /or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures:
1.	Ragging is strictly prohibited.
2.	Lack of courtesy and decorum, indecent behavior anywhere within or outside the campus.
3.	Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
4.	Plagiarism of any nature.

➤ **Attendance and Monitoring progress of studies:**

●	A candidate shall study in concerned department of the Institute for the entire period as a full time student. No candidate is permitted to work in any other laboratory/college/hospital/pharmacy etc., while studying. No candidate should join any other course of study or appear for any other degree examination conducted by this University or any other University in India or abroad during the period of registration.
●	A candidate who has put in a minimum of 75% of attendance in theory and practical separately and who has fulfilled other requirements of the course shall be permitted to appear for University examination.
●	A candidate having shortage of attendance shall repeat the semester when it is offered next.

➤ **Dissertation work:**

	A candidate is required to carry out a research study in select area of his subject, under the supervision of a faculty guide. The results of such a study shall be submitted to the College/University in the form a dissertation as per the prescribed format and within the date stipulated by the University.
●	The dissertation work is aimed at training a postgraduate candidate in research methodology and techniques. It includes identification of the problem, formulation of a

	hypothesis, review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, and comparison of results and Drawing conclusions.
•	Every candidate shall submit to the Department in the prescribed Performa, a synopsis containing particulars of proposed dissertation/ research project work within six to ten months from the date of commencement of the course on or before the date notified by The University. The synopsis shall be sent through the proper channel.
•	Such synopsis will be reviewed and the College will register the dissertation/ research project topic. No change in the dissertation topic/ research project or guide shall be made without prior approval of the College.
1.	<u>Guide:</u> A Guide shall have be at least 2 years of teaching experience. Each guide can take-up a maximum of three students per academic year. However a co-guide can be opted wherever required with prior permission of the Institute and University. The co-guide shall also be a postgraduate teacher recognized by the University as a guide.
	Candidate shall submit synopsis to the University through the Guide and Head of the Institute on or before within one month of second semester or within date notified by the University, whichever earlier.
	Once the synopsis is approved and registered by the University no change in the topic or Guide shall be made without the prior approval of the University.
	In the event of registered Guide leaving the Institute or in the event of the death of the Guide, a change of Guide shall be permitted by the University, on the specific recommendation of the Institute.
2.	<u>Ethical clearance:</u> Ethical Clearance should be obtained for a study involving any procedure on human subject. The candidate should apply for the certificate to the Ethics Committee of the Institute/University, through the Guide and present the study before the Committee for clearance. A copy of the certificate should be attached along with the synopsis forwarded at the time of submission of synopsis. All such clearance should be sought before the final submission of report.
3.	<u>Submission of synopsis:</u> Synopsis should be brevet by guide, HOD and departmental curriculum development cell and approved by the institutional ethics committee before submission to the university. The synopsis should be submitted as per the format on or before one month of second semester, or within the date notified by the University, whichever is earlier. Once the synopsis is approved and registered by the university no change in the topic or Guide shall be made without the prior approval of the University.
4.	<u>Preparation of dissertation:</u> The written text of dissertation shall be as per the format, shall not exceed 100 pages (cover to cover). It should be neatly typed with 1.5 line spacing on one side of the paper (A4 size: 8.27” x 11.69”) and properly bound. Spiral binding should be avoided. E-submission of the dissertation is mandatory.
5.	<u>Final submission of the dissertation:</u> The dissertation complete in all respects and duly certified by the Guide/Co-guide, Course Coordinator/ HOD/ Director should be submitted it to the Controller of Examinations/ College Examination Committee as per the date specified by the University, generally two month before commencement of

	University examinations. Plagiarism of final submitted report should be checked by University ethical and research committee.
6.	The dissertation/ research project should be written under the following headings: <ul style="list-style-type: none"> ✓ Introduction ✓ Aims or objectives of study ✓ Review of literature ✓ Material and methods ✓ Results ✓ Discussion ✓ Conclusion ✓ Summary ✓ References ✓ Tables ✓ Annexure

➤ **Declaration of results and Merit Certificate:**

●	A candidates who pass the entire examination in first attempt within the minimum stipulated time would be eligible for merit certificate..
1.	CPI 75 and above – First class with distinction
2.	CPI 65 and above but less than 75 - First class
3.	CPI 50 and above but less than 65 - Second class
4.	Less than 50 - Fail in that particular course

Assessment:

	<u>Internal</u>	<u>External</u>	<u>Total</u>
Theory	40	60	100
Practical	50	50	100

Internal Evaluation (Theory papers):

Class Test-I	Class Test-II	Class Test-III	Attendance	Assignment /work book assignments & viva	Total
Best Two out of Three CTs					
10	10	10	10	10	40
Duration of Examination			External	Internal	
			3 Hours	1.5 Hours	

Internal Practical Evaluation (50 marks)

The internal evaluation would also be done by the Internal Examiner based on the experiment performed during the internal examination.

During Semester				On the day of Examination	
Experiment	File Work	Viva Voce	Attendance	Experiment	Viva Voce
5 Marks	10 Marks	10 Marks	10 Marks	5 Marks	10 Marks

External Practical Evaluation (50 marks)

The external evaluation would also be done by the External Examiner based on the experiment performed during the external examination.

Experiment	File Work	Viva Voce	Total Experiment
30 Marks	10Marks	10 Marks	50 Marks

Dissertation/ Project Reports Evaluation (100 marks)

The dissertation evaluated at the time of university examination of IV semester by a panel of examiner (Internal and External) appointed by the University.

Internal	External	Total
50Marks	50 Marks	100 Marks

Dissertation/ Project Reports Internal Evaluation (50 marks)

The internal dissertation evaluation would be done by the Internal Examiner based on the thesis and collected data performed during the internal examination.

Progress Report	Viva Voce	Presentation	Total
20 Marks	10Marks	20 Marks	50 Marks

Dissertation/ Project Reports External Evaluation (50 marks)

The external dissertation evaluation would be done by the External Examiner based on the final thesis report submitted before the external examination.

Thesis	Viva Voce	Presentation	Total
20 Marks	10Marks	20 Marks	50 Marks

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester examination and teacher's continuous evaluation. (i.e. both internal and external). A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have minimum CPI 50 in aggregate to clear the program. The student must have qualified all the semester exam along with supplementary for the commencement of internship.

Question Paper Structure

Question paper shall have two sections and examiner shall set questions specific to respective section. Section wise details shall be as mentioned under;

Section 1.	The question paper shall consist of six questions, out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.
Section 2.	Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.
Section 3.	The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.
<u>IMPORTANT NOTES</u>	
Note-1:	<i>There must be at least one question from the entire syllabus to assess the specific element of the Higher Level of Learning (Thinking). Every question in this section must essentially assess at least one of the following aspects of learning: Applying, Analyzing, Evaluating and Creating/ Designing/ Developing.</i>
Note-2:	<i>The question must be designed in such a way that it assesses the concerned Course outcomes (COs) in entirety. It means a question could have multiple parts depending upon the requirement of the specific Course Outcome.</i>
Note-3:	<i>Strictly avoid repetition of questions. Also Assure that there is at least one question assessing every Course Outcome (COs). The copies of COs of this course & syllabus is attached for your reference</i>

Programme Structure

INTRODUCTION

High-quality Paramedical education is essential for the digital age and using technology is powerful way to enhance changing requirements of the dynamic and improved medical field profession. Master of Science in Radiological Imaging Techniques (Radiology/CT/MRI/X-Ray/Mammography/Ultrasound/Interventional) is a 2 years' postgraduate programme meticulously structured to impart in-depth advance knowledge of Imaging methodologies and principles. The curriculum has been designed to meet the growing needs of professionals in the field of clinical radiography, radiation safety, image processing technology, imaging modalities, etc. The programme prepares students to work collaboratively, evaluate data, interpret results, think vitally, draw logical conclusions and make composite decisions. The curriculum of the programme gives students the opportunities to devise plausible solutions to real-life situations in an active healthcare environment. The programme broadly emphasizes the following key areas Specialized and Advances Diagnostic Techniques, instrumentation and as well as awareness for radiation. M.Sc. RIT students should be

equipped to work across time zones, languages, and cultures. Employability, innovation, theory to practice connectedness to the professional staff is the central focus of M.Sc. RIT curriculum. The curriculum is designed as such that the students can gain an in-depth mastery of the academic disciplines and applied functional areas necessary to meet the requirements of academic and hospital administration.

The College emphasis on the following courses *balanced with core, and other courses*: The curriculum of Master of Science in Radiological Imaging Techniques program emphasizes an intensive, flexible education with 36 credits for theory and 49 credits of practical & clinical posting programme. Total 85 credits are assigned for the M.Sc. RIT degree.

The programme structure and credits for Master of Science in Radiological Imaging Techniques are finalized based on the stake holder's requirements and general structure of the programme. Out of 85 credits of classroom contact teaching, 18 credits are to be allotted for core courses(CC), 49 credits are allotted to Skill Enhancement Courses (SEC), 3 credits are allotted to Compulsory Specifics Course (CSC), 15 credits are allotted to Discipline specific Course(DSC).

MAINTENANCE OF LOG BOOK

✓	Every Post Graduate student shall maintain a record of skills he /she has acquired during the two years training period certified by the various Head of departments where he /she has under gone training including outside the institution.
✓	The student should also participate in the teaching and training programs of Under Graduate students of Paramedical courses, both in Theory and Practical from the first year onwards of the Post Graduate Degree course.
✓	In addition the Head of the department should involve their post graduate students in Seminars, Journal clubs, group discussions and participation in work sops, national and international conferences organized by the Department, Institution and outside the institution in the state and outside the state.
✓	Every Post Graduate student should be encouraged to present short title papers in conferences and improve on it and submit them for publication in indexed journals. Motivation by the Head of the Department of essential in this area to sharpen the skills of the Post Graduate students.
✓	The Head of the Department should scrutinize the log book every two months and certify the work done.
✓	At the end of the course the student should summarize the contents and get the log book certified by the Head of the Department and submit the log book at the time of the University Practical Examination.

Clinical Training Evaluation

✓	Students shall be deputed to CT, MRI, DR & USG department wherein they shall undergo practical training of handling patients, special procedures, interventional procedures .
✓	Each student is required to maintain a logbook of the training. Student's performance shall be evaluated on regular basis. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.

M.Sc. RIT: Two Year (4 Semester) CBCS Programme

Basic Structure : Distribution of Courses

S.No	Type of Course	Credit Hours	Total Credits
1	Core Course (CC)	6 Courses of 3 Credit Hrs. each (Total Credit Hrs. 6x3)= 18	18
2	Discipline Specific Course (DSC)	5 Courses of 3 Credit Hrs. each (Total Credit Hrs.5x3)= 15	15
3	Skill-Enhancement Course (SEC)	2 Courses of 9 Credit Hrs. each(Total Credit Hrs. 2x9)= 18	49
		1 Courses of 2 Credit Hrs. each(Total Credit Hrs. 1x2)= 2	
		2 Courses of 10 Credit Hrs. each (Total Credit Hrs. 2x10)=20	
		9 Courses of 1 Credit Hrs. each (Total Credit Hrs. 9x1)= 9	
4	Compulsory Specified Course (CSC)	1 Course of 3 Credit Hrs. each (Total Credit Hrs. 1X3)=3	3
TOTAL			85

❖ CHOICE BASED CREDIT SYSTEM (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the M.Sc. RIT program:

- ✓ **Core Course (CC):** Core courses of M.Sc. RIT program will provide a holistic approach to clinical or practical education, giving students an overview of the field, a basis to build and specialize upon. These core courses are the strong foundation to establish radiographic knowledge and provide broad multi-disciplined knowledge can be studied further in depth during the elective phase.

The core courses will provide more practical-based knowledge, case-based lessons and collaborative learning models. It will train the students to analyze, decide, and lead-rather than merely know-while creating a common student experience that can foster deep understanding, develop decision-making ability and contribute to the hospital and community at large.

A wide range of core courses provides groundwork in the basic hospital management disciplines, patient care handling, responsible radiographer, organizational behavior and human resources etc.

The integrated foundation is important for students because it will not only allow them to build upon existing skills, but they can also explore career options in a range of industries, and expand their understanding of various fields.

The College offers six core courses from first to fourth semester during the M.Sc. RIT program. Each core course will carry 3 credits as already described in above table.

✓ **Skill Enhancement Course (SEC):** This course is designed to provide value-based and/or skill-based knowledge. The College offer fourteen two SECs from I Semester to IV Semester. Each SEC will carry different credits.

✓ **Compulsory Specified Course (CSC):** This is a compulsory course that does not have any choice and will be of 3 credits. Each student of M.Sc. RIT program has to compulsorily pass the CSC course.

□ **PROGRAMME SPECIFIC OUTCOMES: (PSOs)**

The learning and abilities or skills that a student would have developed at the end:

PSO1.	Understanding the relationship between physics and radiology & modern imaging techniques.
PSO2.	Understanding laws/provisions for radiation safety by various regulatory bodies.
PSO3.	Applying the basic and advanced knowledge of hardware, software and applications of computers in health care systems.
PSO4.	Applying quality assurance, quality control measures, safety procedures and Maintenance of radiological equipments.
PSO5.	Analyzing the protocols to perform various Radiological Procedures
PSO6.	Evaluating the factors affecting technical quality of images and various pathological conditions.
PSO7.	Formulating plan for handling patient with drugs & equipments in general as well in emergency situation.

○ **Pedagogy & Unique practices adopted:** “Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept”. In addition to conventional time-tested lecture method, the institute will **emphasize on experiential learning.**

1. Role Play & Simulation: Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

2. **Video Based Learning (VBL):** These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through educational or clinical videos. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL, wherever possible.

3. **Special Guest Lectures (SGL)&Extra Moral Lectures (EML):** Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

4. **Special assistance program for slow learners:** Write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners

5. **Orientation program:** Two week programme is arranged to introduce students to college services which will support their educational and personal goals. To facilitate initial academic advisement, course selection and registration, creating an atmosphere that minimizes anxiety, promotes positive attitude and stimulates excitement for learning. It also helps knowledge of scope, information regarding academic and student service resources and programme. It provides a welcoming atmosphere for student's to meet faculty, staff and continuing students, as well as other new students.

6. **Extracurricular Activities:** Organizing& participation in extracurricular activities will be mandatory to help students develop confidence & face audience with care.

Study & Evaluation Scheme

M.Sc. RIT- I Semester

S.N O.	CATEGORY	COURSE CODE	COURSE NAME	PERIODS			CREDIT	EVALUATION SCHEME		
				L	T	P		INTERNAL	EXTERNAL	TOTAL
1	CC-1	MRIT101	RADIOLOGICAL PROCEDURES	3	-	-	3	40	60	100
2	DSC-1	MRIT102	INSTRUMENTATION OF CONVENTIONAL RADIOLOGICAL EQUIPMENTS	3	-	-	3	40	60	100
3	CC-2	MRIT103	PRINCIPLES OF RADIOGRAPHIC EXPOSURE	3	-	-	3	40	60	100
4	SEC-1	MRIT151	RADIOLOGICAL PROCEDURES (LAB)	-	-	4	2	50	50	100
5	SEC -2	MRIT152	INSTRUMENTATION OF CONVENTIONAL RADIOLOGICAL EQUIPMENTS (LAB)	-	-	2	1	50	50	100
6	SEC -3	MRIT153	PRINCIPLES OF RADIOGRAPHIC EXPOSURE (LAB)	-	-	2	1	50	50	100
7	SEC -4	MRIT154	CLINICAL POSTING	-	-	18	9	50	50	100
Total				9	-	26	22	320	380	700

Study & Evaluation Scheme

M.Sc. RIT- II Semester

S. No.	CATEGORY	COURSE CODE	COURSE	PERIODS			CREDI T	EVALUATION SCHEME		
				L	T	P		INTERNAL	EXTERNAL	TOT AL
1	CC-3	MRIT201	PATIENTS CARE IN DIAGNOSTIC RADIOLOGY	3	-	-	3	40	60	100
2	CC-4	MRIT202	RADIATION PROTECTION IN DIAGNOSTIC RADIOLOGY	3	-	-	3	40	60	100
3	DSC-2	MRIT203	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS	3	-	-	3	40	60	100
4	SEC -5	MRIT251	PATIENTS CARE IN DIAGNOSTIC RADIOLOGY (LAB)	-	-	2	1	50	50	100
5	SEC -6	MRIT252	RADIATION PROTECTION IN DIAGNOSTIC RADIOLOGY (LAB)	-	-	2	1	50	50	100
6	SEC -7	MRIT253	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS (LAB)	-	-	2	1	50	50	100
7	SEC -8	MRIT254	CLINICAL POSTING	-	-	18	9	50	50	100
TOTAL				9	0	24	21	320	380	700

Study & Evaluation Scheme

M.Sc. RIT- III Semester

S. N	CATEGORY	COURSE CODE	COURSE	PERIODS			CREDIT	EVALUATION SCHEME		
				L	T	P		INTERNAL	EXTERNAL	TOTAL
1	CSC-1	MRIT301	BASIC ELECTRONICS AND BIO-STATISTICS	3	-	-	3	40	60	100
2	DSC-3	MRIT302	ADVANCED TECHNIQUES AND INSTRUMENTATION OF CT	3	-	-	3	40	60	100
3	CC-5	MRIT303	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS	3	-	-	3	40	60	100
4	SEC-9	MRIT351	ADVANCED TECHNIQUES AND INSTRUMENTATION OF CT (LAB)	-	-	2	1	50	50	100
5	SEC-10	MRIT352	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS (LAB)	-	-	2	1	50	50	100
6	SEC-11	MRIT353	CLINICAL POSTING	-	-	20	10	50	50	100
Total				9	0	24	21	270	330	600

Study & Evaluation Scheme

M.Sc. RIT- IV Semester

S. NO.	CATEGORY	COURSE CODE	COURSE	PERIODS			CREDIT	EVALUATION SCHEME		
				L	T	P		INTERNAL	EXTERNAL	TOTAL
1	CC-6	MRIT401	ADVANCED TECHNIQUES AND INSTRUMENTATION OF ULTRASOUND	3	-	-	3	40	60	100
2	DSC-4	MRIT 402	ADVANCED TECHNIQUES AND INSTRUMENTATION OF MRI	3	-	-	3	40	60	100
3	DSC-5	MRIT 403	NUCLEAR MEDICINE IMAGING TECHNIQUES	3	-	-	3	40	60	100
4	SEC-12	MRIT451	ADVANCED TECHNIQUES AND INSTRUMENTATION OF ULTRASOUND (LAB)	-	-	2	1	50	50	100
5	SEC-13	MRIT452	ADVANCED TECHNIQUES AND INSTRUMENTATION OF MRI (LAB)	-	-	2	1	50	50	100
6	SEC-14	MRIT453	DISSERTATION WRITING	-	-	20	10	50	50	100
Total				9	-	24	21	270	330	600

Course Code: MRIT101	<u>CORE COURSE (CC)– 1</u> MRIT- SEMESTER-I RADIOLOGICAL PROCEDURES	L-3 T-0 P-4 C-5
Course Outcomes :	On completion of the course, the students will be :	
CO1.	Annotating the basic concepts, theories, techniques & equipment, in and conventional radiography relevant to X-Ray equipments.	
CO2.	Tagging related anatomy of organ for independently performing different diagnostic radiologic procedures .	
CO3.	Discussing equipment and supplies necessary to complete special radiographic procedures with administration of contrast media.	
CO4.	Evaluating the safety aspects of contrast media and describe the allergic reactions associated to use of different contrast media for diagnostic purpose.	
Course Content:		
Unit-1:	Contrast Media – Applications, types, safety aspects, mode and volume of administration, administration techniques., Digestive system: Anatomy and physiology, Associated pathology and radiographic appearance Barium swallow, Barium meal, Barium meal follow through Enteroclysis, Barium enema, Geneto Urinary System: Anatomy and physiology, Associated pathology and radiographic appearance, Intravenous urogram (IVU), Micturating cystourethrogram (MCU), Ascending urethrogram (ASU), Hysterosalpingography (HSG), Fallopian tube recanalisation (FTR), Retrograde urethrogram (RGU)	12 Hours
Unit-2:	Cardio-respiratory system: Anatomy and physiology, Associated pathology and radiographic appearance, Bronchography, Percutaneous lung biopsy, Mammography:, Anatomy and physiology, Indications, Contra Indications and special views ICRP guidelines, BIRADS	6 Hours
Unit-3:	Skull: Related anatomy of facial and cranial bones, Associated pathology and radiographic appearance, Indications, Contra Indications and special views, Vertebral Column: , Related anatomy, Associated pathology and radiographic appearance Indications, Contra Indications and special views, Upper limb: Related anatomy, Associated pathology and radiographic appearance Indications, Contra Indications and special views Lower limb: Related anatomy, Associated pathology and radiographic appearance Indications, Contra Indications and special views	12 Hours
Unit-4:	Pelvis: Related anatomy of pelvic bones and hip joint, Associated pathology and radiographic appearance, Indications, Contra Indications and special views Hepatobiliary System: Related anatomy, Associated pathology and radiographic	03 Hours

	appearance, ERCP/PTBD, T-Tube cholangiography, PTC	
Unit-5:	Dental Radiography: Related anatomy, Associated pathology and radiographic appearance, OPG, Cephalometry, Other Procedures: , Related anatomy, Associated pathology and radiographic appearance, Arthrography, Sialography, dacrocystography, sinography, fistulography	03 Hours
<u>Text Books:</u>	1. Radiographic positioning – Clark’s, Kenneth Bontrager, Merrill’s	
<u>Reference Books:</u>	1. Diagnostic radiography: - a concise practical manual / Glenda J. Bryan ; foreword by J. H. Middlemiss 2. A guide to radiological procedures: chapman(s).	

Course Code: MRIT102	<u>DISCIPLINE SPECIFIC COURSE (DSC)-1</u> MRIT- SEMESTER-I INSTRUMENTAION OF CONVENTIONAL RADIOLOGICAL EQUIPMENTS		L-3 T-0 P-2 C-4
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understanding the basic concepts, theories & method, in applied physics and conventional radiography relevant to X-Ray equipments.		
CO2.	Expressing the components and working of equipments related to x-ray.		
CO3.	Operating X-Ray imaging equipment independently .		
CO4.	Demonstrating application of different components of x-ray.		
CO5.	Analyzing maintenance requirement and care of x-ray equipments in radiology department.		
Course Content:			
Unit-1:	Generation of electrical energy, Distribution of electrical energy, Uses of electricity in hospitals, Safety rules for technologist	04 Hours	
Unit-2:	X ray circuit components, High tension transformers, Main voltage compensation, High tension switches, Stabilizers and UPS	07 Hours	
Unit-3:	Fuses, Switches, Earthing, High tension cables constructions and design, Rectifications, Types of rectifier,s Transformers and its types, Tube rating, Types of generators	07 Hours	
Unit-4:	Switches Circuitbreakers, Exposure switching and itsapplication, Magnetic relay,Thermal relay switches, Interlock in tube circuit and over load inter interlocks	11 Hours	
Unit-5:	Exposure Timers, Timing systems, Electronic timer, Ionization timer, Photo timer, Synchronous timer and impulse timer	07 Hours	
Text Books:	1. X Ray equipment for radiographers – Noreen Chesney & Muriel Chesney		
Reference Books:	2. Christensen’s physics of diagnostic radiology 3. First year physics for radiographers – George Hay 4. Equipments in Diagnostic radiology –E Forster		

<u>Course Code:</u> MRIT103	<u>CORE COURSE (CC)-2</u>		L-3 T-0 P-2 C-4
	MRIT- SEMESTER-I		
	PRINCIPLES OF RADIOGRAPHIC EXPOSURE		
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understanding the basic concepts, theories & method, in applied physics relevant to radiological imaging techniques & image quality		
CO2.	Categorizing provisions for radiation safety by various national & international regulatory bodies.		
CO3.	Tagging of different imaging modalities in radiology department		
CO4.	Differentiating EMR and its application in X –ray diagnosis and therapy.		
CO5.	Evaluating the factors affecting the image quality from x ray.		
Course Content:			
Unit-1:	X ray production, Interaction of radiation with matter Useful range, Clinical application, The Photographic Process, Basic review of photographic emulsion Photographic latent image, Film materials, Speed and contrast of photographic material Intensifying screens and cassettes, Film processing		10 Hours
Unit-2:	Sensitometry, Photographic density, Opacity, Transmission, Production of characteristic curve, Features of characteristic curve, Variation in the characteristic curve with development, Comparison of emulsion by their characteristic curve, Application of characteristic curve, Information from the characteristic curve		09 Hours
Unit-3:	Radiographic image, Radiographic density, Acceptable range, Factors influences density, Radiographic contrast, Components, Factors influence contrast, Management of radiographic image quality		04 Hours
Unit-4:	Resolution, Line spread function & modulation transfer function, Unsharpness in the radiographic image and various factors contributing towards unsharpness, Types of unsharpness, Types of unsharpness, Geometry of the radiographic image, Radiographic mottle, Magnification / distortion – types and factors		08 Hours
Unit-5:	Instrumentation of processing equipment, Automatic film processor (AFP), Layout and planning of dark room, Viewing accessories : viewing boxes Magnifiers and viewing conditions		05 Hours
Text Books:	1. Christensen’s physics of diagnostic radiology		
Reference Books:	1. Radiographic image – Chesney & Chesney 2. Equipments in Diagnostic radiology –E Forster		

NOTE:-	Practical Syllabus will be based on the theory paper (Procedures, Positioning, Patient care, Instrumentation, Radiation Protection, Equipments, Experiment in following areas).	
Course Code: MRIT151	<u>SKILL ENHANCEMENT COURSE (SEC) -1</u> MRIT- SEMESTER-I <div style="background-color: #cccccc; padding: 5px; display: inline-block;">RADIOLOGICAL PROCEDURES (LAB)</div>	L-0 T-0 P-4 C-2
Course Content:		
1.	Contrast Media	
2.	Digestive system	
3.	Geneto Urinary System	
4.	Cardio-respiratory system	
5.	Mammography	
6.	Skull	
7.	Vertebral Column	
8.	Upper limb	
9.	Lower limb	
10.	Pelvis	
11.	Hepatobiliary System	
12.	Dental Radiography	
13.	Other Procedures	

Course Code: MRIT152	<u>SKILL ENHANCEMENT COURSE (SEC)-2</u> MRIT- SEMESTER-I	L-0 T-0 P-2 C-1
	INSTRUMENTATION OF CONVENTIONAL RADIOLOGICAL EQUIPMENTS (LAB)	
Course Content:		
1.	Uses of electricity in hospitals	
2.	Safety rules for technologist	
3.	X ray circuit components	
4.	High tension transformers	
5.	Main voltage compensation	
6.	High tension switches	
7.	Stabilizers and UPS	
8.	Fuses	
9.	Switches	
10.	Earthing	
11.	Exposure Timers	
12.	Timing systems	
13.	Electronic timer	

Course Code: MRIT153	<u>SKILL ENHANCEMENT COURSE (SEC)-3</u>	L-0 T-0 P-2 C-1
	MRIT- SEMESTER-I	
	PRINCIPLES OF RADIOGRAPHIC EXPOSURE (LAB)	
Course Content:		
1.	X ray production	
2.	Interaction of radiation with matter	
3.	Film materials	
4.	Speed and contrast of photographic material	
5.	Intensifying screens and cassettes	
6.	Film processing	
7.	Radiographic image	
8.	Radiographic density	
9.	Acceptable range	
10.	Factors influences density	
11.	Layout and planning of darkroom	
12.	Viewing accessories : viewing boxes	
13.	Magnifiers and viewing conditions	

Course Code: MRIT154	<u>SKILL ENHANCEMENT COURSE (SEC)-4</u>	L-0 T-0 P-18 C-9
	MRIT- SEMESTER-I	
	CLINICAL POSTING	
Course Content:		
	Based on the clinical exposure from hospital.	

<u>Course Code:</u> MRIT201	<u>CORE COURSE (CC)-3</u>		L-3 T-0 P-2 C-4
	MRIT- SEMESTER-II		
PATIENTS CARE IN DIAGNOSTIC RADIOLOGY			
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understanding the concepts of patient care in radiology department with reference to different responsibility of imaging technologist.		
CO2.	Understanding nursing procedures in radiology including handling of emergency situations.		
CO3.	Recognizing care of patient during various procedures performed in radiology department and executing first aid.		
CO4.	Discussing and performing various infection control methods with psychological consideration		
CO5.	Implementing effective communication skills with patients and co-workers.		
Course Content:			
Unit-1:	Introduction to the patient care, Responsibility of the health care facility, Responsibilities of the Imaging technologist, General patient care, Patient transfer technique, Restraint technique, Aspects of patient comfort, Specific patient conditions, Security of the patient property, Obtaining vital signs, Laying up a sterile trolley IV injection administration		10 Hours
Unit-2:	Nursing procedure in radiology, General abdominal preparation, Clothing of the patient, Giving an enema, Handling the emergencies in radiology First aid in the x ray departments.		07 Hours
Unit-3:	Patient care during investigation, GI tract, biliary tract, respiratory tract, gynecology, cardiovascular, lymphatic system, CNS .etc		08 Hours
Unit-4:	Infection control, Isolation technique, Infection source, Transmission modes procedures', Psychological considerations, Sterilization & sterile technique		04 Hours
Unit-5:	Patient education Communication, Patient communication problems, Explanation of examinations, Radiation safety/ protection, Interacting with terminally ill patient Informed consent		07 Hours
<u>Text Books:</u>	1. Care of patients in diagnostic radiology – Chesney & Chesney		
<u>Reference Books:</u>	1. Care of patients in diagnostic radiology –Gunn 2. Patient care in Radiography with an introduction to medical imaging- Ruth Ann Ehrlich		

<u>Course Code:</u> MRIT202	<u>CORE COURSE (CC)-4</u> MRIT- SEMESTER-II RADIATION PROTECTION IN DIAGNOSTIC RADIOLOGY	L-3 T-0 P-2 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the concepts and methods of radiation protection principles and their applications in radiology department.	
CO2.	Obtaining knowledge for management and handling the equipments for various procedures.	
CO3.	Applying the knowledge of department construction layout instructions given by AERB	
CO4.	Applying the regulations of radiation practices according to internationally accepted methods.	
CO5.	Practicing the techniques of radiation protection of patients, occupational workers and general public from secondary radiation.	
Course Content:		
Unit-1:	Introduction to Radiation Protection, Need for Protection, Aim of Radiation Protection, Basic radiation units and qualities, Exposure, Absorbed dose equivalent, Quality factor, Tissue weighting factor	06 hours
Unit-2:	Limits of Radiation exposure, Concept of ALARA(or ALARP), ICRP regulation, Maximum permissible dose, Exposure in pregnancy, children, Protection in Diagnostic Radiology, Protection for primary radiation, Work load, Use factor, Occupancy Factor, Protection in scatter Radiation and leakage radiation, X-Ray room design, Structural shielding, Protective devices, Radiation sign ages	10 Hours
Unit-3:	Technical protective considerations during Radiography, Evaluation of hazards, Effective communication, Immobilization, Beam limiting devices Filtration, Exposure factors Protection in-Fluoroscopy, mammography, mobile radiography, CT scan, Angiography room	10 Hours
Unit-4:	Radiation measuring instruments, Area monitoring, Personals dosimeters, Film badge, Thermo luminescent dosimeter, Pocket dosimeter	04 Hours
Unit-5:	Biological aspects of Radiological protection, Biological effects of radiation, Direct and indirect actions of radiation, concept of detriment-Documentation and stochastic effect of radiation-somatic and general effects, Dose relationship, Effects of antenatal exposure	06 Hours
Text Books:	<i>1. Physics of diagnostic radiology –Christensen</i>	
Reference Books:	1. ICRP manual 2. Radiation protection in medical radiography-Mary Alice Statkiewicz	

<u>Course Code:</u> MRIT203	<u>DISCIPLINE SPECIFIC COURSE (DSC)-2</u> MRIT- SEMESTER-II INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS	L-3 T-0 P-2 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the basic concepts, theories , techniques & equipments for different interventional radiological procedures.	
CO2.	Applying the patient preparations needed before & post procedure care in any interventional radiological examination	
CO3.	Applying provisions for radiation safety and protection as prescribed by various national & international regulatory bodies.	
CO4.	Calculating the factors affecting the image quality .	
CO5.	Applying Care, maintenance and tests , Quality assurance program for equipments.	
Course Content:		
Unit-1:	Introduction, Need for interventional procedures, DSA: Basic principle, Types Equipments: Basics of angiographic equipments, Single and biplane angiographic equipments Angiographic table, Image intensifier, Flat panel detectors, Pulse oximetry, Cardiac resuscitation measure – ECG, Pressure injector, Catheters, needles & other tools, 3D rotational angiography Image processing, Patient monitor.	12 Hours
Unit-2:	Patient care: Preparation for procedure, Post procedure care, Role of radiographer in interventional procedure, Crash trolley – Emergency drugs	05 Hours
Unit-3:	Procedures: Diagnostic & therapeutic interventional procedures, PTC, PTBD, Stending, Nephrostomy, ureteric stending, Guided biopsies of different organs, Drainage of collections / abscesses, Angiograms, angioplasty, embolization, Venusaccess, Radiofrequency ablation Image guided nerve blocks	05 Hours
Unit-4:	Neuro interventional procedures, Embolization of extra or intracranial tumors, vascular malformations, Vetebroplasty – direct puncture, Laser guided procedure, Basics of cardiac catheterization, Safety considerations in angiography room, Room design, Protective device, Radiation monitoring	09 hours
Unit-5:	Care, maintenance and tests: General care, Functional tests Quality assurance program: Acceptable limits of variation, Corrective action	05 Hours
Text Books:	1. Current techniques in interventional radiology – Cope, Costantin	
Reference Books:	1. Interventional Radiology – A practical guide by Anthony Waykinson and Andreas Adam 2. Vascular And Interventional Radiology :Valji(K)	

NOTE:-	Practical Syllabus will be based on the theory paper (Procedures, Positioning, Patient care, Instrumentation, Radiation Protection, Equipments, Experiment in following areas).	
Course Code: MRIT251	<u>SKILL ENHANCEMENT COURSE (SEC)-5</u> MRIT- SEMESTER-II PATIENTS CARE IN DIAGNOSTIC RADIOLOGY (LAB)	L-0 T-0 P-2 C-1
Course Content:		
1.	Introduction to the patient care	
2.	Responsibility of the health care facility	
3.	Responsibilities of the Imaging technologist	
4.	Aspects of patient comfort	
5.	Specific patient conditions	
6.	Security of the patient property	
7.	Obtaining vital signs	
8.	Laying up a sterile trolley	
9.	IV injection administration	
10.	Giving an enema	
11.	Handling the emergencies in radiology	
12.	First aid in the x ray departments	
13.	Nursing procedure in radiology	
14.	General abdominal preparation	
15.	Infection control	
16.	Isolation technique	
17.	Patient education	
18.	Communication	
19.	Patient communication problems	
20.	Explanation of examinations	
21	Radiation safety/protection	

Course Code: MRIT252	<u>SKILL ENHANCEMENT COURSE (SEC)-6</u> MRIT- SEMESTER-II RADIATION PROTECTION IN DIAGNOSTIC RADIOLOGY (LAB)	L-0 T-0 P-2 C-1
Course Content:		
1.	Introduction to Radiation Protection	
2.	Need for Protection	
3.	Aim of Radiation Protection	
4.	Exposure in pregnancy, children	
5.	Protection in Diagnostic Radiology	
6.	Protection for primary radiation	
7.	Protective devices	
8.	Radiation signages	
9.	Protection in	
✓	Fluoroscopy	
✓	mammography	
✓	mobile radiography	
✓	CT scan	
✓	Angiography room	
✓	Personals dosimeters	
✓	Film badge	
✓	Thermo luminescent dosimeter	
✓	Pocket dosimeter	
✓	Radiation measuring instruments	
✓	Area monitoring	
✓	Biological aspects of Radiological protection	
✓	Biological effects of radiation	
✓	Direct and indirect actions of radiation	

Course Code: MRIT253	<u>SKILLENHANCEMENT COURSE (SEC)-7</u>	L-0
	MRIT- SEMESTER-II	T-0
	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS (LAB)	P-2 C-1
Course Content:		
1.	Basics of angiographic equipments	
2.	Single and biplane angiographic equipments	
3.	Angiographic table	
4.	Image intensifier	
5.	Flat panel detectors	
6.	Pulse oximetry	
7.	Cardiac resuscitation measure -ECG	
8.	Pressure injector	
9.	Catheters, needles & other tools	
10.	3D rotational angiography	
11.	Preparation for procedure	
12.	Post procedure care	
13.	Role of technologist in interventional procedure	
14.	Diagnostic & therapeutic interventional procedures	
15.	PTC, PTBD, Stenting	
16.	Nephrostomy, ureteric stenting	
17.	Guided biopsies of different organs	
18.	Drainage of collections /abscesses	
19.	Angiograms, angioplasty, embolization	
20.	Venus access	
21.	Radiofrequency ablation	

22.	Image guided nerve blocks	
23.	Neuro interventional procedures	
24.	Embolization of extra or intracranial tumors, vascular malformations	
25.	Vertebro plasty – direct puncture	

Course Code: MRIT254	<u>SKILL ENHANCEMENT COURSE (SEC)-8</u>	L-0
	MRIT- SEMESTER-II	T-0
	CLINICAL POSTING	P-18
		C-9
Course Content:		
	Based on clinical exposure from hospital.	

<u>Course Code:</u> MRIT301	<u>COMPULSORY SPECIFIC COURSE (CSC)-1</u> MRIT- SEMESTER-III BASIC ELECTRONICS AND BIO-STATISTICS	L-3 T-0 P-0 C-3
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding Biostatistics & methodology of research.	
CO2.	Assessing and designing of research.	
CO3.	Analyzing the Clinical audit and data	
Course Content:		
Unit-1:	Introduction- Introduction to biostatistics & research methodology, mean, median, mode, standard deviation, types of variables & scales of measurements, measure of central tendency & dispersion, rate, ratio, proportion, incidence & prevalence, correlation and regression.	06 Hours
Unit-2:	Sampling- Random and non random sampling, different sample techniques – simple random, stratified, systematic, cluster & multistage. Sampling and non sampling errors and methods of minimizing these errors, Sampling distributions. Statistics and parameter. Standard error. Basic probability distributions - Normal, poisson, binomial distributions with their applications in biological sciences.	09 Hours
Unit-3:	Tests of significance- Basics of testing of hypothesis – Null & Alternative hypothesis, type 1 and type II errors, level of significance (parametric) & power of the tests, p value. Tests of significance – T test (paired & unpaired), Chi square test & Test of proportion, One way analysis of variance . Repeated measures analysis of variance. Tests of significance (non parametric) – Mann – Whitney U Test, Wilcoxon Test, Kruskal – Wallis Analysis of variance, Friedman's Analysis of variance	09 Hours
Unit-4:	Sample size determination, General concept. , Sample size for estimating means and proportion , testing of difference in means and proportions of two groups. Study designs- Descriptive epidemiological methods – case series analysis and prevalence studies . Analytical epidemiological methods – case control and cohort studies. Clinical trials / intervention studies, odds ratio and relative risk , stratified analysis	07 Hours
Unit-5:	Reliability and validity of diagnostic tests, Format of scientific documentations, Structure of research protocols, structure of thesis/research report, formats of reporting in scientific journals. Systematic review and meta analysis., Electricity (AC, DC), Resistors, Capacitors, Circuits, Diodes, Resistance, Transistors,	05 Hours

	Switches and Circuit breakers.	
<u>Text Books:</u>	<ol style="list-style-type: none"> 1. Mahajan BK: Methods in Biostatistics for medical students and research workers, 6th edition Jaypee, 1997 2. Kothari CR: Research methodology – Methods and techniques, Wiley eastern Ltd 	
<u>Reference Books:</u>	<ol style="list-style-type: none"> 1. Sunder Rao PSS, Richard J: Introduction to Biostatistics – A manual for students in Health 2. Sciences, Prentic – Hall of India Pvt Ltd. 	

<u>Course Code:</u> MRIT302	<u>DISCIPLINE SPECIFIC COURSE(DSC)-3</u> MRIT- SEMESTER-III ADVANCED TECHNIQUES AND INSTRUMENTATION OF CT		L-3 T-0 P-2 C-4
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understanding the basic physics, working and handling of computed tomography equipment.		
CO2.	Understanding history, generation & terminology related to computed tomography.		
CO3.	Describing the components and working of equipment related to C.T.		
CO4.	Obtaining knowledge for management and handling the patients and equipment for various procedures.		
CO5.	Applying the techniques of the patient preparations and post procedure care in any CT examination.		
Course Content:			
Unit-1:	Imaging principles in computed tomography, Instrumentation of CT scan, Advances in detector technology, Slip ring technology, Helical CT, Single slice and multi slice scan CT system	09 Hours	
Unit-2:	Image display, Pre and post processing techniques, Image quality in single slice and multi slice helical CT scan, Dose reduction techniques, CT dosimetry	08 Hours	
Unit-3:	Protocol for adult whole body CT, Protocols for paediatric whole body CT, Documentation, CT Artifacts	07 Hours	
Unit-4:	CT angiography, CT fluoroscopy, CT perfusion scanning, Denta scan, CT colonoscopy, CT bronchoscopy, CT coronary angiography, CT calcium scoring	05 Hours	
Unit-5:	Care maintenance and tests, General care, Functional tests, Quality assurance program, Acceptable limits of variation, Corrective action	07 Hours	
<u>Text Books:</u>	1. Computed tomography – physical principles, clinical application & quality control by Euclidseeram		
<u>Reference Books:</u>	1. Computed tomography by Stewart C Bushong 2. Textbook Of Radiology For Residents And Technicians : Bhargava (S K); Bhargava(S)		

Course Code: MRIT303	<u>CORE COURSE (CC) -5</u>		L-3 T-0 P-2 C-4
	MRIT- SEMESTER-III		
	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS		
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understanding the basic concepts, theories & method, in applied physics relevant to radiological imaging techniques & image quality		
CO2.	Identifying the difference in working and use of different X-ray modalities such as Portable, mobile and Fluoroscopic equipment's.		
CO3.	Understanding & applying provisions for radiation monitoring, safety and protection during Fluoroscopic procedures.		
CO4.	Analyzing and identifying the process of image formation and image development.		
CO5.	Understanding the working and applying the techniques to maintain image quality.		
Course Content:			
Unit-1:	Portable x ray equipments, Mobile x ray equipments, Capacitor discharge mobile equipment, Cordless mobile equipments, X ray equipments for the operating theatre	08 Hours	
Unit-2:	Fluoroscopy equipments, Construction and working principles of image intensifier, Viewing the intensified image, Recording the intensified image, Digital fluoroscopy, Panel type image intensifier	09 Hours	
Unit-3:	Fluoroscopy/radiographic tables, General features of fluoroscopy / radiographic tables, The serial changer, Remote control table, The spot film devices	05 Hours	
Unit-4:	Computerized Radiography, Digital Radiography, Equipment for cranial and dental radiography, General dental x ray equipment, Pantomography equipment, Equipment for mammography	07 Hours	
Unit-5:	Care, maintenance and tests, General care, Functional tests, Quality assurance programme, Acceptable limits of variation, Corrective action	07 Hours	
<u>Text Books:</u>	1. X Ray equipment for radiographers – Noreen Chesney & Muriel Chesney		
<u>Reference Books:</u>	1. Christensen's physics of diagnostic radiology 2. Equipments in Diagnostic radiology – E Forster		

NOTE:-	Practical Syllabus will be based on the theory paper (Procedures, Positioning, Patient care, Instrumentation, Radiation Protection, Equipments, Experiment in following areas).	
Course Code: MRIT351	<u>SKILL ENHANCEMENT COURSE (SEC)-9</u> MRIT- SEMESTER-III ADVANCED TECHNIQUES AND INSTRUMENTATION OF CT (LAB)	L-0 T-0 P-2 C-1
Course Content:		
1.	Protocol for adult whole body CT	
2.	Protocols for paediatric whole body CT	
3.	Documentation	
4.	CT Artifacts	
5.	CT angiography	
6.	CT fluoroscopy	
7.	CT perfusion scanning	
8.	Dentascan	
9.	Ct colonoscopy	
10.	CT bronchoscopy	
11.	CT coronary angiography	
12.	CT calcium scoring	

Course Code: MRIT352	<u>SKILL ENHANCEMENT COURSE (SEC)-10</u> MRIT- SEMESTER-III	L-0 T-0 P-2 C-1
	INSTRUMENTATION OF SPECIALIZED RADIOLOGY EQUIPMENTS (LAB)	
Course Content:		
1.	Portable x ray equipments	
2.	Mobile x ray equipments	
3.	Capacitor discharge mobile equipment	
4.	Cordless mobile equipments	
5.	X ray equipments for the operating theatre	
6.	Fluoroscopy equipments	
7.	Construction and working principles of image intensifier	
8.	Viewing the intensified image	
9.	Recording the intensified image	
10.	Digital fluoroscopy	
11.	Computerized Radiography	
12.	Digital Radiography	

Course Code: MRIT353	<u>SKILL ENHANCEMENT COURSE (SEC)-8</u> MRIT- SEMESTER-II	L-0 T-0 P-20 C-10
	CLINICAL POSTING (LAB)	
Course Content:		
	Based on clinical exposure from hospital.	

<u>Course Code:</u> MRIT401	<u>CORE COURSE (CC)-6</u> MRIT- SEMESTER-IV ADVANCED TECHNIQUES AND INSTRUMENTATION OF ULTRASOUND	L-3 T-0 P-2 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding different scanning protocol and its application in medical diagnosis and treatment.	
CO2.	Explaining the basic physics, techniques & equipment components relevant to Ultrasonography	
CO3.	Integrating and illustrating various pathological conditions of clinical Ultrasonography.	
CO4.	Executing the quality management of imaging system	
Course Content:		
Unit-1:	Ultrasound: , Properties of ultrasound, Interaction of ultrasound with matter, Transducers- Types of transducers, Advances in the design of modern ultrasound transducers	08 Hours
Unit-2:	Image display- Display modes, ultrasound instrumentation controls, Image storage, Scan converter memory, Photographic film, Multi format camera, Laser imager, Color and video thermal printer, Computer storage, Pre and post processing techniques	08 Hours
Unit-3:	Doppler imaging- Doppler principles, Continuous wave Doppler and pulsed Doppler, Duplex scanning, Color flow imaging, Power Doppler, Harmonic imaging, Extended field of view	08 Hours
Unit-4:	Ultrasound contrast agents, Image characteristics and artifacts, Vascular, interventional, intra operative and ophthalmic ultrasonography, 3D and 4D ultrasound imaging	06 Hours
Unit-5:	Bio – effects and safety consideration in ultrasound, Ultrasound system performance measurements, Ultrasound equipments quality assurance – conventional & Doppler system testing & documentation, Ultrasound protocols	06 Hours
Text Books:	1. Diagnostic ultrasound by b Carol. M. Rumack	
Reference Books:	1. Color Doppler ultrasound by Allen Paul 2. Sonographic Principles And Instrumentation: Penny (S.M);Fox(T.B);Godwin (C.H)	

<u>Course Code:</u> MRIT402	<u>DISCIPLINE SPECIFIC COURSE (DSC)-4</u>		L-3 T-0 P-2 C-4
	MRIT- SEMESTER-IV		
	ADVANCED TECHNIQUES AND INSTRUMENTATION OF MRI		
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understating about the basic physics and working of MRI equipment		
CO2.	Summarizing the essential hardware and execute different parameters in imaging.		
CO3.	Illustrating the scanning protocols, patient preparation and patient care.		
CO4.	Describing safety procedure for providing clinically safe imaging environment.		
CO5.	Evaluating the factors affecting the image quality		
Course Content:			
Unit-1:	Basic principles -Spin, Precession, Relaxation time, Pulse cycle, T1 weighted image, T2 weighted image, Proton density image	04 Hours	
Unit-2:	MR instrumentation -Types of gradients, RF transmitter and receiver coils, Gradient coils, Shim coils, RF shielding, Computers	08 Hours	
Unit-3:	Pulse sequence -Spin echo pulse sequences – turbo spin echo pulse sequences, Gradient echo sequence – turbo gradient echo pulse sequence, Inversion recovery sequence - STIR sequence, SPIR sequence, FLAIR sequence, Echo planar imaging & Fast imaging sequences, Advanced pulse sequences.	10 Hours	
Unit-4:	MR contrast media, MR angiography – TOF & PCA, MR spectroscopy, Protocols in MRI for whole body, MRI artifacts, Safety aspects in MRI	06 Hours	
Unit-5:	Cardiac MRI, Musculoskeletal imaging protocols, Abdominal imaging protocols, Functional imaging techniques, BOLD imaging Care, maintenance & tests, General care, Functional tests, Quality assurance programme, Acceptable limits of variation, Corrective action	08 Hours	
<u>Text Books:</u>	1. MRI physics for radiologist – Alfred Horowitz		
<u>Reference Books:</u>	1. Fundamentals of MRI – Stark & Bradely 2. MRI in practice – Catherine Brook		

<u>Course Code:</u> MRIT403	<u>DISCIPLINE SPECIFIC COURSE (DSC)-5</u>		L-3 T-0 P-2 C-4
	MRIT- SEMESTER-IV		
NUCLEAR MEDICINE IMAGING TECHNIQUES			
Course Outcomes:	On completion of the course, the students will be :		
CO1.	Understanding about the applied physics of nuclear medicine.		
CO2.	Understanding about the production of radioactive elements and their use in various procedures		
CO3.	Obtaining knowledge for management and handling patients and the equipment for various procedures.		
CO4.	Analyzing and recognizing the dose and route of administration of radiopharmaceuticals as per clinical procedure requirement.		
CO5.	Understanding of the radiation monitoring & dose management as per different regulatory bodies (AERB,BARC,ICRP) guidelines.		
Course Content:			
Unit-1:	Basic atomic and nuclear physics, Quantities activity, Atomic composition and structure, Nucleus composition Radioactivity, Exponential decay Specific activity Parent/Daughter decay, Modes of Radioactive decay		14 Hours
Unit-2:	Radiation detectors, Gas filled detectors-Basic principles, Ionization chambers, Proportional counters, Geiger Muller counters, Semiconductor detectors, Scintillation detectors-basic principles		08 Hours
Unit-3:	Production of radio nuclides, Reactor produced radio nuclide, Reactor principles, Accelerator produced radionuclide, Radio nuclide generator,s Instrumentation, Basic principles, System components, Detector systems and electronics, Collimators, Image display an recording systems, Scanning cameras, Radio pharmacy, Radiopharmaceuticals, General principles of tracer technique, Preparation of different labeled compounds with technetium-99m isotope, Cold kits		04 Hours
Unit-4:	In vivo technique, Static and dynamic studies, Thyroid imaging, Imaging of bone, Respiratory system, Urinary system, G.I system, Cardiovascular system, Iodine 131 uptake studies, Iodine 131 therapy of thyro toxicosis and thyroid ablation		02 Hours
Unit-5:	SPECT imaging, PET imaging, Radiation safety in nuclear medicine, Radiation units quantities, MPD, Safe handling of radioactive materials, Storage of radioactive materials, Procedures for handling spills, Disposal of radioactive waste Radiation monitoring Survey meters, Personnel dosimeters, Wipe testing, Contamination monitor, Isotope calibrator, Area monitor, Inventory of isotopes		08 Hours
<u>Text Books:</u>	<ol style="list-style-type: none"> 1. Physics in Nuclear Medicine-Sorenson 2. Physics in Nuclear Medicine- Powsner 		

NOTE:-	<i>Practical Syllabus will be based on the theory paper (Procedures, Positioning, Patient care, Instrumentation, Radiation Protection, Equipments, Experiment in following areas</i>	
Course Code: MRIT451	<u>SKILL ENHANCEMENT COURSE (SEC)-12</u> MRIT- SEMESTER-IV ADVANCED TECHNIQUES AND INSTRUMENTATION OF ULTRASOUND (LAB)	L-0 T-0 P-2 C-1
Course Content:		
1.	Ultrasound:	
2.	Properties of ultrasound	
3.	Interaction of ultrasound with matter	
4.	Transducer	
5.	Types of transducers	
6.	Advances in the design of modern ultrasound transducers	
7.	Laser imager	
8.	Color and video thermal printer	
9.	Computer storage	
10.	Pre and post processing techniques	
11.	Doppler principles	
12.	Continuous wave Doppler and pulsed Doppler	
13.	Duplex scanning	
14.	Colour flow imaging	
15.	Power Doppler	
16.	Harmonic imaging	
17.	Extended field of view	
18.	Vascular, interventional, intra operative and ophthalmic ultrasonography	
19.	3D and 4D ultrasound imaging	
20.	Ultrasound protocols	

Course Code: MRIT452	<u>SKILL ENHANCEMENT COURSE (SEC)-13</u>	L-0
	MRIT- SEMESTER-IV	T-0
	ADVANCED TECHNIQUES AND INSTRUMENTATION OF MRI (LAB)	P-2 C-1
Course Content:		
1.	Basic principles	
2.	RF transmitter and receiver coils	
3.	Gradient coils	
4.	Shim coils	
5.	RF shielding	
6.	Spin echo pulse sequences – turbo spin echo pulse sequences	
7.	Gradient echo sequence – turbo gradient echo pulse sequence	
8.	Inversion recovery sequence - STIR sequence , SPIR sequence, FLAIR sequence	
9.	MR contrast media	
10.	MR angiography – TOF &PCA	
11.	MR spectroscopy	
12.	Protocols in MRI for whole body	
13.	MRI artefacts	
14.	Safety aspects in MRI	
15.	Cardiac MRI	
16.	Musculoskeletal imaging protocols	
17.	Abdominal imaging protocols	
18.	Functional imaging techniques	
19.	BOLD imaging	

Course Code: MRIT453	<u>SKILL ENHANCEMENT COURSE (SEC)-14</u>	L-0
	MRIT- SEMESTER-IV	T-0
	DISSERTATION WRITING	P-20
		C-10
Course Content:		
1.	It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by staff of the department based on participation of students in various teaching/ learning activities. It may be structured and assessment shall be done using checklists that assess various aspects. Model checklists are given which may be copied and used.	
2.	Journal Review Meeting (Journal Club): the ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist).	
3.	Seminars/ symposia: the topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist II).	

Format of Model Checklists

Checklist- I: MODEL CHECKLIST FOR EVALUATION OF JOURNAL REVIEW PRESENTATIONS

Name of the student:

Date:

Name of the faculty/ observer:

Title of the paper:

Journal detail:

Sl. No	Items of observation during presentation	Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper/ subject					
6	Audio- visual aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					
Remarks						

Name and Signature of the Faculty

Checklist- II: MODEL CHECKLIST FOR THE EVALUATION OF THE SEMINAR PRESENTATIONS

Name of the student:

Date:

Name of the faculty/observer:

Title of the seminar:

Sl. No	Items of observation during presentation	Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Topic chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been consulted					
5	Ability to respond to questions on the paper/ subject					
6	Audio- visual aids used					
7	Ability to defend the topic					
8	Clarity of presentation					
9	Any other observation					
	Total score					
Remarks						

Name and Signature of the Faculty

Checklist- III: CONTINUOUS EVALUATION OF DISSERTATION WORK BY GUIDE/ CO- GUIDE

Name of the student:

Date:

Name of the faculty/ observer:

Topic:

Sl. No	Points of observation during presentation	Poor 0	Below average 1	Average 2	Good 3	Very good 4
1	Periodic consultation with guide/ co-guide					
2	Depth of Analysis/ Discussion					
3	Department presentation of findings					
4	Quality of Final Output					
5	Others					
	Total score					
Remarks						



Name and Signature of the Faculty