VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM, THIRUVANMIYUR - CHENNAI

UNDERGRADUATE DEGREE PROGRAMME

Bs.c. MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY

4 Year UG Degree (3 + 1 year -INTERNSHIP)

CURRICULUM & SYLLABUS

REGULATION 2026

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2026 -2027

Department of MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY

School of ALLIED HEALTH SCIENCES

VELS

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(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
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DEPARTMENT OF MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY

VISION OF THE DEPARTMENT
To be a Centre of excellence in Medical Radiology and Imaging Technology education, clinical training, research and innovation, producing competent, ethical and patient-centered imaging professionals committed to radiation safety, quality assurance, evidence-based practice and lifelong learning.

MISSION OF THE DEPARTMENT	
M1	To provide competency-based education and training integrating basic sciences, radiological sciences, imaging technology and clinical practice.
M2	To develop technically and clinically competent professionals capable of performing radiographic and imaging procedures safely and effectively
M3	To promote radiation protection, quality assurance and patient safety in accordance with professional and regulatory standards
M4	To cultivate patient-centred care, communication, ethics, professionalism and multidisciplinary teamwork among students.
M5	To encourage critical thinking, evidence-based practice, research, innovation and lifelong learning to meet advances in medical imaging technology
M6	To prepare responsible healthcare professionals capable of contributing to quality improvement, community healthcare needs and the advancement of the radiology profession.

PROGRAMME OUTCOMES (PO)	
PO1	Gaining clinical efficiency in the field of medical imaging and analysis
PO2	Sharpening critical thinking skills
PO3	Understanding clinical environment and patient needs
PO4	Nurturing commitment and ethical behavior
PO5	Strengthening communication skills and empathy to deal with patients, families, and other health care providers
PO6	Able to do the image processing
PO7	Should be able to undertake Mammography, CT scan and MRI procedures independently.
PO8	Should be able to handle all radiological and imaging equipment independently

Medical Radiology and Imaging Technology (B. MRIT)

Introduction:

Learning Objectives:

Bachelor in Medical Radiology and Imaging Technology (BMRIT) program is to provide students with a high quality, well-rounded educational experience which results in graduates who possess the knowledge, skills and abilities to enter the field of diagnostic imaging as entry-level MRITs. Graduates of the BMRIT program will be able to demonstrate the necessary skills to integrate the theoretical knowledge and essential clinical skills to perform radiography, radiological and imaging procedures including interventional procedures with utmost radiation safety measures as well as to provide exemplary patient care in a variety of healthcare settings with diverse patient populations

The objectives of the program are to:

- Provide the profession and community with trained qualified MRITs.
- Provide education a comprehensive program that promotes problem solving, critical thinking and communication skills in the clinical environment.
- Students will demonstrate quality patient care skills including professionalism and ethical behaviors as specified in the code of ethics.
- Provide graduate students with specific skills necessary making them to be competent at entry level.

Expectation from the future graduate in the providing patient care.

- Should be able to undertake all radiological and imaging procedures independently or as a key team member wherever required.
- Able to do the image processing.
- Should be able to handle all radiological and imaging equipment independently.
- Should ensure radiation protection and quality assurance.
- Undertake care and maintenance of all radiological and imaging equipment.
- Able to evaluate images for technical quality.
- Able to identify and manage emergency situations.
- Able to receive and document verbal, written and electronic orders in the patient's medical record.
- Should have computer skills.
- Should be able to provide empathetic professional patient care.
- Able to demonstrate professional growth, sense of professionalism and desire to learn.
- Able to demonstrate the core values of caring, integrity and discovery.
- To exhibit keen interest, initiative & drive in the overall development of the Department and 'Leadership Qualities' for others to follow.
- He / She is expected to be confident and to perform all the duties diligently with utmost sincerity and honesty

Teaching faculty and infrastructure (minimum standard to start the programmes):

Institute should mandatorily be associated with the state medical colleges whereby they can make use of the available patient load and medical infrastructure as a part of their training curriculum (May be through MOU).

- Standalone institutions must have an MoU with either a medical college or hospital or healthcare facility as per the guidelines (desired number of Radiology equipment/beds/OPD etc.) defined in the curriculum to ensure practical exposure to the students.
- MoU to also define the radiology clinical supervision of the students –institutional staff or clinical preceptors can be considered.

For the institutes to be capable of providing high-quality training to the student and exposure to all the related modalities, it should have the following:

- X-ray Unit (CR, DR)
- Mobile X-ray unit
- Fluoroscopic unit
- Ultrasonography, Color Doppler Equipment
- Multi-slice C.T. Scan,
- Mammography
- DEXA
- MRI
- DSA

The teaching faculty (with annual intake of up to 20 students or student's staffs ratios must be 5:1 to be maintained) for the MRITs should have a minimum of Master in the MRIT or MRIT with PhD in relevant subject.

- 1 Professor
- 1 Assoc. Professor
- 3 Asst. Professor
- 2 demonstrators

Method of teaching and learning-

- Lecture
- Tutorial
- Problem based learning
- Small group teaching and learning
- Continuous interactive learning
- Case-based
- Project based
- Research project- Research was considered by the group to be very important in order to keep pace with other professions and to generate a research background for our own profession.
    - Seminars

- Clinical conferences
- E-learning
- Skills laboratory
- Industrial visit

Infrastructure requirements (with annual intake of up to 20 students)**:**

- Minimum 4 classrooms with minimum seating capacity of 30 students
- Faculty rooms, Common rooms for students
- Auditorium/Conference room with minimum seating capacity of 150 students.
- A minimum 2000 sqft library area
- Student canteen/cafeteria
- Office rooms for staff

Eligibility for admission

Selection procedure:

1. He/she has passed the Higher Secondary (10+2) or equivalent examination recognized by any Indian University or a duly constituted Board with Physics, Chemistry, Biology

   OR

2. Candidates who have studied abroad and have passed the equivalent qualification as determined by the University will form the guideline to determine the eligibility and must have passed in the subjects: Physics, Chemistry, Biology and English up to 12th Standard level.

   OR

3. Candidates who have passed the Senior Secondary school Examination of National Open School with a minimum of 5 subjects with any of the following group subjects.
   - English, Physics, Chemistry, Botany, Zoology
   - English, Physics, Chemistry, Biology and any other language
4. He/she has attained the age of 17 years as on or before the 31st December of the year of admission) & maximum age limit is 30 years.
5. He/she must furnish at the time of submission of application form, a certificate of Physical fitness from a registered medical practitioner and two references from persons other than relatives testifying to satisfactory general character.
6. Admission to Bachelor Medical Radiology and Imaging Technology course shall be made based on eligibility and an entrance test to be conducted for the purpose.

Selection of eligible candidates:

Selection to the BMRIT course shall be based on merit obtained in the National Entrance and Eligibility Test (NEET) conducted by the central government or its authorized agency.

In accordance with NCAHP regulations Institution/university having hospital setup shall be permitted an annual intake capacity of 20 admissions annually apart from inservice /Govt.Sponsored Candidates

as per NCIAHP Act. Thereafter these can be increased to 40/60 BMRIT admissions annually. The phase-wise requirements to be fulfilled by the applicant colleges after obtaining letter of intent and Letter of Permission for establishment of new college or increase in annual intake for 40/60 BMRIT admissions annually as per ICAHP regulations.

Admission of Lateral Entry candidates:

Number of intake: lateral entry admission must not be more than 10% of the annual intake.
Lateral entry to second year for allied and healthcare science courses for candidates who have passed diploma program from the Government Boards and recognized by State/Central University, fulfilling the conditions specified and these students are eligible to take admission on lateral entry system only if the same subject have been studied at diploma level.

There may be need of deliberation on the inclusion of a few bridging courses are advisable for those having less qualified subjects.

A candidate with a minimum 2 years full-time diploma in Medical Imaging Technology/Radiography recognized by a Government Body is eligible for lateral entry to the 3rd semester.

Note: Candidates with minimum 2 years full-time diploma in Medical Imaging Technology/Radiography from a recognized Government Body shall have passed 'plus-two' [10+2] with Physics, Chemistry and Biology as subjects with minimum 1 years of radiology working experience in hospital/academic institution or

Candidates with minimum 3 years full-time diploma in Medical Imaging Technology/Radiography from a recognized Government Body shall have passed 'plus-two' [10+2] with Arts/Commerce as subjects, should have studied Physics, Chemistry and Biology as principal subjects during the tenure of the Medical Imaging Technology course with minimum 1 years of radiology working experience in hospital/academic institution. Eligibility of the lateral candidates based on examination conducted by NCAHP.

Foreign nationals and candidates who have qualified from a foreign University/Board should obtain permission from the NCAHP commission prior to the admission for equivalence of the qualification.
Note: Curriculum task force members decided not to submit the Diploma of MRIT curriculum and requested NCAHP to phase out the course within five years. (As it was decided during the previous meeting).

Duration of the course

Duration of the course: 3 years (6 semesters) + 1 year (7th and 8th semester) internship. Total 4 years or 8 semesters programme. (per semester 640 hours of Theory & Practical hours) and 2400 hours of internship.

Total hours of the course: 6240 hours.

Medium of instruction:

English shall be the medium of instruction for all the subjects of study and for examination of the course.

Maximum period for completion of the course:

- The maximum period for completion of BMRIT is 7 years.
- If a candidate does not complete within the 6years, he/she should re-register.

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.
- A candidate who has a minimum of 75% attendance in theory and practical separately and who has fulfilled other requirements of the course shall be permitted to appear for examination.
- A candidate having shortage of attendance shall repeat the exam when it is offered next.

Assessment and Evaluation

Scheme of Evaluation

The academic performance is assessed on the basis of both Continuous Internal Evaluation (CIE) assessment and End Semester Examination (ESE) in each semester.

ESE weightage will be in the ratio of 30 % for CIE and 70 % for ESE.

Continuous Internal Evaluation (CIE)

- 30% of the total marks is allotted for CIE in each course.
- 50% of CIE shall be based on the average of marks obtained in two notified formative written tests. Absence without prior permission for a formative test shall result in scoring of the test as zero.
- The remaining 50% of CIE will be based on internal assessments in the form of evaluation seminars, journal club presentations, case presentations, completion of assignments etc. which will be specified in the individual course curricula.
- CIE will be conducted for theory and practical for each course wherever applicable.
- A Candidate must secure at least 40% of total marks fixed for CIE in the particular subject in order to be eligible to appear for the End Semester Examination (ESE) for that subject.

End semester examination (ESE)

- There shall be a University Examination at the end of each semester.
- To be eligible to appear for university examination a candidate should fulfill all the following conditions
- Undergone satisfactorily the approved program of study in the course/courses for the prescribed duration
- 75% attendance separately in theory and in practical/hospital postings, in each course
- Shall have the minimum attendance requirement in all courses of that semester for the first appearance
- Secure at least 50% of total marks fixed for CIE in a particular course; and
- Fulfill any other requirement that may be prescribed by the University from time to time.

- The End semester examination will consist of Theory examination for all courses and in addition, Practical examination for specified courses.
- Theory examination
- Written tests with question types, pattern, duration and weightage as specified in the Course-wise curricula
- Setting of question papers and evaluation of answer scripts as per University regulations
- Practical examination
- Broad outline would be in the form of Spotters, Demonstration of equipment handling, Case based discussions.

Criteria for pass:

A Candidate must score 50%separately in theory and practical wherever applicable to be declared as pass. In case of fail, subsequently a candidate has to appear for both theory and practical examination of the university in that particular course.

Attendance and appearance for Exam:

Candidates not possessing required attendance in a particular course as prescribed by university will not be allowed to take up examinations and has to appear for supplementary examination whenever board conducts exam for the particular course very next time.

Stipend: All students shall be paid a minimum amount of Rupees 7000/- per month as stipend during internship or at par with other streams as per Consumer Price Index as per NCIAHP act

CREDIT DISTRIBUTION

Bsc.,MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY

Total Credits to be earned: 170

4 Year UG degree (3 + 1 Year - Internship)

Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	3 yrs Total Credits
Foundation courses	6	4	2	-	-	-	12
Core courses	5	13	15	18	17	14	82
Programme Courses	7	-	-	-	-	2	9
Clinical Education	5	5	4	4	4	5	27
Total Credits	23	22	21	22	21	21	130

INTERNSHIP : 40 credits

CURRICULUM STRUCTURE

FIRST SEMESTER

Teaching and Examination Scheme

Course Name : Bachelor in Medical Radiology and Imaging Technology

Duration of Program: Four Years (Eight Semesters) Pattern : Full Time Duration : 18 Weeks

Semester : **First**

S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				
			L	T	C/P	Credits (L+T+P)	Exam Duration in Hrs.	CIE	ESE	Total		CIE	ESE	Total		Grand Total
								Max Mark	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks	
1.	Human Anatomy	BMRIT-001	3	--	--	3	2.5	30	70	100	50	--	--	--	--	**100**
2.	Physiology	BMRIT-002	3	--	--	3	2.5	30	70	100	50	--	--	--	--	**100**
3.	Basics of Radiation Physics	BMRIT-003	2	-	6	5	2.5	30	70	100	50	30	70#	100	50	**200**
4.	Introduction to Healthcare	BMRIT-004	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
5.	Medical Terminology and Record keeping	BMRIT-005	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
6.	Basic Computers and Information science	BMRIT-006	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
7.	Medical Law and Ethics	BMRIT-007	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
8.	Professionalism and Values	BMRIT-008	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
9.	Principals of Management	BMRIT-009	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
10.	English & Communication skills	BMRIT-010	1	--	--	1	--	30	70*	100	50	--	--	--	--	--

11.	BMRIT Radiology Clinical Education – part I (studentship)		--	--	15	5	--	--	--	--	--	--	--	--	--	--
	Total		**13**	**2**	**21**	**23**	**--**	**--**	**--**	**300**	**--**	**--**	**--**	**100**	**--**	**400**

Student Contact Hours Per Week: 36**Hrs.Theory and practical periods of 60 minutes each.**
Medium of Instruction: **English**
Total Marks: **400**
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L – Lectures ((hrs/week), T - Tutorial, P – Practical {Clinical / Practicals (hrs/week)}
*Internal Assessment, # External Assessment.

SECOND SEMESTER

Teaching and Examination Scheme

Course Name : Bachelor in Medical Radiology and Imaging Technology

Duration of Program: Four Years (Eight Semesters) Pattern : Full Time **Duration : 18 Weeks**

Semester : **Second**

S. N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				
								CIE	ESE	Total		CIE	ESE	Total		Grand Total
			L (hrs/ week)	T	C/ P (hrs/week)	Credits (L+T+P)	Exam Durati in Hrs.	Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks	
1.	Basics of Microbiology	BMRIT -011	2	--	--	2	2.5	30	70	100	50	--	--	--	--	100
2.	Basics of Biochemistry	BMRIT -012	2	--	--	2	2.5	30	70	100	50	--	--	--	--	100
3.	Conventional Radiography and Equipment	BMRIT -013	4	--	2	5	2.5	30	70	100	50	--	--	--	--	100
4.	Clinical Radiography Positioning (Part I)	BMRIT -014	4	1	6	8	--	30	70	100	50	30	70#	100	50	200
5.	BMRIT Radiology Clinical Education – part II (studentship)		--	--	15	5	--	--	--	--	--	--	--	--	--	--
	Total		**12**	**1**	**23**	**22**	--	--	--	400	--	--	--	100	--	500

Student Contact Hours Per Week: 36**Hrs.Theory and practical periods of 60 minutes each.**
Medium of Instruction: **English**
Total Marks **: 500**
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical
*Internal Assessment, # External Assessment.

THIRD SEMESTER

Teaching and Examination Scheme																
Course Name: Bachelor in Medical Radiology and Imaging Technology																
Duration of Program: Four Years (Eight Semesters) Pattern : Full Time Duration : 18 Weeks Semester : **Third**																
S.N.	**Course Title**	**Course Code**	**Teaching Scheme**				**Examination Scheme**									
							Theory					Practical				Grand Total
			L (hrs/week)	T	C/ (hrs/week)	Credits (L+T+P)	Exam Duration in Hrs.	CIE Max Marks	ESE Max Marks	Total Max Marks	Total Min Marks	CIE Max Marks	ESE Max Marks	Total Max Marks	Total Min Marks	
1.	Pathology	BMRIT -015	2	--	--	2	2.5	30	70	100	50	--	--	--	--	**100**
2.	Clinical Radiography Positioning (Part II)	BMRIT-016	2	1	6	6	2.5	30	70	100	50	30	70#	100	50	**200**
3.	Radiography and Image Processing Techniques	BMRIT-017	2	--	2	3	2.5	30	70	100	50	--	--	--	--	**100**
4.	Contrast Media& Special Radiological procedures	BMRIT-018	2	1	6	6	2.5	30	70	100	50	30	70#	100	50	**200**
5.	BMRIT Radiology Clinical Education – part III (studentship)		--	--	12	4	--	--	--	--	--	--	--	--	--	--
	Total		**6**	**4**	**26**	**21**	--	--	--	**400**	--	--	--	**200**	--	**600**

Student Contact Hours Per Week: 36**Hrs.Theory and practical periods of 60 minutes each.**

Medium of Instruction: **English**

Total Marks **: 600**

Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical

*Internal Assessment, # External Assessment.

*Internal Assessment (Institutional Level examination) marks are not to be counted for the grade at the end of the semester.

FOURTH SEMESTER

Teaching and Examination Scheme

Course Name : Bachelor in Medical Radiology and Imaging Technology

Duration of Program :Four Years (Eight Semesters) Pattern : Full Time **Duration : 18 Weeks**

Semester : **Fourth**

S.N	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				Grand Total
			L (hrs/week)	T	C/P (hrs/week)	L (hrs/week)	Exam Duration in Hrs.	CIE	ESE	Total		CIE	ESE	Total		
								Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks	
1.	Cross sectional anatomy	BMRIT-019	2	--	6	5	--	--	--	--	--	70#	30	100	50	**100**
2.	Modern Radiological Imaging Equipment and Physics	BMRIT-020	2	1	2	3	2.5	70	30	100	50	--	--	--	--	**100**
3.	Interventional Radiology Techniques	BMRIT-021	2	1	4	4	2.5	70	30	100	50	70#	30	100	50	**200**
4.	Patient Care in Radiology	BMRIT-022	1	1	4	4	2.5	70	30	100	50	70#	30	100	50	**200**
5.	BMRIT Radiology Clinical Education – part IV (studentship)		--	--	12	4	--	--	--	--	--	--	--	--	--	--
		Total	**7**	**3**	**26**	**22**	--	--	--	**300**	--	--	--	**300**	--	**600**

Student Contact Hours Per Week: 36**Hrs.Theory and practical periods of 60 minutes each.**

Medium of Instruction: **English**

Total Marks: **600**

Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical

*Internal Assessment, # External Assessment. *

Internal Assessment (Institutional Level examination) marks are not to be counted for the grade at the end of the semester.

FIFTH SEMESTER

Teaching and Examination Scheme																
Course Name : Bachelor in Medical Radiology and Imaging Technology																
Duration of Program :Four Years (Eight Semesters) Pattern : Full Time Duration : 18 Weeks Semester : **Fifth**																
S.N.	**Course Title**	**Course Code**	**Teaching Scheme**				**Examination Scheme**									**Grand Total**
							Theory					**Practical**				
			Theory (hrs/week)	**Tutorial**	**Clinical / Practicals (hrs/week)**	**Credits (L+T+P)**	**Exam Duration in Hrs.**	**CIE**	**ESE**	**Total**		**CIE**	**ESE**	**Total**		
								Max Marks	**Max Marks**	**Max Marks**	**Min Marks**	**Max Marks**	**Max Marks**	**Max Marks**	**Min Marks**	
1.	Basics Techniques in CT Technology	BMRIT-023	4	1	8	9	2.5	30	70	100	50	30	70#	100	50	**200**
2.	Radiation Safety in Diagnostic Radiology	BMRIT-024	2	1	4	5	2.5	30	70	100	50	30	70#	100	50	**200**
3.	Quality Assurance in Diagnostic Radiology and Regulatory Requirements	BMRIT-025	1	1	2	3	--	--	--	--	--	30	70#	100	50	**100**
4.	BMRIT Radiology Clinical Education – part V (studentship**)**		--	--	12	4	--	--	--	--	--	--	--	--	--	--
	Total		**7**	**3**	**26**	**21**	--	--	--	**200**	--	--	--	**300**	--	**500**

Student Contact Hours Per Week: 36 **Hrs. Theory and practical periods of 60 minutes each.**
Medium of Instruction: **English**
Total Marks **: 500**
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical
*Internal Assessment, # External Assessment.
*Internal Assessment (Institutional Level examination) marks are not to be counted for the grade at the end of the semester.

SIXTH SEMESTER

Teaching and Examination Scheme																	
Course Name: Bachelor in Medical Radiology and Imaging Technology																	
Duration of Program: Four Years (Eight Semesters) Pattern : Full Time **Duration : 18 Weeks** Semester : **Sixth**																	
S.N.	**Course Title**	**Course Code**	**Teaching Scheme**				**Examination Scheme**										**Grand Total**
							Theory					**Practical**					
			Theory (hrs/week)	**Tutorial**	**C/P (hrs/week)**	**Credits (L+T+P)**	**Exam Duration in Hrs.**	**CIE**	**ESE**	**Total**		**CIE**	**ESE**	**Total**			
								Max Marks	**Max Marks**	**Max Marks**	**Min Marks**	**Max Marks**	**Max Marks**	**Max Marks**	**Min Marks**		
1.	Basics Techniques In MRI Technology	BMRIT-026	3	1	8	8	2.5	30	70	100	50	30	70#	100	50		**200**
2.	Introduction to Nuclear Medicine Techniques	BMRIT-027	1	1	2	3	2.5	30	70	100	50	--	--	--	--		**100**
3.	Ultrasound Techniques	BMRIT-028	2	1	--	3	2.5	30	70	100	50	--	--	--	--		**100**
4.	Biostatistics And Research Methodology	BMRIT-029	1	1	--	2	--	30	70*	100	50	--	--	--	--		--
5.	BMRIT Radiology Clinical Education – part VI (studentship)		--	--	15	5	--	--	--	--	--	--	--	--	--		--
	Total		**7**	**4**	**25**	**21**	**--**	**--**	**--**	**300**	**--**	**--**	**--**	**100**	**--**		**400**

Student Contact Hours Per Week: 36**Hrs. Theory and practical periods of 60 minutes each.**

Medium of Instruction: **English**

Total Marks **: 400**

Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical

*Internal Assessment, # External Assessment.

*Internal Assessment (Institutional Level examination) marks are not to be counted for the grade at the end of the semester.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semesters.
- Provide simulation and skill labs for practising skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.

FIRST SEMESTER

SUBJECT: Human Anatomy
Subject Code: BMRIT – 001
RATIONALE

Anatomy is a key component of all education programmes for MRITs and should have a strong focus on organ position, orientation and relationships. The topics provide the student with an understanding of the structure and relationships of the systems and organs of the body which is essential in patient preparation and positioning. The radiographic anatomy component will enable MRITs to evaluate images prior to reporting by the radiologist.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Describe the general anatomy of human body

CO2: Explain normal disposition of various structures and organs in the body and its clinical correlation

CO3: Describe the microscopic structure of various tissues

CO4: Determine the topography of various structures on the surface of the body

CO5: Identify and locate structures of the body

CO6: Identify organs and tissues under microscope

CO7: Point out various features of appearance of normal body in skiagrams

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	
3	**--**	**--**	**3**	**30**	**70**	**--**	**--**	**100**

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable tutorial assignments of minimum one hour per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	**Introduction: Human Body as a Whole** Definition of anatomy and its subdivisions, Terms of location, positions and planes, Cell and its organelles, Epithelium – definition, classification, describe with examples, functions, Glands – classification, describe serous and mucous glands with examples, Basic tissues – classification with examples	**08**	14

II	**Locomotion and Support** Cartilage – types, examples and histology Bone – classification, examples and histology. Parts of long bone, names of all bones, vertebral column and intervertebral disc. Fontanel's of fetal skull. Joints – classification of joints with examples, typical synovial joint (in detail). Muscular system – classification of muscular tissue and histology Important muscles of the body- Sternocleidomastoid, Trapezius, Muscles of tongue, Deltoid, Biceps brachii, Intercostal muscles, Thoracic diaphragm, Rectus abdominis, External oblique, Internal oblique, Transversus abdominis, Pelvic diaphragm, Gluteus maximus, Gluteus medius, Gluteus Minimus, Quadriceps femoris, Soleus.	**08**	14
III	**Cardiovascular System** Heart – size, location, chambers, exterior and interior, Blood supply of heart, Pericardium, Systemic and pulmonary circulation, Branches of aorta - common carotid artery, subclavian artery, Axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery, dorsalis pedis artery., Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, median cubital vein, Dural venous sinuses, Lymphatic system – cisterna chyli and thoracic duct, Lymphatic tissues and its histology, Regional lymph nodes – cervical, axillary and inguinal lymph nodes. **Respiratory System** Parts of RS – nose, nasal cavity, paranasal air sinuses, larynx, trachea, lungs, pleura, bronchopulmonary segments, Histology of trachea and lungs.	**08**	20
IV	**Gastro-Intestinal System Theory** Parts of GIT- oral cavity (lip, cheek, tongue, salivary glands, palate, dentition) pharynx (Waldeyer's ring) esophagus, stomach, small and large intestine and appendix, Liver, gall bladder, pancreas and spleen, Histology of esophagus, stomach, small and large intestine, liver, gall bladder and pancreas. **Peritoneum** Description of reflection, folds and pouches in brief.	**08**	14
V	**Urinary System** Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder. **Reproductive System** Parts of male reproductive system- testis, vas deferens, epididymis, prostate, Parts of female reproductive system- uterus, fallopian tubes, ovary, mammary gland, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary. **Endocrine Glands**	**08**	20

	Names of all endocrine glands, describe in detail on pituitary gland, thyroid gland and parathyroid gland, suprarenal gland, Histology of pituitary, thyroid, parathyroid, suprarenal gland.		
VI	**Nervous System** Neuron, Classification of nervous system, Cerebrum, cerebellum, brain stem, spinal cord & spinal nerve, Meninges, ventricles and cerebrospinal fluid, Blood supply of the brain, Cranial nerves (in brief), Nerve plexus (Brachial & lumbar) **Sensory Organs** Skin and its appendages, Eye – parts of eye ball and lacrimal apparatus, Extra-ocular muscles, Histology of cornea and retina, Ear – parts of ear- external, middle and inner ear and contents Embryology Spermatogenesis and oogenesis, Ovulation, fertilization, Placenta	**08**	14
Total		**48**	96

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		**Hours**
1.	Demonstration of Histology of types of epithelium, Histology of serous, mucous and mixed salivary gland, Surface marking of the body region wise.	1
2.	Demonstration of Histology of hyaline, elastic and fibrocartilage, Demonstration of all bones showing parts, radiographs of normal bones and joints, Histology of compact bone (TS and LS), Demonstration of all muscles of the body, Histology of skeletal, smooth and cardiac muscle.	1
3.	Demonstration of heart, pericardium and vessels of the body, Histology of large artery, medium sized artery and large vein, Histology of lymph node, spleen, tonsil and thymus, Normal chest radiograph showing heart shadows, Normal angiograms. Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea.	1
4.	Demonstration of parts of GIT, liver, gall bladder, pancreas and spleen, Histology of tongue, salivary glands, esophagus, stomach, small and large intestine, liver, gall bladder, pancreas and spleen, Radiographs of abdomen plain and contrast. Demonstrations of reflections, folds and pouches.	1

Sr. No		Hours
5.	Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen – IVP, retrograde cystogram. Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary, Radiographs of pelvis – Hysterosalpingogram. Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands.	1
6.	Demonstration of Histology of peripheral nerve and optic nerve, Demonstration of major nerves in the body, Demonstration of cranial cavity and parts of brain, Histology of cerebrum, cerebellum, spinal cord Demonstration of Histology of thin and thick skin, Demonstration of histology of cornea and retina.	1
	Total	**6**
Demonstration will be part of theory/tutorial classes. There is in separate credit for the practicals/demonstrations.		

SUBJECT: PHYSIOLOGY
Subject Code: BMRIT – 002
RATIONALE

Physiology provides the students with knowledge of the function of systems and organs and their relationships and underpins the understanding of how various imaging modalities are to be selected depending upon the clinical history.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Explain the normal functioning of organs and systems.

CO2: Understand the interrelationships and interactions among various organs and systems for maintaining homeostasis.

CO3: Assess the relative contribution of each organ systems toward the maintenance of constant internal environment

CO4: Differentiate between normal and abnormal functioning of organs and systems,

CO5: Understand physiological basis of pathogenesis and treatment of diseases and disorders.

CO6: Apply the physiological basis in the field of allied health care

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**ESE**	**CIE**	**100**
3	**--**	**--**	**3**	**30**	**70**	**--**	**--**	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable tutorial assignments of minimum one hour per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	**General physiology** Introduction to Physiology, Concept of Homeostasis, cell – Morphology – Functions of organelles and Cell membrane, Transport mechanisms, Body fluid compartments. **Muscle nerve physiology** Neurons: Morphology, Action Potential, Neuroglia: Types & functions, Muscles: Types, structure of sarcomere. Neuromuscular junction, sliding filament mechanism of contraction. **Blood** Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis – stages, essential factors, regulation of Erythropoiesis, Hemoglobin: Functions, concentration, physiological variations. Fate of Hemoglobin – Jaundice, types, Color index, MCH, MCV, MCHC, PCV – normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood grouping. Landsteiner's laws, ABO system, determination of blood groups, blood transfusion, complications of incompatible blood transfusion, Rh group, erythroblastosis foetalis, prevention and treatment, Blood bank. Haemostasis: Mechanisms. Clotting mechanism: factors, intrinsic and extrinsic pathways. Disorders of clotting – hemophilia, vitamin K deficiency. Anticoagulants – mechanism of action and their uses, Anemia: Classification – Morphological and Etiological, Blood volume: normal values.	**10**	**15**
II	**Cardiovascular system** Organization of cardiovascular system, greater and lesser circulation, Physiological anatomy of the heart, nerve supply, Junctional tissues of heart (pacemaker), Cardiac cycle: Mechanical events, Heart sounds, causes, characteristics and significance, Normal ECG, clinical significance of ECG, Heart rate – Physiological variations, Cardiac output: Definitions, normal values, physiological variations, Arterial blood pressure: Definitions, normal values, physiological variations, factors maintaining blood pressure. Role of baroreceptors in regulation of blood pressure.	**10**	**10**
III	**Respiratory system** Respiratory and Non-respiratory function of respiratory system. Physiological anatomy of respiratory system Functions of respiratory	**8**	**10**

	tract. Respiratory membrane. Respiratory muscles. Surfactant: functions, respiratory distress syndrome. Definitions of terms used in respiratory physiology: Eupnea, Hyperpnoea, Tachypnea, Apnea, Dyspnea. Mechanics of breathing – intrapulmonary and Intrapleural pressure changes during a respiratory cycle. Spirometry – Lung volumes and capacities. Vital capacity. Oxygen transport: Role of hemoglobin, factors affecting, oxygen carrying capacity. Carbon dioxide transport: forms, chloride shift (Hamburgers phenomenon). Respiratory centers. Role of chemo receptors in regulation of respiration. Pulmonary ventilation and alveolar ventilation. Partial pressure of gases, Calculation of partial pressure of gasses in mixture. Arterial and venous blood gas concentrations and contents. Hypoxia: Types and effects Cyanosis, Asphyxia, Periodic Breathing, Acclimatization. Hyperbaric O2 therapy, Artificial respiration and Ventilators.		
IV	**Excretory system** Functions of kidneys. Nephrons – Juxta glomerular apparatus – functions, Steps in Urine formation – Ultrafiltration, Tubular Reabsorption, Tubular Secretion, GFR. Definition, normal values, factors affecting GFR, measurement of GFR, Renal threshold for glucose, tubular load for glucose, Role of aldosterone and ADH in urine formation, Micturition, Innervation of bladder. Diuresis, Renal functions tests – Based on analysis of urine and analysis of blood, Skin: Functions of skin. Sweat glands.	**4**	**05**
V	**Digestive system** Introduction, structure of alimentary canal, Saliva: Composition, functions, Stomach: Functions. Gastric Juice: composition, functions, Pancreatic Juice: Composition and functions, Liver: Functions, Bile: composition, functions, Gall bladder: functions, Succusentericus: Composition, functions. Functions of large intestine, Movements of small intestines, Deglutition.	**4**	**05**
VI	**Endocrine system** Major endocrine glands- Hormone: Definition, Anterior pituitary: hormones and their functions, disorders – Giganitism, acromegaly, dwarfism, Posterior pituitary: Hormones – diabetes insipidus, Thyroid: Hormones, normal values, functions, role of TSH. Disorders: simple goitre, myxoedema,	**8**	**15**

	cretinism, Grave's disease, Adrenal cortex: hormones, functions of cortisol and aldosterone. Addison's disease, Cushing's syndrome, Adrenal medulla: actions of adrenaline and noradrenaline, Endocrine pancreas: Insulin & glucagon, functions, Regulation of blood glucose level, diabetes mellitus, Parathyroid: Functions of PTH. **Nervous system** Synapse: Types, Transmission, Sensory receptors: Definition, Classification Organization of spinal cord, Functions of Dorsal column and Spinothalamic tract, Functions of Corticospinal tract, Reflex Action: Definition, reflex arc, Functions of Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Cerebral cortex: Lobes & functions. EEG – Definition and uses, Autonomic nervous system: Organization & functions, Cerebrospinal fluid: Composition and function.		
VII	**Special senses** Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & inner ear, cochlea, Deafness – types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell **Reproductive system** Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system: Ovarian hormones functions – Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.	**10**	**10**
Total		**54**	**70**

SUGGESTED PRACTICALS/DEMONSTRATION

	SUGGESTED PRACTICALS/DEMONSTRATION	**Hours**
	Study of Microscope and its uses Collection of blood and study of hemocytometer Hemoglobinometry Determination of RBC count Determination of WBC count Determination of blood groups Determination of bleeding time	8

	SUGGESTED PRACTICALS/DEMONSTRATION	Hours
	Determination of clotting time Recording of Arterial Blood Pressure, Clinical examination of Radial pulse Recording of spirogram and determination of vital capacity Artificial respiration, CPR Demonstration of ECG recording	
	Total	8
Demonstration will be part of theory/tutorial classes. There is in separate credit for the practicals/demonstrations.		

SUBJECT: Basics Of Radiation Physics
Subject Code: BMRIT – 003
RATIONALE

Radiation physics is one of the primary pillars underlying the practice of radiology technology and understanding the principles of radiation physics helps BMRIT become better technologist.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Describe general physics related to imaging

CO2: Differentiate between within general

radiation

CO3: Identify construction of radiology equipment's

CO4: Interpret quality of control of radiology equipment's

CO5: Differentiate between x-ray equipment's and other radiology related equipment's

CO6: Describe production of x-rays

CO7: Describe circuit system of radiology equipment's

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	
2	**--**	**6**	**5**	**30**	**70**	**30**	**70**	**200**

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable tutorial assignments of minimum one hour per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	**Basic concepts**: Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron volt-Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence-Fluorescence-electromagnetic spectrum.	5
II	**Electricity and magnetism**: Electric charges, Coulomb's law-Unit of charge-Electric potential, unit of potential-Electric induction, capacitance and Capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR-Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current. **Electromagnetic waves**: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.	6
III	**Electronics** Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers. Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply. Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback-negative feedback in amplifiers.	5
IV	**Discovery of x-rays-X-ray production and properties**: Bremsstrahlung radiations-Characteristics X-Rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets.	5
V	**Heat** Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation in both stationary and rotating X-ray tubes).	4
VI	**Interaction of ionizing radiation with matter**-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation. Interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficient-coherent scattering-photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance.	5

VII	**Exponential attenuation** (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number. Radiation intensity and exposure, photon flux and energy flux density. LET, range of energy relationship for alpha, beta particles with X-Rays. **Physical quantity, its unit and measurement**: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit.	**6**
Total		**36**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		**Hours**
1.	Basic concepts	**108**
2.	Electricity and magnetism, Electromagnetic waves	
3.	Electronics	
4.	Discovery of x-rays-X-ray production and properties	
5.	Heat	
6.	Interaction of ionizing radiation with matter-	
7.	Exponential attenuation, Physical quantity, its unit and measurement	
Total		**108**

SUBJECT: Introduction To Healthcare
Subject Code: BMRIT – 004
RATIONALE

The course provides the students a basic insight into the main features of Indian health care delivery ystem and how it compares with the other systems of the world.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	--	--	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
Introduction to Health: Definition of Health, Determinants of Health, Health indicators of India, Health team concept National Health Policy National Health Programs (Brief objectives and scope) Family welfare programs in India Introduction to Nursing: Nursing and Nursing principles, Interpersonal relationships, Bandaging basic turns, Bandaging extremities, Triangular bandages and their applications Nursing position, bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's position, comfort measures, Aids, rest and sleep Lifting and transporting patients, Transferring patients to wheel chair, transferring from bed to stretcher Bedside Management: Proper usage of bed pan, Observation of stools, urine, sputum. Understand the use and care of catheters. Enema procedures Method of giving nourishment: Feeding, tube feeding, drips, transfusion Monitoring and recording of vitals Simple aseptic techniques, sterilization and disinfection Observation of surgical dressings Concepts of First Aid	**18**

SUBJECT: Medical Terminologies and Record Keeping
Subject Code: BMRIT – 005
RATIONALE

This course introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	**--**	**--**	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency

Topic and contents	Hours
Topics include: origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests. Topics to be covered under the subject are as follows: 1. Derivation of medical terms. 2. Define word roots, prefixes, and suffixes. 3. Conventions for combined morphemes and the formation of plurals. 4. Basic medical terms. 5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots. 6. Interpret basic medical abbreviations/symbols. 7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system. 8. Interpret medical orders/reports. 9. Data entry and management on electronic health record system.	**18**

SUBJECT: Basic Computers and Information Science
Subject Code: BMRIT – 006
RATIONALE

The students will be able to appreciate the role of computer technology. The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	**--**	**--**	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
Topics to be covered under the subject are as follows: 1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. 2. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems). 3. Processor and memory: The Central Processing Unit (CPU), main memory. 4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. 5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.). 6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge. 7. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.	**18**

8. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs. 9. Introduction of Operating System: introduction, operating system concepts, types of operating system. 10. Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network. 11. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet. 12. Application of Computers in clinical settings. Practical on fundamentals of computers - 1. Learning to use MS office: MS word, MS PowerPoint, MS Excel. 2. To install different software. 3. Data entry efficiency	

SUBJECT: Medical Law and Ethics
Subject Code: BMRIT – 007
RATIONALE

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice". Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	**--**	**--**	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
The important and relevant topics that need to focus on are as follows: 1. Medical ethics - Definition - Goal - Scope 2. Introduction to Code of conduct 3. Basic principles of medical ethics – Confidentiality 4. Malpractice and negligence - Rational and irrational drug therapy 5. Autonomy and informed consent - Right of patients 6. Care of the terminally ill- Euthanasia 7. Organ transplantation 8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.	**18**

9. Professional Indemnity insurance policy 10. Development of standardized protocol to avoid near miss or sentinel events 11. Obtaining an informed consent. 12. Medical ethics - Definition - Goal - Scope 13. Introduction to Code of conduct 14. Basic principles of medical ethics – Confidentiality 15. Malpractice and negligence - Rational and irrational drug therapy 16. Autonomy and informed consent - Right of patients 17. Care of the terminally ill- Euthanasia 18. Organ transplantation 19. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects. 20. Professional Indemnity insurance policy 21. Development of standardized protocol to avoid near miss or sentinel events 22. Obtaining an informed consent.	

SUBJECT: Professionalism and Values
Subject Code: BMRIT – 008
RATIONALE

The module on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant is professionalism in terms of healthcare system and how it affects the overall patient environment.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	**--**	**--**	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
1. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality 2. Personal values- ethical or moral values 3. Attitude and behavior- professional behavior, treating people equally 4. Code of conduct, professional accountability and responsibility, misconduct 5. Differences between professions and importance of team efforts 6. Cultural issues in the healthcare environment	**18**

SUBJECT: Principals Of Management
Subject Code: BMRIT – 009
RATIONALE

The course is intended to provide a knowledge about the basic principles of Management.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	**--**	**--**	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
1. Introduction to management 2. Strategic Management 3. Foundations of Planning 4. Planning Tools and Techniques 5. Decision Making, conflict and stress management 6. Managing Change and Innovation 7. Understanding Groups and Teams 8. Leadership 9. Time Management 10. Cost and efficiency	**18**

SUBJECT: English and Communication skills
Subject Code: BMRIT – 010
RATIONALE

Patients need to feel safe enough to communicate honestly and openly with their care providers to receive effective treatments. Providers need to convey treatment plans and health education clearly, accessibly, and empathetically so that patients can receive optimal care.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	**T**	**P**	**C**	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
1	--	--	**1**	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
Language-Basic Content: Review of grammar, Remedial study of grammar, building vocabulary Introduction Parts of speech Exercise on use of grammar Tense, Number, Gender **Assessment methods:** Objective type, Fill in the blanks. Content: Read and comprehend prescribed course books Reading, Summarizing, Comprehension **Assessment methods:** Fill in the blanks and one-mark questions Content: Various Forms of Composition Letter writing Note taking Precise	**18**

writings Diary writing Reports on health problem etc. Official correspondence: Outgoing correspondence, replying incoming correspondence, writing circulars, notices, charge memos, note taking, writing summaries, observation reports. Teaching learning activities: Exercise on writing: Letter writing, resume/CV Essay writing. **Assessment methods**: Applications, short reports to be written. Content: English- Spoken mode, Debates, Telephonic conversion, formal & informal conversation: Agreeing emphasizing, interrupting, politely, opinions, interviews, visual presentation. Teaching learning activities: Participating in seminar, Telephonic conversion, conversation in different situations, practice in public speaking **Assessment methods:** Assessment of the skills based on the checklist. Content: Listening to comprehension media, audio, video, speeches, definition of listening, types of listening, purposes of listening, obstacles for listening, contexts of listening, to be a good listener, listening to a lecture etc. Teaching learning activities: Listening to audio, video tapes and identify the key points. **Assessment methods:** Practical test of listening and filling out the blanks, essay type.	

BMRIT Radiology Clinical Education – part I (studentship)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semesters.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.

SECOND SEMESTER

Subject: Basics of Microbiology

Subject Code: BMRIT – 011

RATIONALE

Basics of Microbiology helps students to gain information about structure, metabolism reproduction, function and diseases caused by bacteria, viruses, bacterial viruses, animal viruses, archaea, mycoplasma and Phytoplasma. It also makes students aware of the nature and other important aspects of the microorganisms.

COURSE OUTCOMES

At the end of the course students will be able to...

CO001: Describe the structure, classification, morphology and growth of bacteria

CO002: Describe the methods sterilization and disinfection and its applications

CO003: Explain the concepts of immunity, hypersensitivity and immunization

CO004: Describe Nosocomial infections and methods for prevention of Hospital acquired infections

CO005: Describe the management of biomedical waste

CO006: List the common fungi and viruses and explain their importance

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	
2	**--**	**--**	**2**	**70**	**30**	**--**	**--**	**100**

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	Morphology of Bacteria: (Structure, size, shape, arrangement cell wall, flagella, spore, capsule, fimbria) Physiology of Bacteria: (Bacterial growth curve, Temp, O2, Co2, micro and macro nutrient growth requirements) Culture Media	**9**

	Culture Methods Antimicrobial sensitivity tests Sterilization and Disinfections: Definition, Dry heat Sterilization, Moist heat Sterilization, Chemical disinfectants, Gaseous disinfection, Test for disinfection / Sterilization control	
II	Infection: Classification, Sources of infection, Modes of transmission Nosocomial infection including biomedical waste management: Definition, Classification, Significance, Prevention and control Biomedical waste management	**8**
III	Immunology: Immunity, Antigen, Antibody, Hypersensitivity	**5**
IV	General Properties of fungi. (General characters, classification, Morphology, Reproduction) General Properties of Viruses. (General character, classification based on Genome, Capsid, Envelope & replication and cultivation of virus).	**7**
V	Applied Microbiology: Pyrexia of unknown origin, Meningitis, Zoonotic infections, Hepatitis, HIV infection and AIDS, Food poisoning, Diarrhea, Urinary tract infections, Pulmonary Tuberculosis	**7**
Total		**36**

SUBJECT: Basics of Biochemistry
Subject Code: BMRIT – 012
RATIONALE

Biochemistry is a key component of all education programmes for MRITs and should have a strong focus on laboratory investigation with radiological procedures. The topics provide the student with an understanding of the blood investigation and relationships of the systems which are essential in patient preparation and procedures.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Understand the responsibility of health care personals and hazards faced in the clinical laboratory **CO2:** Explain the different types, use, care and maintenance of laboratory apparatus and instruments. **CO3:** Understand the fundamental chemistry and knowledge of different solutions

CO4: Understand what acids, bases, salts and indicators are and also know about acid base balance

CO5: Describe the sample collection procedure to analyse various biochemical parameters

CO6: Describe assimilation of nutrients and consequences of malnutrition

CO7: Understand the different functional tests like LFT (Liver function test), RFT (Renal function test)

CO8: Understand the overview of tumor markers, cardiac markers, blood sugar and GTT, lipid profile and diagnostic enzymology

CO9: Describe the applications of radioisotopes

eaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	
2	**--**	**--**	**2**	**30**	**70**	**--**	**--**	**100**

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	**Nutrition** Calorific value Nitrogen Balance Respiratory quotient BMR Nutritional importance of carbohydrate, lipids, proteins, vitamins and minerals Emphasis on parenteral nutrition	9
II	**Acid–Base Balance** Henderson Hassel Bach equation Buffers of the body fluids Ph regulation Disturbance in acid base balance Anion gap Basic principles & estimation of blood gases and ph. **Water & Electrolyte balance** Over view of water and electrolyte balance Basic principles in estimation of Electrolyte Normal values and interpretation	9
III	**Clinical chemistry** **Brief over view of normal values and interpretation of results** Renal function tests Liver function tests Tumor markers Cardiac markers Diagnostic Enzymology Lipid profile	9

	Blood sugar and GTT Normal &Abnormal urine analysis	
IV	Radioisotopes: Definition, Application &Hazards Normal and abnormal urine analysis Clinical charts on LFT, RFT, and diagnostic enzymology	**9**
Total		**36**

SUBJECT: Conventional Radiography and Equipment

Subject Code: BMRIT – 013

RATIONALE

Conventional Radiography and Equipment provide the students' knowledge about the x-ray equipment working and also about how x-rays are produced

COURSE OUTCOMES

At the end of the course students will be able to...

CO001: Describe the structure and working of x-ray tube, production of x-rays

CO002: Describe the types of x-ray tube and heat dissipation methods

CO003: Explain the x-ray generator circuits

CO004: Describe the different circuit types

CO005: Describe the meters and exposure timers

CO006: List the control of scattered radiation

CO007: Describes about the fluoroscopy

CO008: Explains about the care and maintenance of x-ray equipment's

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	
4	**--**	**2**	**5**	**30**	**70**	**--**	**--**	**100**

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable tutorial assignments of minimum one hour per unit based on the curriculum

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	**X-ray tube:** historical aspects, construction of X-ray tubes, requirements for X-ray production(Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes(Coolidge tubes, tube envelop and housing) cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulation and rotating tubes-line focus principle-space charge effect, tube cooling-Modern X-ray tubes-stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality and intensity of x-rays-factors influencing them. **Production of x-rays:** X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart;	**10**
II	**Rotating anode x - ray tube:** construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum. **Grid controlled and high speed tubes**, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation).Interlocking and X-ray tube overload protection. **Heat dissipation methods**, tube rating, heat units, operating conditions and maintenance and Q.A procedures.	**10**
III	**Filament current and voltage**, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits-high frequency generators-falling load generators, Capacitors discharge and grid control systems. **X-ray generator circuits:** Vacuum tube diodes-semi-conductor diodes-transistor-Rectification-half and full wave-self rectification-X-ray generator; filament circuit-kilo Voltage circuit-single phase generator-three phase generator-constant potential generator-Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing.	**10**
IV	**High tension circuits:** H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment;	**10**

	mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation. **Interlocking circuits: Relays:** description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.	
V	**Meters and exposure timers:** Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer.	**10**
VI	**Control of scattered radiation: Beam limiting devices:** cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; Filters- inherent filters, added filters, heavy metal filters, grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.	**8**
VII	**Fluoroscopy:** Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid controlled x-ray tube.	**8**
VIII	**Care and Maintenance of X-ray equipment;** General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.	**6**
Total		**72**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	X-ray tube; Production of x-rays	5
2.	Rotating anode x - ray tube; Grid controlled and high speed tubes; Heat dissipation methods	4
3.	Filament current and voltage; X-ray generator circuits	5
4.	High tension circuits; Interlocking circuits; Relays	5
5.	Meters and exposure timers	5
6.	Control of scattered radiation: Beam limiting devices	4
7.	Fluoroscopy	4
8.	Care and Maintenance of X-ray equipment	4

SUBJECT: Clinical Radiography Positioning (PART I)
Subject Code: BMRIT – 014
RATIONALE

Clinical Radiography Positioning Part- 1 provides the students with knowledge of x-ray imaging, positioning and all the care that should be taken.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Understand the basic patient positioning during radiographic investigation.

CO2: Apply special positioning skills for different pathological and physical conditions.

CO3: Application of equipments while working in radiology departments.

CO4: Choose proper position during radiography.

CO5: Explain relative positions of x-ray tube and patient relevant exposure factors during radiography.

CO6: Explain the use of accessories.

CO7: Explain the anatomic and physiological basis of the procedure to be undertaken.

CO8: Explain the radiographic appearances of both normal and common abnormal conditions.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	
4	**1**	**6**	**8**	**30**	**70**	**30**	**70**	**200**

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable tutorial assignments of minimum one hour per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	**Principles of Radiography:** Preparation of the Room, Apparatus and Instruments Positions of the Patient: Erect, Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc. Relative position of X-Ray tube and patient, relevant exposure factors. Use of accessories such as radiographic cones, grid and positioning aids. Anatomic and Physiological basis	**8**

	of the procedure, Association with theory with practical work. Radiographic appearances, both normal and common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and types of subject. Radiation protection, use of gonad shield, practical methods of reducing radiation dose to the patient.	
II	**Upper limb:** Routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus. Supplementary projections for Scaphoid, Carpal tunnel, Ball Catchers projections, Head of the Radius, Supracondylar fracture and Olecranon process	**10**
III	**Lower limb:** Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, knee-joint, patella and femurs. Supplementary projections for Talo-Calcaneal joint, Forced projections for torn ligaments, Flat Feet, Club Feet, Intercondylar projections for loose bodies in the knee, Axial projection for Patella.	**10**
IV	**Shoulder Girdle and Thorax:** Routine projections for the shoulder joint, Scapula, Acromio-Clavicular joint, Clavicle, Sternoclavicular joint, Sternum and Ribs. Supplementary projections for the axial projection of Clavicle, Bicipital groove, Coracoid process.	**10**
V	**Vertebral Column:** Routine projections for Atlanto -Occipital joint, cervical spine, Cervico- thoracic Junction, thoracic Spine, lumbar Spine, Lumbo Sacral Region, Sacrum and Coccyx. Supplementary projections for the intervertebral foramina, posterior arch of Atlas, Flexion and Extension of Cervical Spine, Scoleosis and Kyphosis, Sacro Ileac Joint.	**12**
VI	**Skull:** Routine projections for cranium and facial bones; Supplementary projections for trauma, Towne's method, Sellaturcica, Optic foramina, Jugular foramina, Temporal bones, Mastoids, Petrous bone, Zygomatic arches, Orbits, Maxillae, Nasal bones, Mandible, Temporomandibular joints. Nasal Sinuses: Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, erect and horizontal projections for fluid levels.	**12**
VII	**Pelvic girdle and hip region:** Routine projections for the whole pelvis, Sacro-Ileac joints, hip joint and Neck of Femur.	**10**

	Supplementary projections for the greater and lesser trochanters of Femur. Frog leg projection, Ischeum, Symphysis Pubis, Ileum, Acetabulum and Congenital Dislocation of Hip, Arthrodesis. **Skeletal survey:** Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.	
Total		**72**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		**Hours**
1.	Principles of Radiography	15
2.	Upper limb	17
3.	Lower limb	17
4.	Shoulder Girdle and Thorax	14
5.	Vertebral Column	15
6.	Skull	15
7.	Pelvic girdle and hip region, Skeletal survey	15
	Total	**108**

BMRIT Radiology Clinical Education – part II (studentship)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semester.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship