BACHELOR OF SCIENCE

IN

MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY

(BMRIT)

REGIONAL INSTITUTE OF PARAMEDICAL AND NURSING SCIENCES

under Mizoram University

Rules and Regulations for Four Year Degree Course of
B.Sc. Medical Radiology and Imaging Technology
(BMRIT)

Based on

Ministry of Health and Family Welfare, Govt. of IndiaAllied Health Section 2015-16

Model Curriculum Handbook
MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY

CONTENTS

Introduction:

Learning Objectives:

The Aim of B.Sc. in Medical Radiology and Imaging Technology program is to provide highest and Atomic Energy Regulatory Board (AERB) accredited educational process through formal didactic and state-of-the-art clinical experiences that will render qualified, patient focused, compassionate, critical thinkers Medical Radiology and Imaging Technologist for the community who are engaged in lifelong learning. The graduates of the program are prepared to apply for the Level I Radiation Safety Officer (RSO) as per AERB norms.

The objectives of the program are to:

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

Expectation from the future graduate in the providing patient care.

1. Should be able to undertake Mammography, CT scan and MRI procedures independently.
2. Assist in specialized radiological procedures.
3. Able to do the image processing.
4. Should be able to handle all radiological and imaging equipment independently.
5. Should ensure radiation protection and quality assurance
6. Undertake care and maintenance of all radiological and imaging equipment
7. Able to evaluate images for technical quality
8. Able to identify and manage emergency situations.
9. Able to receive and document verbal, written and electronic orders in the patient's medical record.
10. Should have computer skills.
11. Should be able to provide empathetic professional patient care.
12. Able to demonstrate professional growth, sense of professionalism and desire to learn
13. Able to demonstrate the core values of caring, integrity and discovery.
14. To exhibit keen interest, initiative & drive in the overall development of the Department and 'Leadership Qualities' for others to follow
15. He / She is expected to be confident and to perform all the duties diligently with utmost sincerity and honesty.
16. Any other duty/task/work assigned by any higher authority like Director, Dean, Medical Superintendent, Head of the Department from time to time; either in "Public Interest" or in the interest of upkeep / development of the Department / Institutions.

Short Title Commencement

The regulation shall be called the Regulation for Continuous Assessment and Grade Point (CAGP) B.Sc. Medical Radiology and Imaging Technology (BMRIT) Course of the Mizoram University, Aizawl Mizoram.

This shall come into force from the Academic Year July, 2023

Definition

1. **Semester**- Each semester duration is 6 months
2. **Total Semester**- Total semester will be eight (8)
3. **Duration** – Six (6) Semesters and 1 year Internship (VII & VIII Semesters of Hospital/Institutional posting/Internship)
4. **Continuous Assessment** – Theory and Practical examination conducted by the Department concerned including overall assessment of the conduct of the individual student recorded by the Department.
5. **Semester Examination** – Examination conducted by the Department/University after 6months for the first six (6) semesters and continuous evaluation without end semester examination for VII and VIII semesters as part of Internship Program.

The regulation framed is subject to modification/amendment /addition and deletion from time to time by BUGS/Academic Council of Mizoram University.

1. Academic Programme

- Bachelor of Science in Medical Radiology and Imaging Technology shall be a full-time course
- During an academic year (Semester), a candidate shall be enrolled only for one programme of studies and shall not appear in any other examination of this or any other university.

2. Duration of the Course

Duration of the course: 4 years or 8 semesters. (1350 hours of Theory & 900 hours of Practical) and 2560 hours of Internship

Total hours – 4810 hours

3. Medium of Instruction:

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

4. 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 pass marks in Physics, Chemistry, Biology.
   OR
   Diploma in Medical Radiology and Imaging Technology after completing 12^{th} class/ 10+2 of CBSE or equivalent with minimum aggregate of 50% marks in Physics, Chemistry and Biology provided the candidate has passed in each subject separately.
2. Candidates who have studied abroad and have passed the equivalent qualification as determined by the Association of Indian Universities 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.

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.
    a) English, Physics, Chemistry, Botany, Zoology
    b) English, Physics, Chemistry, Biology and any other language
4. He/she has attained the age of 17 years as on - (current year) & maximum age limit is 30 years.
5. He/she has to 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 B.Sc. Medical Radiology and Imaging Technology course shall be made on the basis of eligibility and an entrance test to be conducted for the purpose. No candidate will be admitted on any ground unless he/she has appeared in the admission test and interview.
    a) Entrance test, to be conducted by the university as per the syllabus under 10 +2 scheme of CBSE/State Board subject-wise distribution of questions will be as 30% in Physics, 30% in biology, 30% in Chemistry, 5% in English (Language & Comprehension) and 5% in General Awareness about health-related methods.
    b) Successful candidates on the basis of written Test will be called for the interview & shall have face an interview board. The interview board will include the Head of the Department of medical imaging (Chairman of the Board) along with the principal / chief faculty as well as Chief of MRIT apart from other nominees, whose recommendations shall be final for the selection of the students.
    c) During subsequent counseling (s) the seat will be allotted as per the merit of the candidate depending on the availability of seats on that particular day.
    d) Candidate who fails to attend the Medical Examination on the notified date(s) will forfeit the claim for admission and placement in the waiting list except permitted by the competent authority under special circumstances.
    e) The name of the student(s) who remain(s) absent from classes for more than 15 days at a stretch after joining the said course will be struck off from the college rolls without giving any notice

5. Provision of Lateral Entry:

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.

6. Intake Capacity: 40

7. Commencement of the Course: 1st July of each academic year

8. Commencement of Examination: Date of examination will be fixed by the University after due consultation with the concerned Head of Institution.

9. Working Days: Each semester shall consist of 6 months

10. Teaching Days: There will be at least 70 teaching days.

11. Eligibility for appearing in the Semester examination:

Attendance:

A candidate has to secure minimum 75% attendance in overall with at least-

a) 75% attendance in theoretical
b) 75% in practical for qualifying to appear for the final examination.

No relaxation, whatsoever, will be permissible to this rule under any ground including indisposition etc.

12. Assessment:

Assessments should be completed by the academic staff, based on the compilation of the student's theoretical & clinical performances throughout the training programme. To achieve this, all assessment forms and feedback should be included and evaluated. Student must attain at least 50% marks in each Theory, Internal assessment and Practical independently/separately for each individual subject. Students failed to attain 50% marks in internal assessment will have one time re-appearance chance before starting the internship.

13. Examination: There shall be Semester system of examination for evaluation of the students.

i. The Semester Examinations will be conducted by the University as per the existing/standing rules of the University. Any student who fails in any subject will repeat the examination along with the next semester exams in the particular subject where the student has failed.
ii. Non-appearance in regular semester examination shall be treated as losing the first chance.
iii. The duration of Semester Examination in theory papers and practical will be as specified and depending on number of credit hours.
iv. Maximum number of chances permitted for each paper is 4 including the first chance.
v. The maximum period to complete the course will be 8 years.
vi. A student shall not be declared to have passed the examination unless he/she secures at least 50% marks in each paper. (Internal assessment and End semester exam separately)
vii. Mode of Improvement/Re-evaluation will be as per existing MZU (Mizoram University) guidelines.

14. External Examiners

External Examiners as and when necessary are to be appointed by the Mizoram University from the panel of external examiners approved by the relevant academic bodies.

15. Internal Examiners

The University shall appoint the Internal Examiners subject wise from the Institute in consultationwith Head of Department/ Head of Institute

16. (a) Date of Examination:

Semester Examination date will be notified by the University in consultation with Head of the Institute/HOD.

(b) Question Papers:

- Theory Papers: Each theory paper in semester examination will be set by examiners chosen from an approved panel by the concerned department of the institute as per guidelines
- The marks for internal assessment will be awarded by the concerned department of the institute as per guidelines
- Practical Papers: Practical exams will be conducted by external examiners and internal examiners as appointed by Mizoram University from approved panel and marks awarded as per guidelines.

17. Promotion to next higher class

- Any candidate securing 50% marks aggregate in each paper of a semester examination will be declared pass and grade will be allotted.
- No grade will be allotted in the event of a student securing less than 50% marks aggregate in any paper.
- Any candidate failing in any paper will be entitled to sit in the failed paper as a non-regular student
- They will continue to attend classes with their regular batch for all the semesters including internship
- Degree certificate will be awarded only after successfully clearing all papers.
- Maximum chance in any paper is 4 (one regular + three additional)
- Maximum time to clear all papers is 8 years
- In the event of any student not clearing any paper in maximum 4 chances or in the event of any student not clearing all papers within the stipulated time of 8 years, will have to leave the course uncompleted and no degree certificate will be awarded

18. Grading of performances

a) Based on the performance of the student in each semester, the grade shall be awarded on a 10-point scale as per CGPA system:

Marks range (Out of 100)	**Grade**	**Grade Points performance**	**Description**
91-100	O	10	Outstanding
81-90	A+	9	Excellent
71-80	A	8	Very Good
61-70	B+	7	Good
50-60	B	6	Average
<50	**-**	**Not to be considered for awarding Grade**	

The minimum pass marks in each paper for Theory and Practical shall be 50% and securing aggregate of 50% for each paper (Continuous Assessment and External) in a Semester Examination.

b) Based on the performance of the students, Division shall be awarded as per the CGPA acquired for both semester and the entire programme.

CGPA	**Division**
8.1-10	Distinction
7.0-8.0	1st
6.0-6.9	2nd
Below 6	Fail

- At the end of each semester examinations, a student shall be awarded a Semester Grade Point Average which will be calculated as:

$$\text{SGPA} = \frac{\text{Total Credit Points per semester}}{\text{Total Credits per Semester}}$$

- At the end of the entire programme, a student shall be awarded a Cumulative Grade Point Average which will be calculated as:

$$\text{CGPA} = \frac{\text{Sum of total credit points for the programme}}{\text{Sum of total credit for the entire programme}}$$

- Conversion formula of CGPA to percentage of marks:

  Percentage of marks = (CGPA x 10) - 5, if CGPA < 9
  Percentage of marks = (CGPA x 15) - 50, if CGPA ≥ 9

c) Award of Rank:
Rank will be awarded as per Mizoram University rules.
Students who failed to complete internship within one year after publication of 6th semester result will not be considered for awarding rank.

d) A candidate securing 8 and above Grade Point in any papers (Theory & Practical separately) will be awarded 'Honor's in that paper or papers as per Mizoram University rule. This is applicable only to students that appear on regular exam (1st chance) / re-evaluated regular exam (1st chance).

19. Registration: A candidate admitted to the course shall register with the Mizoram University by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to the University through Head of Institute within the stipulated time.

20. Practical Training / Internship:
A practical training of 1 year counted as semesters VII and VIII in a designated institution or hospital will be compulsory as an internship.

One project work/dissertation - submitted to the department within the last month of internship will be counted as Continuous assessment carrying 100marks for VII and VIII semesters(combined).

Completion of Internship: Students before obtaining certificate and mark sheets should obtain satisfactory certificate of completion of Internship from the Head of Department of the Institute/Hospital. Grade points will be awarded for Semesters VII and VIII without any separate end semester examination.

21. Re-evaluation of Answer papers: Re-evaluation of answer papers will be as per rules and regulation of Mizoram University.

22. Admission Procedure: As envisaged in the constitution of RIPANS, admission will be on the basis of nomination from the respective North Eastern states as per the quota allotted to each of them viz. – Arunachal Pradesh, Assam, Nagaland, Manipur, Meghalaya, Mizoram, Tripura and Sikkim.

In case of any vacancy remaining, they can be subsequently filled up by students from the North Eastern region on pro-rata basis.

23. Notwithstanding above, Vice Chancellor, Mizoram University, is empowered to solve any problem under statutory removal of difficulties.

SEMESTER WISE DISTRIBUTION OF SUBJECTS AND MARKS

I Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/001T	Healthcare Delivery System in India	25	75	100	2	1	-	**3**
BMRIT/002T	IT and Communication Skills	25	75	100	2	1	-	**3**
BMRIT/003T	Medical Terminology, Record Keeping and Medical Law & Ethics	25	75	100	2	1	-	**3**
BMRIT/004T	Patient Safety and Quality	25	75	100	2	1	-	**3**
BMRIT/005T	Principles of Management, Research Methodology and Biostatistics	25	75	100	2	1	-	**3**
BMRIT/001P	Healthcare Delivery System in India	25	75	100	-	-	1	**1**
BMRIT/002P	IT and Communication Skills	25	75	100	-	-	1	**1**
BMRIT/003P	Medical Terminology, Record Keeping and Medical Law & Ethics	25	75	100	-	-	1	**1**
BMRIT/004P	Patient Safety and Quality	25	75	100	-	-	1	**1**
BMRIT/005P	Principles of Management, Research Methodology and Biostatistics	25	75	100	-	-	1	**1**
	Total marks	**250**	**750**	**1000**	**Total Credit**			**20**

II Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/006T	Human Anatomy	25	75	100	2	1	-	**3**
BMRIT/007T	Physiology and Pathology	25	75	100	2	1	-	**3**
BMRIT/008T	Radiological Physics	25	75	100	2	1	-	**3**
BMRIT/009T	Radiographic and Image Processing Techniques	25	75	100	2	1	-	**3**
BMRIT/010T	Environmental Studies	25	75	100	2	1	-	**3**
BMRIT/006P	Human Anatomy	25	75	100	-	-	1	**1**
BMRIT/007P	Physiology and Pathology	25	75	100	-	-	1	**1**
BMRIT/008P	Radiological Physics	25	75	100	-	-	1	**1**
BMRIT/009P	Radiographic and Image Processing Techniques	25	75	100	-	-	1	**1**
BMRIT/010P	Environmental Studies	25	75	100	-	-	1	**1**
	Total marks	**250**	**750**	**1000**	**Total Credit**			**20**

III Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/011T	Clinical Radiography Positioning I	25	75	100	2	1	-	**3**
BMRIT/012T	Modern Radiological and Imaging Equipment	25	75	100	2	1	-	**3**
BMRIT/013T	Contrast and Special Radiography Procedures	25	75	100	2	1	-	**3**
BMRIT/014T	Quality Control in Radiology and Radiation Safety	25	75	100	2	1	-	**3**
BMRIT/015T	Regulatory Requirements and Quality Assurance	25	75	100	2	1	-	**3**
BMRIT/011P	Clinical Radiography Positioning I	25	75	100	-	-	1	**1**
BMRIT/012P	Modern Radiological and Imaging Equipment	25	75	100	-	-	1	**1**
BMRIT/013P	Contrast and Special Radiography Procedures	25	75	100	-	-	1	**1**
BMRIT/014P	Quality Control in Radiology and Radiation Safety	25	75	100	-	-	1	**1**
BMRIT/015P	Regulatory Requirements and Quality Assurance	25	75	100	-	-	1	**1**
Total marks		**250**	**750**	**1000**	**Total Credit**			**20**

IV Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/016T	Cross Sectional Anatomy I	25	75	100	2	1	-	**3**
BMRIT/017T	Physics of Newer Imaging Modalities	25	75	100	2	1	-	**3**
BMRIT/018T	Clinical Radiography Positioning II	25	75	100	2	1	-	**3**
BMRIT/019T	Radiographic Techniques of USG and Mammography	25	75	100	2	1	-	**3**
BMRIT/020T	Clinical Imaging of Chest and Abdomen	25	75	100	2	1	-	**3**
BMRIT/016P	Cross Sectional Anatomy I	25	75	100	-	-	1	**1**
BMRIT/017P	Physics of Newer Imaging Modalities	25	75	100	-	-	1	**1**
BMRIT/018P	Clinical Radiography Positioning II	25	75	100	-	-	1	**1**
BMRIT/019P	Radiographic Techniques of USG and Mammography	25	75	100	-	-	1	**1**
BMRIT/020P	Clinical Imaging of Chest and Abdomen	25	75	100	-	-	1	**1**
Total marks		**250**	**750**	**1000**	**Total Credit**			**20**

V Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/021T	Cross Sectional Anatomy II	25	75	100	2	1	-	**3**
BMRIT/022T	Radiographic Techniques of CT- I	25	75	100	2	1	-	**3**
BMRIT/023T	Radiographic Techniques ofMRI- I	25	75	100	2	1	-	**3**
BMRIT/024T	Clinical Cardiac Radiology	25	75	100	2	1	-	**3**
BMRIT/025T	Clinical Neuro-Imaging	25	75	100	2	1	-	**3**
BMRIT/021P	Cross Sectional Anatomy II	25	75	100	-	-	1	**1**
BMRIT/022P	Radiographic Techniques of CT- I	25	75	100	-	-	1	**1**
BMRIT/023P	Radiographic Techniques ofMRI- I	25	75	100	-	-	1	**1**
BMRIT/024P	Clinical Cardiac Radiology	25	75	100	-	-	1	**1**
BMRIT/025P	Clinical Neuro-Imaging	25	75	100	-	-	1	**1**
	Total marks	**250**	**750**	**1000**	**Total Credit**			**20**

VI Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/026T	Hospital Practice and Care of Patients	25	75	100	2	1	-	**3**
BMRIT/027T	Radiographic Techniques of CT- II	25	75	100	2	1	-	**3**
BMRIT/028T	Radiographic Techniques ofMRI- II	25	75	100	2	1	-	**3**
BMRIT/029T	InterventionalRadiology	25	75	100	2	1	-	**3**
BMRIT/030T	Molecular Advanced Imaging	25	75	100	2	1	-	**3**
BMRIT/026P	Hospital Practice and Care of Patients	25	75	100	-	-	1	**1**
BMRIT/027P	Radiographic Techniques of CT- II	25	75	100	-	-	1	**1**
BMRIT/028P	Radiographic Techniques ofMRI- II	25	75	100	-	-	1	**1**
BMRIT/029P	InterventionalRadiology	25	75	100	-	-	1	**1**
BMRIT/030P	Molecular Advanced Imaging	25	75	100	-	-	1	**1**
	Total marks	**250**	**750**	**1000**	**Total Credit**			**20**

VII & VIII Semester

Course No.	Subject	Mark Scale			Credit Distribution			Credit
		C/A	*End Sem.*	*Total*	*L*	*T*	*P*	
BMRIT/031P	BMRIT Internship	100	-	100	-	-	40	**40**
	Total marks	100	-	100	**Total Credit**			**40**

Overall Marks and Credit points:

Semester	Marks	Credit Points
I	1000	20
II	1000	20
III	1000	20
IV	1000	20
V	1000	20
VI	1000	20
VII & VIII	100	40
Total	**6100**	**160**

Academic Calendar:

Semester I - July to December
Semester II - January to June
Semester III - July to December
Semester IV - January to June
Semester V - July to December
Semester VI - January to June
Semester VII & VIII - July to June

Internal Evaluation

- Semester I, III and V
  C1-August
  C2-October
  End Semester – November/December
- Semester II, IV and VI
  C1-February
  C2-April
  End Semester – May/June

I SEMESTER

Course No : BMRIT/001T
Course Title : Healthcare Delivery System in India
Credit : 3 (2-1-0)

Course Outline:

Unit I	Introduction to healthcare delivery system: Healthcare delivery system in India at primary, secondary and tertiary care, Community participation in healthcare delivery system, Health system in developed countries, Private Sector, National Health Mission, National Health Policy, Issues in Health Care Delivery System in India
Unit II	National Health Programmes- Background objectives, action plan, targets, operations, achievements and constraints in various National Heath Programmes, Health scenario of India- past, present and future
Unit III	Introduction to AYUSH system of medicine: Introduction to Ayurveda, Yoga and Naturopathy, Unani, Siddha, Homeopathy, Need for integration of various system of medicine
Unit IV	Demography & Vital Statistics: Demography – its concept, Vital events of life & its impact on demography, Significance and recording of vital statistics, Census & its impact on health policy
Unit V	Epidemiology: Principles of Epidemiology, Natural History of disease, Methods of Epidemiological studies, Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Course No : BMRIT/001P
Course Title : Healthcare Delivery System in India
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribes to cover all theoretical aspects.

1. Community orientation and clinical visit
2. Presentation on related topics

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

I SEMESTER

Course No : BMRIT/002T
Course Title : IT and Communication Skills
Credit : 3 (2-1-0)

Course Outline:

Unit I	Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. 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).
Unit II	Processor and memory: The Central Processing Unit (CPU), main memory Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. 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.).
Unit III	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. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
Unit IV	Introduction of Operating System: introduction, operating system concepts, types of operating system. Computer networks: introduction, types of networks (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network. 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. Application of Computers in clinical settings.
Unit V	Basic Language Skills: Grammar and Usage. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation. Teaching the different methods of writing like letters, E-mails, report, case study, Collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization. Basic concepts & principles of good communication Special characteristics of health communication. Types & process of communication Barriers of communication & how to overcome

Course No : BMRIT/002P
Course Title : IT and Communication Skills
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects:

1. MS-office, Cloud Computing, data entry efficiency, etc.
2. Group Discussion Demonstration of communication skills including verbal and non-verbal

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

I SEMESTER

Course No : BMRIT/003T
Course Title : Medical Terminology, Record Keeping and Medical Law & Ethics
Credit : 3 (2-1-0)

Course Outline:

Unit I	Derivation of medical terms. Define word roots, prefixes, and suffixes Conventions for combined morphemes and the formation of plurals
Unit II	Basic medical terms. Form medical terms utilizing roots, suffixes, prefixes, and combining roots. Interpret basic medical abbreviations/symbols.
Unit III	Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system. Interpret medical orders/reports Data entry and management on electronic health record system
Unit IV	Medical ethics - Definition - Goal – Scope Introduction to Code of conduct. Basic principles of medical ethics – Confidentiality Malpractice and negligence - Rational and irrational drug therapy Autonomy and informed consent - Right of patients Care of the terminally ill- Euthanasia. Organ transplantation
Unit V	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. Professional Indemnity insurance policy Development of standardized protocol to avoid near miss or sentinel events. Obtaining an informed consent

Course No : BMRIT/003P
Course Title : Medical Terminology, Record Keeping and Medical Law & Ethics
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration of record maintenance and history taking.
2. Interpretation of medical abbreviations/symbols.
3. Interpret medical orders/reports

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

I SEMESTER

Course No : BMRIT/004T
Course Title : Patient Safety and Quality
Credit : 3 (2-1-0)

Course Outline:

Unit I	Quality assurance and management - Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Quality Improvement Tools, Introduction to NABH guidelines Basics of emergency care and life support skills - Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods, One- and Two-rescuer CPR, Using an AED (Automated external defibrillator).Managing an emergency including moving a patient
Unit II	Disaster preparedness and management- Fundamentals of emergency management, Psychological impact management, Resource management, Preparedness and risk reduction, Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management,
Unit III	Bio medical waste management and environment safety- Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste, BMW Management & methods of disinfection, Modern technology for handling BMW, Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection (Protective devices)
Unit IV	Infection prevention and control - Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE), Prevention & control of common healthcare associated infections,, Components of an effective infection control program, and Guidelines (NABH and JCI) for Hospital Infection Control
Unit V	Antibiotic Resistance-History of Antibiotics, How Resistance Happens and Spreads, Types of resistance- Intrinsic, Acquired, Passive, Trends in Drug Resistance, Actions to Fight Resistance, Bacterial persistence, Antibiotic sensitivity, Consequences of antibiotic resistance, Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals

Course No : BMRIT/004P
Course Title : Patient Safety and Quality
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visits to hospital/radiology department to understand and observing the work flow in radiology departments.
2. Demonstration of principles of first aid and management of emergencies in radiology
3. Demonstration and observation of maintenance of cleanliness, hygiene and principles of asepsis

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

I SEMESTER

Course No : BMRIT/005T
Course Title : Principles of Management, Research Methodology and Biostatistics
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to management Strategic Management Foundations of Planning Planning Tools and Techniques
Unit II	Decision Making, conflict and stress management Managing Change and Innovation Understanding Groups and Teams
Unit III	Leadership Time Management Cost and efficiency
Unit IV	Introduction to research methods. Identifying research problem. Ethical issues in research Research design. Basic Concepts of Biostatistics. Types of Data Research tools and Data collection methods. Sampling methods Developing a research proposal
Unit V	Accessing research literature: Use of databases and other sources Understanding research design: Qualitative and quantitative methodologies - their differences and potential integration. Evaluating research and its potential for informing practice. Developing research questions and devising methods for their investigation. Ethical issues in research Analysis: Analysis of qualitative and quantitative data. Utilization of appropriate software to assist in the retrieval of information and data analysis Clinical audit: Distinctiveness of research and audit processes and their function Research Skills and Management: The role of evidence-based practice within health and welfare

Course No : BMRIT/005P
Course Title : Principles of Management, Research Methodology and Biostatistics
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects.

1. Identifying research problems
2. Understanding the basic concepts of biostatistics
3. Developing a research proposal

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

II SEMESTER

Course No : BMRIT/006T
Course Title : Human Anatomy
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction of human body, cells and tissue, anatomical positions, terms and description Basic embryology and development Musculo-skeletal system of body- structure of bones, vertebral column, joints, types of joints, trunk, muscles, types of muscles. Upper and lower limbs – structure, blood supply, nerve supply, venous drainage, lymphatic etc.
Unit II	Cardiovascular system including the heart and circulatory system, major blood vessels, arteries, veins, capillaries, lymphatics Respiratory system including the lungs, trachea, bronchus, Broncho-pulmonary segments, alveoli, arterial supple, venous drainage, lymphatics, capillaries.
Unit III	Central Nervous System including the brain, spinal cord, central and peripheral nervous systems, autonomic nervous system, brachial plexus, sacral plexus, cranial nerves. Head and neck including the skull, ears, middle ear cavity, temporal bone, para nasal sinuses, pharynx, larynx, oral cavity, face, tongue, nasal cavity, eyes and other sensory organs
Unit IV	Gastro-intestinal tract including the esophagus, stomach, small intestine, large intestine, cecum, appendix, anal canal. Hepato-biliary system including the Liver, Gall bladder, biliary tree, pancreas, spleen, canaliculi
Unit V	Genito-Urinary, excretory system including kidneys, ureters, urinary bladder, urethra, prostate. Male and female reproductive system including the testes, seminal vesicles, uterus, cervix, fallopian tubes, ovaries. Endocrinal system including the pituitary, thyroid, hormones etc.

Course No : BMRIT/006P
Course Title : Human Anatomy
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects.

1. Identification of bones, joints, anatomical position
2. Identification of GI tract, respiratory system, cardio-vascular system and human reproductive systems
3. Identification of anatomical landmarks

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

II SEMESTER

Course No : BMRIT/007T
Course Title : Physiology and Pathology
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction, functional organization of body structures, musculo-skeletal system Blood cells, plasma, blood groups, lymphatics etc. Physiology of cardiovascular system including heart and circulation, blood pressure, arteries, veins
Unit II	Physiology of respiration including lungs, trachea, larynx, bronchus, Broncho-pulmonary segments. Physiology of the excretory system including formation and excretion of urine, reabsorption of water, functional unit of kidneys, process of micturition. Male and female reproductive system.
Unit III	Physiology of the hepato-biliary system including production and circulation of bile, storage of bile, portal circulation. Physiology of the Gastro-intestinal tract including stomach, digestive system, enzymes including pancreatic enzymes excretory function of colon, water reabsorption. Function of the nervous system including sensory and motor nervous system, neuron, peripheral nerves, autonomic nervous system, brain, production and circulation of CSF
Unit IV	Basic Pathology – introduction to pathological condition, cellular structure, metabolism, pathogenesis of disease Inflammation – definition, types, degeneration, cell death, granulomatous inflammation etc. Regeneration and healing process.
Unit V	Tumors, definition, benign, malignant, tumors affecting various systems – neoplasia. Hypersensitivity, infection, infestation Hemodynamic disorders, hemorrhage, ischemia, infection.

Course No : BMRIT /007P
Course Title : Physiology and Pathology
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects.

1. Demonstration by models of human body and functions
2. Recording of blood pressure, pulse, respiration and bowel sound
3. Identifying basic pathological processes
4. Demonstration by model of common tumours of the human body.

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

II SEMESTER

Course No : BMRIT/008T
Course Title : Radiological Physics
Credit : 3 (2-1-0)

Course Outline

Unit I	Units and measurements-Force, work, power and energy-Temperature and heat Electricity and magnetism, Electromagnetic waves, Sound, Heat, Semiconductors, Semiconductor diodes, Transistors, High tension Circuits
Unit II	X-rays: 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 Control of scattered radiation Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure.
Unit III	Interaction of ionizing radiation with matter- 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. X-ray tube: historical aspects, construction of X-ray tubes, requirements for X-ray production, tube voltage, current, space charge, cathode assembly, X-ray production efficiency, advances in X-ray tubes, heel effect, off focus radiation, tube insert and housing -Quality and intensity of x-rays-factors influencing them. Interlocking and X-ray tube overload protection. Heat dissipation methods, tube rating, heat units, operating conditions and maintenance.
Unit IV	Filament current and voltage, X-ray 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.
Unit V	Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit, Radiation detection and measurements: Principle of radiation detection-Basic principles of Gas filled detectors (ionization chambers, proportional counters, and G.M counters) and scintillation detectors. Measuring system: free ionization chamber-thimble ion chamber-condenser chamber-secondary standard dosimeter-film dosimeter-chemical dosimeter-Thermo Luminescent Dosimeter-Pocket dosimeter

Course No : BMRIT/008P
Course Title : Radiological Physics
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration of x-ray tube
2. Study of kv and mAs in Radiography
3. Demonstrate use of grids, improving radiographic contrast.

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

II SEMESTER

Course No : BMRIT/009T
Course Title : Radiographic and Image Processing Techniques
Credit : 3 (2-1-0)

Course Outline

Unit I	Radiographic Film Construction, Types, Handling of exposed and unexposed films. Types, applications, advantages/limitations of different types, safe light requirements. Sensitometer: Photographic density-characteristic curve-information from the characteristic curve-speed Vs definition. Storage of X-ray film.
Unit II	Intensifying screens: Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor-speed and detail-crossover effect-resolution-mottle-reciprocity-screen asymmetry-cleaning. New phosphor technology-influence of kilo voltage. Photo-stimulable phosphor Imaging. Cassettes: Structure and function-Types-single, gridded, film holder-Design features and consideration with loading/unloading-Care and maintenance (cleaning). Photochemistry Processing: manual processing -automatic processor Automatic Film Processor
Unit III	Radiographic image-components of image quality-unsharpness in radiographic image-contrast of the radiographic image-distinctness of the radiographic image-size, shape and spatial relationships. Factors affecting Image Quality: Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Radiographic illuminators and viewing conditions, visual acuity and resolution.
Unit IV	Presentation of radiographs-opaque letters and markers-Identification of dental films-preparation of stereo radiographs-viewing conditions. Monitor Images-Characteristics of the video image-television camera-imaging camera. Laser-light and laser-laser imaging-laser imagers-imaging plates-Dry cameras. Processing room: location of the dark room-dark room illumination-equipment and layout-X-ray viewing room-Day light processing-Daylight handling-daylight systems with cassettes-without cassettes.
Unit V	Dark Room: The processing area, Dark room design, construction, illumination, entrance safe lighting-types, Room storage, shelving of films, Cleaning and maintenance. Dark Room Planning: For A Small Hospital, for A Large Hospital Location of Dark Room and construction of Dark Room, Dry Bench, Loading and Unloading Cassettes. Hangers, Wet Bench Cleanliness, Control of Dust, Dark Room Sink Hatches and Drier, Safe Lights, Direct and Indirect, Uses, Factors Affecting Safelight Performance, Safelight Tests. Viewing Room, Film Dispensing

Course No : BMRIT/009P
Course Title : Radiographic and Image Processing Techniques
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration of working of intensifying screen, latent image formation
2. Identification of parts of x-ray machine
3. Visit to darkroom and room layout
4. Film handling and storage
5. Preparation of developer, fixer and replenisher solution
6. Care of cassettes
7. Artefacts in radiography and prevention

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

II SEMESTER

Course No : BMRIT/010T
Course Title : Environmental Studies
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to Environmental studies: Multidisciplinary nature, scope & importance, Ecosystems- structure & function; Energy flow; food chain; food webs & ecological succession. Case study of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem
Unit II	Natural Resources: Renewable & Non- renewable Resources Land resources & land use change, Land degradation, soil erosion & desertification. Deforestation: Causes & impacts due to mining, dam building on environment, forests, biodiversity & tribal populations Water: Use & over exploitation of surface & ground water, floods, droughts, conflicts over water (international & inter- state) Energy resources: Renewable & non-renewable, use of alternate energy sources, growing energy needs
Unit III	Biodiversity & Conservation Levels of biological diversity: genetic, species & ecosystem diversity; bio-geographic zones of India; biodiversity patterns and global biodiversity hotspots. India as a mega- diversity nation; endangered & endemic species of India Threats to biodiversity: Habitat loss, poaching of wildlife, man- wildlife conflicts, biological invasions; Conservation of biodiversity: in-situ & ex-situ Ecosystem & biodiversity services: ecological, economic, social, ethical, aesthetic & informational value
Unit IV	Environmental pollution Types, causes, effects & controls; Air, water, soil & noise pollution Nuclear hazards & nuclear health risks Solid waste management: control measures of urban & industrial waste
Unit V	Environmental Policies & Practices, Sustainable & sustainable development, Climate change, global warming, ozone layer depletion, acid rain & impacts on human communities and agriculture, greenhouse effect, Environmental Laws: Environment Protection Act, Air (Prevention & Control of Pollution) Act; Water (Prevention & Controlof Pollution) Act; Wildlife Protection Act, Forest Conservation Act Human communities & the environment, Human population growth: impact on environment, human health & welfare, Environmental movements: Chipko movement, Silent Valley, Bishnois of Rajasthan, Environmental communication and publicawareness, case studies (e.g. CNG vehicles in Delhi)

Course No : BMRIT/010P
Course Title : Environmental Studies
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visit to an area to document environmental assets: river/ forests/ flora/ fauna etc.
2. Visit to a local polluted site: Urban/ rural/ industrial/ agricultural
3. Study of common plants, insects, birds and basic principles of identification

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

III SEMESTER

Course No : BMRIT/011T
Course Title : Clinical Radiography- Positioning I
Credit : 3 (2-1-0)

Course Outline

Unit I	Upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus supplementary techniques for the above. E.g., Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections. Lower limb: Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments, Subtalar joint and talo calcaneal joint. Inter condylar projection of the knee. Tibial tubercle. Length measurement technique.
Unit II	Shoulder girdle and thorax: Technique for shoulder joint, scapular, clavicle, acromio clavicular joints, sternum, ribs, sterno-clavicular joint. Supplementary projections and techniques: Recurrent dislocation of shoulder. Traumatic dislocation of shoulder. Cervical ribs. Vertebral column: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco- lumber spine, lumbo sacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: Scoliosis ,Kyphosis ,Spondylolisthesis ,disc lesion ,Union of spinal graft
Unit III	Pelvic girdle and hip region: Technique for whole pelvis. Ilium, ischium, pubic bones, sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques- Congenital dislocation of hips Epiphysis of femur Lateral projections for hip joints to show femoral head and neck relationship. Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.
Unit IV	Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for: Petrous temporal for mastoids. Internal auditory canal. - Accessory nasal sinuses., Tempero - mandibular joint. - Orbits and optic foramen. - Zygomatic arches., Styloid process. - Pituitary fossa. - Jugular foramen. Dental Radiography- Technique for intra oral full mouth. - Occlusal projections. - Extra oral projections including orthopantomography. - Supplementary techniques
Unit V	Upper respiratory system- Technique for post nasal airways, larynx, trachea, thoracic inlet, Valsalva manoeuvre. - Phonation. Lungs and Mediastinum: Technique for routine projections- Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions. Abdominal viscera- Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus. Radiography using mobile X-ray equipment- Radiography in the ward: Radiography in the specialized unit, such as: Intensive care unit, Coronary care, Neonatal unit. - Radiography in the operating theatre. awareness, case studies

Course No : BMRIT/011P
Course Title : Clinical Radiography- Positioning I
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Skull, head and neck radiography
2. Extremities radiography
3. Mobile radiography
4. Respiratory system radiography
5. Dental radiography

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

III SEMESTER

Course No : BMRIT/012T
Course Title : Modern Radiological & Imaging Equipment
Credit : 3 (2-1-0)

Course Outline

Unit I	Special radiological equipment: Portable and mobile x-ray units, dental x-ray machine, skull table mammographic device - Technical aspects of Mammography; High Tension Generators, x-ray tubes-their types and advancements; Accessories; Resolution
Unit II	Quality control; Application and role in medicine. Digital radiography equipment, digital subtraction techniques. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of tomographic movements, Tomosynthesis, Stich radiography, Dual energy x-ray absorptiometry (DEXA) scan
Unit III	Computed radiography: its principle, physics & equipment. Digital Radiography. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications
Unit IV	Vascular Imaging Equipment: Introduction, historical developments, Principle, scanned projection radiography, digital subtraction angiography, applications and definition of terms
Unit V	Picture archiving and communication system (PACS)

Course No : BMRIT/012P
Course Title : Modern Radiological & Imaging Equipment
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visits to radiology department
2. Demonstration of various equipments

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

III SEMESTER

Course No : BMRIT/013T
Course Title : Contrast and Special Radiography Procedures
Credit : 3 (2-1-0)

Course Outline

Unit I	Responsibility of Radiographer during Radiological Procedures. Preparation of Patient for Different Procedures. Contrast Media - Positive and Negative, Ionic & Non – Ionic. Adverse Reactions to Contrast Media and Patient Management. Emergency Drugs in the Radiology Department. Emergency Equipment's in the Radiology Department. Aseptic technique. Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures
Unit II	Gastrointestinal Tract: Fluoroscopy, general considerations, responsibility of radiographers, Barium swallow, pharynx and esophagus, Barium meal and follow through .Hypotonic duodenography .Small bowel enema .Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined. Water soluble contrast media - eg. gastrograffin studies Salivary glands: Routine technique, procedure – sialography
Unit III	Biliary system: Plain film Radiography, Intravenous cholangiography. Percutaneous cholangiography.Endoscopic retrograde cholangio-pancreatography (ERCP) .Operative cholangiography .Post-Operative cholangiography (T - tube Cholangiography) Urinary system: Intravenous urography .Retrograde pyelography .Antegrade pyelography. Cystography and micturating cystouresthrography. Urethrography (ascending). Renal puncture Female reproductive system: Hysterosalpingography
Unit IV	Respiratory system: Bronchography: Awareness, Sinusography: Routine technique and procedure, Macroradiography: General principles. Requirement. Equipment. Technique. Localization of foreign bodies: General location principles. Ingested; inhaled; inserted; embedded foreign bodies. Foreign bodies in eye. Preparation of the area to be investigated. Appropriate projection for all.Techniques to locate non-opaque foreign body.
Unit V	Soft Tissue Radiography: High and low kilo voltage technique; differential filtration. Non - screen technique - simultaneous screen and non -screen technique. Multipleradiography. Uses of soft tissue radiography. High kV Radiography: General principles, Relation to patient dose. Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement. Radiographic factor; application and uses

Course No : BMRIT/013P
Course Title : Contrast and Special Radiography Procedures
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Administration of contrast media
2. Dry demonstration and observation of various procedures covered in theory

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

III SEMESTER

Course No : BMRIT/014T
Course Title : Quality Control in Radiology and Radiation Safety
Credit : 3 (2-1-0)

Course Outline

Unit I	Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance. Quality assurance programme at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing;
Unit II	Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration
Unit III	Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipment; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme. Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment
Unit IV	Radioactivity- Sources of radiation - natural radioactive sources - Quality factor - Flux-Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public. Biological Effects of radiation: Ionization, Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.
Unit V	Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey – ALARA- personnel dosimeters (TLD and film batches) - occupational exposure. Radiation Hazard evaluation and control Dose and Dosimetry, CT Dose Index Dose area product in fluoroscopy and angiography systems, AGD in mammography.

Course No : BMRIT/014P
Course Title : Quality Control in Radiology and Radiation Safety
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visits to installation of radiology department
2. Demonstration of safety techniques
3. Demonstration of various personal monitoring devices and its use

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

III SEMESTER

Course No : BMRIT/015T
Course Title : Regulatory Requirements and Quality Assurance
Credit : 3 (2-1-0)

Course Outline

Unit I	Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.
Unit II	Quality assurance program tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance procedures, Phantom measurements - CT, US and MRI. Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern
Unit III	Role of Radiographer in Planning, QA & Radiation Protection, Role of technologist in radiology department - Personnel and area monitoring, Setting up of a new X-Ray unit, staff requirement, AERB specifications for site planning and mandatory guidelines – Planning of X-ray rooms, Darkrooms
Unit IV	Inspection of X-Ray installations - Registration of X-Ray equipment installation-Certification -Evaluation of workload versus radiation factors
Unit V	Occupational exposure and protection Tools/devices. ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act and guidelines.

Course No : BMRIT/015P
Course Title : Regulatory Requirements and Quality Assurance
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Practical aspect following of AERB guidelines
2. Visits to various installation of diagnostic radiology
3. Demonstration of various shielding devices and barriers

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

IV SEMESTER

Course No : BMRIT/016T
Course Title : Cross Sectional Anatomy I
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology
Unit II	Anatomy of the upper thorax- Surface anatomy relationships, Bony structures and muscles, Blood vessels
Unit III	Divisions of the mid-thorax, heart and great vessels- Lungs, heart and great vessels, Esophagus
Unit IV	Anatomy of the Abdomen- Major organs and their accessories, Abdominal blood vessels
Unit V	Anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems Reproductive Organs

Course No : BMRIT/016P
Course Title : Cross Sectional Anatomy I
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration of sectional anatomy covered in theory

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

IV SEMESTER

Course No : BMRIT/017T
Course Title : Physics of Newer Imaging Modalities
Credit : 3 (2-1-0)

Course Outline

Unit I	Computed Tomography its principle, various generations and advancements
Unit II	Magnetic Resonance Imaging- its principle, advancements and applications
Unit III	Digital Radiography and Digital subtraction angiography equipment- principle, advancements and applications Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy systems
Unit IV	Fusion Imaging including PET-CT, PET- MRI Tele radiology HIS, RIS and PACS
Unit V	DEXA equipment- principle, advancements and applications

Course No : BMRIT/017P
Course Title : Physics of Newer Imaging Modalities
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration and observation of CT, MRI DEXA and digital radiography
2. Demonstration of various types of archiving devices available
3. Use of computers in radiology department
4. Demonstration and observation of PACS

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

IV SEMESTER

Course No : BMRIT/018T
Course Title : Clinical Radiography- Positioning II
Credit : 3 (2-1-0)

Course Outline

Unit I	Radiography of Skull and Radiography of cranial bones; including special techniques for sella turcica, orbits, optic foramina, superior orbital fissure and inferior orbital fissure etc. Facial bones; Paranasal sinuses, Temporal bone and Mastoids. Dental Radiography: Radiography of teeth-intra oral, extra oral and occlusal view
Unit II	Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen
Unit III	Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography. Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques.
Unit IV	Macro-radiography: Principle, advantage, technique and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry. High KV techniques principle and its applications. Soft tissue Radiography including Mammography - its techniques, equipment, advancements and applications. Localization of foreign bodies. Various techniques
Unit V	Trauma radiography/Emergency radiography Neonatal and Pediatric Radiography, Tomography and Tomosynthesis. Dual energy X-ray absorptiometry Forensic Radiography

Course No : BMRIT/018P
Course Title : Clinical Radiography- Positioning II
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration and observation of patient preparation, techniques involved in topics covered in theory
2. Demonstration of traumatic patient radiography
3. Observation of Forensic radiography

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

IV SEMESTER

Course No : BMRIT /019T
Course Title : Radiographic Techniques of USG and Mammography
Credit : 3 (2-1-0)

Course Outline

Unit I	Ultrasonography Basic Principle, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. Transducer technology, types, Principle, construction and working, characteristics of US beam. Production of ultrasound: Piezoelectricity Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing.
Unit II	Ultrasound display modes: A, B, M. Real-time ultrasound: Line density and frame rate, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety.,
Unit III	Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography, Techniques of sonography-selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients.
Unit IV	Mammography- History and introduction Its techniques, equipment advancements and applications Digital Mammography
Unit V	Breast cancer screening, BIRAD classification. Current trends in screening of breast cancer, Self-examination vs mammographic screening Role of radiographer, quality assurance in screening programmes. Radiation dose and screening issues- specificity and sensitivity, advantages, hazards of screening. Evaluation of palpable lesions. Sonomammography, role of color Doppler, USG screening of breasts

Course No : BMRIT /019P
Course Title : Radiographic Techniques of USG and Mammography
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration of various types of USG equipment
2. Demonstration of color Doppler and its uses in vascular and non-vascular imaging
3. Demonstration and handling of mammography machine, imaging techniques
4. Screening programmes and role of radiographers

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

IV SEMESTER

Course No : BMRIT/020T
Course Title : Clinical Imaging of Chest and Abdomen
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to Role of Radiology in Chest and Abdominal Imaging. Introduction to important diseases involving the Chest and Abdomen Clinical Features of diseases of Chest and Abdomen
Unit II	Radiological anatomy of the Chest and Abdomen – X-Ray, USG, CT and MRI corelation
Unit III	Emergency imaging of Chest diseases and findings Imaging of Chest diseases using various Radiographic techniques
Unit IV	Emergency imaging of Abdominal Diseases Imaging of Abdominal diseases using various Radiographic techniques
Unit V	Radiological Interventions in Chest and Abdominal imaging

Course No : BMRIT/020P
Course Title : Clinical Imaging of Chest and Abdomen
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribes to cover all theoretical aspects.

1. Clinical visit
2. Presentation on related topics

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

V SEMESTER

Course No : BMRIT/021T
Course Title : Cross Sectional Anatomy II
Credit : 3 (2-1-0)

Course Outline

Unit I	CT/MRI Images of the Thorax - Normal and pathologic
Unit II	CT/MR Images of Abdomen - Normal and pathologic
Unit III	CT/MR Images of the Male/Female Pelvis- Normal and pathologic
Unit IV	Neuro Anatomy- Scan planes Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts,
Unit V	Arterial/venous systems, Basal ganglia, Cranial nerves Spine- Vertebra and disc, Spinal cord and meninges Neck- Arterial/venous systems, Muscles, Glands and pharynx

Course No : BMRIT/021P
Course Title : Cross Sectional Anatomy II
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration and observation cross sectional anatomy mentioned in theory

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

V SEMESTER

Course No : BMRIT /022T
Course Title : Radiographic Techniques of CT- I
Credit : 3 (2-1-0)

Course Outline

Unit I	Basic Computed Tomography- Basic principles of CT, history, generations of CT, CT instrumentation, Data acquisition, image formation in CT, Advantages and disadvantagesof CT
Unit II	Spiral CT –advantages, CT image reconstruction and display parameters, Hounsfield unit, values of normal tissues, Multislice CT and newer developments
Unit III	Recording CT images, digital archiving, Post processing and multiplanar reconstruction CT image quality, CT image display, grey scale contrast optimization
Unit IV	Use of contrast, administration, patient preparation, artifacts in CT, techniques to minimize artifacts
Unit V	Housing transport, requirements, AERB guidelines for CT techniques to reduce patient dose, maintenance of equipment and accessories.

Course No : BMRIT/022P
Course Title : Radiographic Techniques of CT- I
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration of parts of CT scan machine
2. Use of contrast in CT imaging
3. Demonstration of image archiving in CT

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

V SEMESTER

Course No : BMRIT/023T
Course Title : Radiographic Techniques of MRI- I
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to MRI history, Magnets – types of magnets, Superconductor MRI and newer developments field strength – tesla
Unit II	Basic physics, data acquisition, relaxation time, gradient, spin echo techniques. Larmour frequency – equation and constant. Effect of magnetic field on cells.
Unit III	MR Instrumentation: – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers.
Unit IV	Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP.
Unit V	MRI room design and installation, Copper shielding, requirements, uses, practical aspects. Effect of shielding on image quality, Safety factors in MRI, Precautions in MRI

Course No : BMRIT/023P
Course Title : Radiographic Techniques of MRI- I
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visits to MRI unit for demonstration and observation of MRI machine
2. Demonstration of various MR equipment
3. Demonstration and observation of MRI room design and installation

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

V SEMESTER

Course No : BMRIT/024T
Course Title : Clinical Cardiac Radiology
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to Role of Radiology in Cardiology Introduction to important diseases involving the Heart with emphasis on Lifestyle induced diseases
Unit II	Radiological anatomy of the Heart using various modalities – X-Ray, Echo, Color Doppler, CT and MRI
Unit III	Emergency imaging of Heart diseases Imaging of heart for morphology, electrophysiology and functioning
Unit IV	Vascular imaging of the heart. Indications for angiography and viability studies and various techniques
Unit V	Interventions in cardiology and vascular imaging. Role of DSA and Cath lab

Course No : BMRIT/024P
Course Title : Clinical Cardiac Radiology
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribes to cover all theoretical aspects.

1. Clinical visit
2. Presentation on related topics

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

V SEMESTER

Course No : BMRIT/025T
Course Title : Clinical Neuro Imaging
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to Role of Radiology in Neurology Introduction to important diseases involving the CNS
Unit II	Radiological anatomy of the Brain and Spine and the peripheral nerves using various techniques.
Unit III	Emergency imaging of Brain and Head and Neck with emphasis on trauma Imaging of Brain including the central nervous system and various techniques Imaging of the head and neck – various techniques
Unit IV	Emergency imaging of Spine with emphasis on trauma Imaging techniques for Spine Imaging of the Peripheral Nervous system
Unit V	Interventions in Neurology – Role of DSA and various interventional techniques Role of intra-operative imaging

Course No : BMRIT/025P
Course Title : Clinical Neuro Imaging
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribes to cover all theoretical aspects.

1. Clinical visit
2. Presentation on related topics

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

VI SEMESTER

Course No : BMRIT/026T
Course Title : Hospital Practice and Care of Patients
Credit : 3 (2-1-0)

Course Outline

Unit I	NABH guidelines, Hospital procedure: Hospital staffing and organization; medico- legal aspects; stock-taking and stock keeping. Departmental procedures: Department staffing and organizations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department; General preliminaries to the exam
Unit II	Basics of emergency care and life support skills, First aid: Aims and objectives of first aid; Emergency treatment to the collapsed patient. Artificial respiration and resuscitation..., Care of the patient: FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices, Chest tubes and lines. First aid - shock, electrical shock, hemorrhage, burns, Asphyxia, fractures, loss of consciousness
Unit III	Infection prevention and control: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc. Principles of asepsis: Sterilization
Unit IV	Drugs in the department: Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti-hypertensive etc. Administration of drugs and contrast media. Antibiotic Resistance- History of Antibiotics, How Resistance Happens and Spreads, Consequences of antibiotic resistance, Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals
Unit V	Disaster preparedness and management: Fundamentals of emergency management, Psychological impact management, Resource management, Preparedness and risk reduction, Key response functions

Course No : BMRIT/026P
Course Title : Hospital Practice and Care of Patients
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visits to hospital/Radiology department
2. Demonstration on principles of on-site disaster management
3. Demonstration of drugs in radiology department

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

VI SEMESTER

Course No : BMRIT/027T
Course Title : Radiographic Techniques of CT II
Credit : 3 (2-1-0)

Course Outline

Unit I	CT Brain, Chest Abdomen Head and Neck
Unit II	CT Cholangiography, CT Urography CT Enteroclysis, HRCT- lungs and temporal bone
Unit III	CT Angiography, CT fluoroscopy
Unit IV	CT Musculoskeletal Imaging
Unit V	CT Dose Reduction, Dual source system

Course No : BMRIT/027P
Course Title : Radiographic Techniques of CT II
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Demonstration and performing of various examinations covered in theory
2. Visits to hospital/radiology department

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

VI SEMESTER

Course No : BMRIT/028T
Course Title : Radiographic Techniques of MRI- II
Credit : 3 (2-1-0)

Course Outline

Unit I	Pulse sequences of MRI
Unit II	MRI Head and Neck, Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies
Unit III	MRCP MR Enteroclysis MR arthrography
Unit IV	Diffusion MRI and echo-planar imaging Use of MRI in Interventional MRI, MRI operation suite
Unit V	MR contrast media – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI, Recent advances in MRI

Course No : BMRIT/028P
Course Title : Radiographic Techniques of MRI- II
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Visits to hospital/radiology department
2. Demonstration and performing of examinations covered in theory

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

VI SEMESTER

Course No : BMRIT/029T
Course Title : Interventional Radiology
Credit : 3 (2-1-0)

Course Outline

Unit I	Basic angiography and DSA: History, technique, patient care, Percutaneous catheterization, catheterization sites, Asepsis, Guidewire, catheters, pressure injectors, accessories, Use of digital subtraction- single plane and bi-plane.
Unit II	Diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure. Central Nervous System: Myelography, Cerebral studies, Ventriculography
Unit III	Arthrography: Shoulder, Hip, Knee, Elbow
Unit IV	Carotid Angiography (4 Vessel angiography) Thoracic and Arch Aortography, Selective studies: Renal, SMA, Coeliac axis, Vertebral angiography, Femoral arteriography, Angiocardiography DSA -indications, use, techniques
Unit V	Venography: Peripheral venography, Cerebral venography, Inferior and superior venocavography, Relevant visceral phlebography Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophyiology

Course No : BMRIT/029P
Course Title : Interventional Radiology
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribed to cover all theoretical aspects

1. Dry demonstration of various interventional techniques
2. Observation and assisting procedures
3. Demonstration and usage of various types of interventional accessories
4. Demonstration of angiographic techniques
5. Demonstration of vascular interventional techniques

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

VI SEMESTER

Course No : BMRIT/030T
Course Title : Molecular Advanced Imaging
Credit : 3 (2-1-0)

Course Outline

Unit I	Introduction to Advanced Molecular imaging and its uses in modern health care delivery system Role of Radio imaging in early detection and curative management of diseases by early detection
Unit II	Pathophysiology of Various diseases processes with particular emphasis on Pathophysiology of Various Cancers
Unit III	Introduction to Equipment available for Molecular imaging with focus on SPECT , Contrast Studies, PET , PET-CT and PET-MRI
Unit IV	Diagnostic Onco imaging – Multimodality approach in benign and malignant conditions – Role of Radiology and Various Imaging techniques General approach to clinical diagnosis of various tumours
Unit V	Interventions in Oncology management and various Radiographic procedures for management of various cancers – Curative and palliative management

Course No : BMRIT/030P
Course Title : Molecular Advanced Imaging
Credit : 1 (0-0-1)

Practical will include the following and additional as prescribes to cover all theoretical aspects.

1. Clinical visit
2. Presentation on related topics

Pattern of Examinations:

Theory: 100 marks (75 External+25 Continuous Assessment)

Continuous Assessment There will be 2 Internal Examination in each semester consisting of total **40 marks (20+20)** in which average marks will be taken as **20 marks** and **five (5) marks for Attendance**. The sum of these marks will constitute Continuous Assessment (C1+C2) marks which will be out of 25(twenty-five).

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the Semester, there will be a final exam (C3) that will be conducted by the university consisting of 75 (seventy-five) marks. This will be Descriptive Type questions consisting of 65 marks with total of 15 questions-3 questions from each unit and students will have to answer any thirteen (13) questions each carrying 5 marks. Short Answer Type questions consisting of five (5) questions -1 question from each unit carrying two (2) marks each. Theory paper will be of 3 hours duration.

Component (C3)	**Total marks**
Short Answer (5x2 marks)	10 marks
Descriptive Type (13x5 marks)	65 marks

Practical: 100 marks (75 External +25 Continuous Assessment)

Internal Assessment: Practical assessment in the form of spotting / viva will be conducted by the Department and marks obtained from these will be taken into account while calculating the total internal assessment marks which will be out of 25.

Component (C1+C2)	**Total marks**
Continuous Assessment	20 marks
Regularity in the class	5 marks

End Semester: At the end of the semester a practical exam will be conducted jointly by the external and internal examiners for a total of **75 marks** and will comprise the following:

Component (C3)	**Total marks**
Spotting /Practical	40 marks
Viva-Voce	25 marks
Record	10 marks

VII & VIII SEMESTER

Course No : BMRIT/031P
Course Title : BMRIT Internship
Credit : 40 (0-0-40)

INTERNSHIP –Students have to undertake the rotational postings for minimum of 2560 total hours during which students have to work under supervision of an experienced staff in the following areas:

Sl.No.	Postings	Duration in Months	Minimum Hours
1	Conventional radiography including CR, DR and PACS	3 months	640 hours
2	Radiographic special procedures including diagnostic and Therapeutic Interventional Procedures	2 months	426 hours
3	Ultrasonography & Doppler Imaging	1 month	214 hours
4	Computed Tomography	3 months	640 hours
5	Magnetic Resonance Imaging	3 months	640 hours

List of Abbreviations

2D	Two Dimensional
3D	Three Dimensional
AC	Alternate Current
ALARA	"As Low As Reasonably Achievable"
AEC	Automatic Exposure Control
AED	Automated External Defibrillator
AERB	Atomic Energy Regulatory Board
AHP	Allied and Healthcare Professional
BLS	Basic Life Support
BSc. MRIT	Bachelor of Science in Medical Radiology and Imaging Technology
BMW	Bio Medical Waste
BVM	Bag-Valve-Masks
CATS	Credit Accumulation and Transfer System
CBCS	Choice-Based Credit System
CbD	Case-based Discussion
CBSE	Central Board of Secondary Education
CEX	Mini Case Evaluation Exercise
COPD	chronic obstructive pulmonary disease
CPR	Cardiopulmonary Resuscitation
CT	Computerized Tomography
DC	Direct Current
DMRIT	Diploma in Medical radiology and Imaging Technology
DOPs	Direct Observation of Procedures
DRR	Digitally Reconstructed Radiographs
ECG	Electrocardiogram
ECTS	European Credit Transfer System
EEG	Electroencephalography
ERCP	Endoscopic Retrograde Cholangio Pancreatography
FW	Full wave
GI	Gastro Intestinal
HRCT	High-resolution computed tomography
HSSC	Healthcare Sector Skill Council
HU	Heat Unit
HVT	Half Value Thickness
HW	Half Wave
ICRP	International Commission on Radiological Protection
IT	Information Technology
JCI	Joint Commission International
LDR	Low Dose-Rate
MIP	maximum intensity projection
MLC	Medico Legal Case
MLC	Multi Leaf Collimator
MSc.MRIT	Master of Science in Medical Radiology and Imaging Technology
MoHFW	Ministry of Health and Family Welfare
MPR	Multiplanar reconstruction
MRI	Magnetic Resonance Imaging
MSc	Master of Science
NAAC	National Assessment and Accreditation Council
NABH	National Accreditation Board for Hospitals & Healthcare Providers
NCRC	National Curricula Review Committee
NIAHS	National Initiative for Allied Health Sciences
NSDA	National Skills Development Agency
NSQF	National Skills Qualification Framework

OSCE	Objective Structured Clinical Examination
OSLER	Objective Structured Long Examination Record
OSPE	Objective Structured Practical Examination
PACS	picture archiving and communication system
PCA	Phase contrast angiography
PET	Positron Emission Tomography
PhD	Doctor of Philosophy
PPE	Personal Protective Equipment
PTBD	Percutaneous transhepatic biliary drainage
QA	Quality Assurance
QC	Quality Control
RBC	Red Blood Cells
RIAHS	Regional Institute of Allied Health Sciences
RPP	Radiation Protection Programme
SCA	Sudden Cardiac Arrest
SDL	Self –Directed Learning
SPECT	Single-Photon Emission Computed Tomography
TLD	Thermoluminescent Dosimeter
TSU	Technical Support Unit
TVT	Tenth Value Thickness
UGC	University Grants Commission
USG	Ultrasonography
UHC	Universal Health Coverage
WBC	White Blood Cells
WHO	World Health Organization
WWW	World Wide Web

Reference: Ministry of Health and Family Welfare Allied Health Section 2015-16
Model Curriculum Handbook MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY