SCHEME & SYLLABUS

Bachelors of Medical Radiology & Imaging Technology

As Per NCAHP

Program Code: UG063

Department of Allied Health Sciences, UIAHS

Sant Baba Bhag Singh University

2026

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

ABOUT THE DEPARTMENT

The Department of Allied Health Sciences, formerly the Department of Natural Science, was established in 2015. Over the years, the department has flourished and now offers programs at the graduate, postgraduate, and doctoral levels in Medical Laboratory Sciences (MLS), Medical Radiology & Imaging Technology (MRIT), and Anaesthesia & Operation Theatre Technology (AOTT). With modern laboratories, experienced faculty, and strong clinical collaborations, the Institute integrates scientific knowledge, practical skills, and ethical values to prepare competent healthcare professionals aligned with national and global healthcare standards.

ABOUT THE PROGRAMME:

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

The objectives of the program:

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

SALIENT FEATURES OF THE DEPARTMENT:

- Strong academic framework aligned with **NCAHP guidelines** and national regulatory standards.
- Well-equipped, modern laboratories with advanced diagnostic and clinical equipment.
- Experienced and research-oriented faculty with strong academic and clinical expertise.

- Extensive hands-on training through hospital tie-ups and healthcare collaborations.
- Career-oriented programmes with strong employability prospects in the healthcare sector.

ELIGIBILITYCRITERIA

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

OR

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

OR

Candidates who have passed the Senior Secondary school Examination of National Open School with a minimum of 5 subjects with any of the following group subjects.
English, Physics, Chemistry, Botany, Zoology English, Physics, Chemistry, Biology and any other language.

DURATION

4 Year Program (including 1 year of clinical training /internship)- Bachelor's degree level

Admission of Lateral Entry candidates:

Number of intake: lateral entry admission must not be more than 10% of the annual intake.

Lateral entry to second year for allied and healthcare science courses for candidates who have passed diploma program from the Government Boards and recognized by State/Central University, fulfilling the conditions specified and these students are eligible to take admission on lateral entry system only if the same subject have been studied at diploma level.

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

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

Candidates with minimum 3years full-time diploma in Medical Imaging Technology/Radiography from a recognized Government Body shall have passed 'plus-two' [10+2] with Arts/Commerce as subjects, should have studied Physics, Chemistry and Biology as principal subjects during the tenure of the Medical Imaging Technology

Course with minimum 1years of radiology working experience in hospital/academic institution. Eligibility of the lateral candidates based on examination conducted by NCAHP.

Foreign nationals and candidates who have qualified from a foreign University/Board should obtain permission

from the NCAHP commission prior to the admission for equivalence of the qualification.

Selection of eligible candidates:

He/she has attained the age of 17 years as on or before the 31st December of the year of admission) & maximum age limit is 30 years

He/she must furnish at the time of submission of application form, a certificate of Physical fitness from

a registered medical practitioner and two references from persons other than relatives testifying to satisfactory

general character. Admission to Bachelor Medical Radiology and Imaging Technology course shall be made

based on eligibility and an entrance test to be conducted for the purpose.

Selection to the BMRIT course shall be based on merit of 12th/University entrance test/ University Entrance.

CAREER PATHWAYS

A career in radiology is a rewarding path that combines medical expertise with cutting-edge imaging technology. Here is a comprehensive guide to pursuing a career in radiology. B.Sc. Graduates are hired both by Government and private organizations.They may join Post Graduation Courses further.

- Focus areas may include radiography, radiation therapy, nuclear medicine, or diagnostic medical sonography.
    - Gain hands-on experience through clinical rotations and internship
    - Government Jobs: Prepare students for various government jobs such as at gov hospitals, military and other public sectors etc.
    - Higher Studies: This path way prepares students for Higher Studies and help in the research also **Entrepreneurship**: To set up new ventures.

Program Objective

PO1	**Clinical care**: Organize and implement the prescribed preventive, investigative and management plans; and will offer care and appropriate follow-up services to patient in a cost-effective way
PO2	**Communication**: Communicate effectively and appropriately with patients/clients, caregivers, her health professionals and other members of the ccommunity
PO3	**Ethics and accountability at all levels:** Understand the core concept of clinical ethics and law so that they may apply these to their practice as healthcare service-providers.
PO4	**Commitment to professional excellence:** Execute professionalism and reflect technical competence, appearance, empathy, compassion, honor, integrity in his/her thought and action to ensure safe delivery of healthcare
PO5	**Leadership and mentorship:** Demonstrate leadership qualities where needed to ensure clinical productivity and patient satisfaction in an autonomous and confident manner**.**
PO6	**Social accountability and responsibility:** Recognize that allied health professionals need to judiciously manage resources and promote innovation and sustainability to provide optimal patient care in socially responsible manner.
PO7	**Scientific attitude and scholarship:** To be engaged in evidence-based practice, need based research studies and to apply and disseminate research findings and knowledge for improving the quality of care.
PO8	**Lifelong learning:** Recognize the need and have the ability to engage in independent and continues lifelong learning and improvement in skills and knowledge while harnessing modern tools and technology for the advancement of self and profession**.**

Program Outcomes

After Completion of the program, the students would be able to

PEO1	Demonstrate technical proficiency, in-depth knowledge and application of scientific and safety principles in all allied health professional programs and apply clinical skills to one's own work, as a member and leader in a team, and in multidisciplinary clinical settings and to attain high level of proficiency in defined clinical competencies of the allied health technologists.
PEO2	Recognize that allied and healthcare professionals need to be advocates within the health care system, to judiciously manage resources and to acknowledge their social accountability. To serve the community, region and the nation and will hence direct all research and service activity towards addressing their priority health concerns. Have ability to engage in independent and lifelong learning and improvement in skills

	and knowledge while harnessing modern tools and technology.
PEO3	Practice with ethics and accountability at all the levels (clinical, professional, personal and social). To always exhibit high level of professionalism and this be reflected in his/her thought and action, as well as in a range of attributes and characteristics that include technical competence, empathy, verbal and non-verbal communication, an anti-discriminatory and non-judgmental attitude. Communicate effectively and appropriately with patients/clients, care-givers, other health professionals.
PEO4	Inculcate the skills to function effectively as an individual and as an active member of multi-disciplinary health team.
PEO5	Ability to apply principles of patient safety and ethical conduct in all aspects of radiologic technology practice.
PEO6	This program demonstrates the skills, knowledge, and professionalism essential for success in the workplace and contribution to the advancement of radiologic sciences and healthcare delivery.
PEO7	Develop skills to take on a leadership role in order to ensure clinical productivity and patient satisfaction. Must be able to respond in an autonomous and confident manner to planned and uncertain situations and should be able to manage themselves and others effectively.

Program Specific Outcomes

PSO1	Understand and apply principles of physics and operation of the imaging equipment's and demonstrate knowledge of specified imaging modalities, relevant anatomy, positioning, image quality assurance and diagnostic decision making.
PSO2	Demonstrate knowledge of radiation protection principles and perform radiographic procedures ensuring safety of patients and personnel involved.
PSO3	Ability to have knowledge of BLS & ACLS and ability to deliver it whenever required.
PSO4	Ability to Assist a radiologist in diagnosing various diseases with the help of imaging
PSO5	Able to detect any Changes in patient's physiological status & able to tackle all types of Complications.
PSO6	Knowledge of Basic Science of Anatomy, Physiology, Pathology & Microbiology etc.

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18	Clinical Radiography Positioning Part –II	BMRIT-016	3rd
19	Radiography and Image Processing Techniques	BMRIT-017	3rd
20	Contrast Media & Special Radiological procedures	BMRIT-018	3rd
21	BMRIT Radiology Clinical Education – part III (studentship)	BMRIT-III	3rd
22	Cross-Sectional Anatomy	BMRIT-019	4th
23	Modern Radiological Imaging Equipment and Physics	BMRIT-020	4th
24	Interventional Radiography Techniques	BMRIT-021	4th
25	Patient Care in Radiology	BMRIT-022	4th
26	BMRIT Clinical Education- Part IV (studentship)	BMRIT-IV	4th
27	Basics Techniques in CT Technology	BMRIT-023	5th
28	Radiation Safety in Diagnostic Radiology	BMRIT-024	5th
29	Quality Assurance in Diagnostic Radiology and Regulatory Requirements	BMRIT-025	5th
30	BMRIT Radiology Clinical Education – part V(studentship)	BMRIT-V	5th
31	Basic Techniques in MRI Technology	BMRIT-026	6th
32	Introduction to Nuclear Medicine Techniques	BMRIT-027	6th
33	Ultrasound Techniques	BMRIT-028	6th

34	Biostatics and Research Methodology	BMRIT-029	6th
35	BMRIT Directed Clinical Education-Part VI (studentship)	BMRIT-VI	6th
36	Internship- I	BMRIT-VII	7th
37	Internship - II	BMRIT-VIII	8th

Course Scheme for Bachelor of Medical Radiology and Imaging Technology

Teaching and Examination Scheme

Course Name : Bachelor OF Medical Radiology and Imaging Technology

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

Semester: **FIRST**

S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				
			L	T	C/P	Credits (L+T+P)	Exam Duration in Hrs.	CIE Max Mark	ESE Max Marks	Total Max Marks	Total Min Marks	CIE Max Marks	ESE Max Marks	Total Max Marks	Total Min Marks	Grand Total
1.	Human Anatomy	BMRIT -001	3	--	--	3	2.5	30	70	100	50	--	--	--	--	**100**
2.	Physiology	BMRIT -002	3	--	--	3	2.5	30	70	100	50	--	--	--	--	**100**
3.	Basics of Radiation Physics	BMRIT -003	2	-	6	5	2.5	30	70	100	50	30	70#	100	50	**200**
4.	Introduction to Healthcare	BMRIT -004	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
5.	Medical Terminology And Record keeping	BMRIT -005	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
6.	Basic Computers and Information science	BMRIT -006	1	--	--	1	--	30	70*	100	50	--	--	--	--	--

7.	Medical Law and Ethics	BMRIT -007	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
8.	Professionalism and Values	BMRIT -008	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
9.	Principals of Management	BMRIT -009	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
10.	English& Communication skills	BMRIT -010	1	--	--	1	--	30	70*	100	50	--	--	--	--	--
11.	BMRIT Radiology Clinical Education – part I (studentship)	**BMRIT - I**	--	--	15	5	--	--	--	--	--	--	--	--	--	--
	Total		**15**	**0**	**21**	**23**	**--**	**--**	**--**	**300**	**--**	**--**	**--**	**100**	**--**	**400**

Student Contact Hours Per Week: 36 **Hrs. Theory and practical periods of 60 minutes each.** Medium of Instruction: **English**
Total Marks: **400**

Abbreviations: ESE-End Semester Exam, CIE-Continuous Internal Evaluation, L–Lectures ((hrs/week),T-Tutorial, P– Practical {Clinical/ Practicals (hrs/week)}
*Internal Assessment,# External Assessment.

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

Teaching and Examination Scheme

Course Name: Bachelor OF Medical Radiology and Imaging Technology

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

Semester: **Second**

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

Student Contact Hours Per Week: 39* **Hrs. Theory and practical periods of 60minutes each.**

Medium of Instruction: **English** Total Marks **: 500**

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

*Internal Assessment,# External Assessment.

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

Teaching and Examination Scheme

Course Name: Bachelor OF Medical Radiology and Imaging Technology

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

Semester: **THIRD**

S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				Grand Total
							Exam Duration	CIE	ESE	Total		CIE	ESE	Total		
			L	T	C/ (hrs/week)	Credits (L+T+P)		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks	
1.	Pathology	BMRIT -015	2	--	--	2	2.5	30	70	100	50	--	--	--	--	**100**
2.	Clinical Radiography Positioning (Part II)	BMRIT -016	2	1	6	6	2.5	30	70	100	50	30	70#	100	50	**200**
3.	Radiography and Image Processing Techniques	BMRIT -017	2	--	2	3	2.5	30	70	100	50	--	--	--	--	**100**
4.	Contrast Media& Special Radiological procedures	BMRIT -018	2	1	6	6	2.5	30	70	100	50	30	70#	100	50	**200**
5.	BMRIT Radiology Clinical Education– part III (studentship)	BMRIT -III	--	--	12	4	--	--	--	--	--	--	--	--	--	--
	Total		**8**	**2**	**26**	**21**	**--**	**--**	**--**	**400**	**--**	**--**	**--**	**200**	**--**	**600**

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

Medium of Instruction: **English** Total Marks **: 600**

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

*Internal Assessment,# External Assessment.

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

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

Teaching and Examination Scheme

Course Name: Bachelor OF Medical Radiology and Imaging Technology

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

Semester: **FOURTH**

S.N	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				
			L	T	C/P (hrs/week)	L (hrs/week)	Exam Duration	CIE Max Marks	ESE Max Marks	Total Max Marks	Total Min	CIE Max Marks	ESE Max Marks	Total Max Marks	Total Min Marks	Grand Total
1.	Cross sectional anatomy	BMRIT -019	2	--	6	5	--	--	--	--	--	70#	30	100	50	**100**
2.	Modern Radiological Imaging Equipment and Physics	BMRIT -020	2	1	2	3(4*)	2.5	70	30	100	50	--	--	--	--	**100**
3.	Interventional Radiology Techniques	BMRIT - 021	2	1	4	4(5*)	2.5	70	30	100	50	70#	30	100	50	**200**
4.	Patient Care in Radiology	BMRIT - 022	1	1	4	4	2.5	70	30	100	50	70#	30	100	50	**200**
5.	BMRIT Radiology Clinical Education – part IV (studentship)	BMRIT -IV	--	--	12	4	--	--	--	--	--	--	--	--	--	--
		Total	**7**	**3**	**28**	**22**	--	--	--	**300**	--	--	--	**300**	--	**600**

Student Contact Hours Per Week: 38 **Hrs. Theory and practical periods of 60 minutes each.**

Medium of Instruction: **English** Total Marks: **600**

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

*Internal Assessment, # External Assessment.

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

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

Teaching and Examination Scheme

Course Name: Bachelor OF Medical Radiology and Imaging Technology

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

Semester: **FIFTH**

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

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

Medium of Instruction: **English** Total Marks**:500**

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

*Internal Assessment, # External Assessment.

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

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

Teaching and Examination Scheme

Course Name: Bachelor OF Medical Radiology and Imaging Technology

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

Semester: **SIXTH**

S.No.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
							Theory					Practical				Grand Total
								CIE	ESE	Total		CIE	ESE	Total		
			Theory (hrs/week)	Tutorial	C/P (hrs/week)	Credits (L+T+P)	Exam Duration in	Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks	
1.	Basics Techniques In MRI Technology	BMRIT -026	3	1	8	8	2.5	30	70	100	50	30	70#	100	50	**200**
2.	Introduction to Nuclear Medicine Techniques	BMRIT -027	1	1	2	3	2.5	30	70	100	50	--	--	--	--	**100**
3.	Ultrasound Techniques	BMRIT - 028	2	1	--	3	2.5	30	70	100	50	--	--	--	--	**100**
4.	Biostatistics And Research Methodology	BMRIT -029	1	1	--	2	--	30	70*	100	50	--	--	--	--	--
5.	BMRIT Radiology Clinical Education – part VI (studentship)	BMRIT -VI	--	--	15	5	--	--	--	--	--	--	--	--	--	--
	Total		**7**	**4**	**25**	**21**	**--**	**--**	**--**	**300**	**--**	**--**	**--**	**100**	**--**	**400**

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

Medium of Instruction: **English** Total Marks**:400**

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

*Internal Assessment, # External Assessment.

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

Syllabus coordinator: Mr. Abdul Wahid & Ms. Insha Imtiyaz

Course Name: Bachelor OF Medical Radiology and Imaging Technology **Semester: SEVEN**							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	BMRIT-VII	Internship-I	0	0	20	20	Internship

Students must undertake the rotational postings during which students have to work under supervision of an

Experienced staff in the following areas:

Minimum 2400 hours (calculated based on 8 hours per day for one year of internship)

Course Name: Bachelor OF Medical Radiology and Imaging Technology **Semester: EIGTH**							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	BMRIT-VIII	Internship-II	0	0	20	20	Internship
TOTAL			0	0		**20**	**20**

Total Contact Hours for I-VIII semester: 261

Total Credit Hours for I-VIII semester: 170

LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

Students have to do hands on practice on following Techniques:

Exp. No. Name of Practical/ Exercise/ Assignment/ Case Study

Seventh Semester

1 Radiation Physics

2 Radiographic Positioning

3 Conventional Radiography and Equipment

4 Contrast Media& Special Radiological/ imaging procedures

5 Interventional Radiology/ imaging techniques

6 Patient Care in Radiology

Eighth Semester

7 Basics Techniques in CT Imaging Technology

8 Radiation Safety in Diagnostic Radiology

9 Quality Assurance in Diagnostic Radiology and Regulatory Requirements

10 Basics Techniques in MRI Imaging Technology

11 Introduction to Nuclear Medicine Techniques* (if facility available)

12 Ultrasound Techniques

GENERAL GUIDELINES FOR CLINICAL EDUCATION (INTERNSHIP)

The Institutes/Hospitals/Diagnostic Centers can be Government, Public limited, private enterprises or ownership.

Training Area: Students should be trained in large and medium scale Hospitals/Diagnostic Centers.

However, despite the best efforts by the Institute, if large and medium scale Hospitals/Diagnostic Centers are not available to all students then, students can also be placed in small scale Institutes/Hospitals/Diagnostic Centers approved by the NCAHP competent body.

Skill Knowledge Partner (SKP): To be identified by the Institute as per their programme areas like

1. Government Hospitals.
2. Corporate Hospitals
3. Private Hospitals
4. Diagnostic Centers
5. Any other relevant industry

Note: All these needs to be approved by the NCAHP competent body.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in very semesters
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have journal club/UG teaching/Mentoring/seminars/workshops on new developments/ technologies. Check annexure for marking criteria.

All practical skills must be supervised and recorded in a digital Logbook and skills to be evaluated after the completion of the studentship.

Course Scheme Summary

Sem.	L	T	P	Contact hrs/wk	Credits	Project/ Training
First	15	0	21	36	23	C
Second	12	1	23	39	22	C
Third	8	2	26	36	21	C
Fourth	7	3	28	38	22	C
Fifth	7	3	26	36	21	C
Sixth	7	4	25	36	21	C
Seventh	0	0	20	20	20	6 Months
Eighth	0	0	20	20	20	6 Months

Total Contact Hours for I-VIII semester: 261

Total Credit Hours for I-VIII semester: 170

CO/PO Mapping (S/M/Indicates strength of correlation) S–Strong, Medium, W–Weak

Cos	Program Outcomes (POs)							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	M	S	S	M	S	S	S
CO2	S	M	S	M	M	S	S	S
CO3	S	W	M	W	W	S	S	S
CO4	M	M	S	M	W	S	S	S

FIRST SEMESTER

Human Anatomy

Course Code	**BMRIT-001**
Course Title	Human Anatomy
Type of course	Theory
LTP	3 0 0
Credits	3
Course prerequisite	10+2 Medical
Course Objective	• To ,tissues and organs. • To understand the anatomical organization, coordination and integrated functions of human body.
Course Outcomes	**CO1**: Describe the general anatomy of human body. Explain normal disposition of various structures and organs in the body and its clinical correlation. Describe the microscopic structure of various tissues **CO2:** Determine the topography of various structures on the surface of the body. Describe the microscopic structure of various tissues **CO3:** Identify and locate structures of the body **CO4**: Identify organs and tissues under microscope. Point out various features of appearance of normal body in Diagrams

UNIT-I

Introduction: Human Body as a Whole

Definition of anatomy and its subdivisions, Terms of location, positions and planes, Cell and its organelles, Epithelium – definition, classification, describe with examples, functions, Glands – classification, describe serous and mucous glands with examples, Basic tissues – classification with examples.

Locomotion and Support

Cartilage – types, examples and histology

Bone – classification, examples and histology. Parts of long bone, names of all bones, vertebral column and intervertebral disc. Fontanel's of fetal skull.

Joints – classification of joints with examples, typical synovial joint (in detail). Muscular system – classification of muscular tissue and histology

Important muscles of the body- Sternocleido mastoid, Trapezius, Muscles of tongue, Deltoid, Biceps brachii, Intercostal muscles, Thoracic diaphragm, Rectus abdominis, External oblique, Internal

oblique, Transversus abdominis, Pelvic diaphragm, Gluteus maximus, Gluteus medius, Gluteus Minimus, Quadriceps femoris, Soleus.

UNIT-II :

Cardiovascular System

Heart – size, location, chambers, exterior and interior, Blood supply of heart, Pericardium, Systemic and pulmonary circulation, Branches of aorta - common carotid artery, subclavian artery, Axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery, dorsalis pedis artery., Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, median cubital vein, Dural venous sinuses, Lymphatic system – cisterna chyli and thoracic duct, Lymphatic tissues and its histology, Regional lymph nodes – cervical, axillary and inguinal lymph nodes.

Heart – size, location, chambers, exterior and interior, Blood supply of heart, Pericardium, Systemic and pulmonary circulation, Branches of aorta - common carotid artery, subclavian artery, Axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery, dorsalis pedis artery., Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, median cubital vein, Dural venous sinuses, Lymphatic system – cisterna chyli and thoracic duct, Lymphatic tissues and its histology, Regional lymph nodes – cervical, axillary and inguinal lymph nodes.

Gastro-Intestinal System Theory

Parts of GIT- oral cavity (lip, cheek, tongue, salivary glands, palate, dentition) pharynx (Waldeyer's ring) esophagus, stomach, small and large intestine and appendix, Liver, gall bladder, pancreas and spleen, Histology of esophagus, stomach, small and large intestine, liver, gall bladder and pancreas.

Peritoneum

Description of reflection, folds and pouches in brief.

UNIT-III

Endocrine Glands

Names of all endocrine glands, describe in detail on pituitary gland, thyroid gland and parathyroid gland, suprarenal gland, Histology of pituitary, thyroid, parathyroid, suprarenal gland.

Urinary System

Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder.

Reproductive System

Parts of male reproductive system- testis, vas deferens, epididymis, prostate, Parts of female reproductive system- uterus, fallopian tubes, ovary, mammary gland, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary.

UNIT-IV

Nervous System

Neuron, Classification of nervous system, Cerebrum, cerebellum, brain stem, spinal cord & spinal nerve, Meninges, ventricles and cerebrospinal fluid, Blood supply of the brain, Cranial nerves (in brief), Nerve plexus (Brachial & lumbar)

Sensory Organs

Skin and its appendages, Eye – parts of eye ball and lacrimal apparatus, Extra- ocular muscles, Histology of cornea and retina, Ear – parts of ear- external, middle and inner ear and contents

Embryology

Spermatogenesis and oogenesis, Ovulation, fertilization, Placenta

Text and Reference Book

S.No	Name	Author(S)	Publisher
1.	Anatomy & Physiology-Ross And Wilson	Anne Waugh & Allison Grant	Churchill Living Stone
2	Anatomy and Physiology: Understanding the Human Body	Robert Clark	Jones & Bartlett publishers
3.	Functional Histology	James S. lowe, Barbara young, Allen Stevens & John W Heath	Elsevier

Physiology

Course Code	**BMRIT-002**
Course Title	Physiology
Type of course	Theory
LTP	3 0 0
Credits	3
Course prerequisite	10+2 Medical
Course Objective	• Explain the normal functioning of organs and systems. • Explain the normal functioning of organs and systems
Course Outcomes	**CO1:** Explain the normal functioning of organs and systems. Understand the interrelationships and interactions among various organs and systems for maintaining homeostasis**.** Determine the topography of various structures on the surface of the body. Explain the normal functioning of organs and systems **CO2:** Assess the relative contribution of each organ systems toward the maintenance of constant internal environment. **CO3:** Differentiate between normal and abnormal functioning of organs and systems, **CO4:** Understand physiological basis of pathogenesis and treatment of diseases and disorders. Apply the physiological basis in the field of allied health care

UNIT-I

Introduction to Physiology, Concept of Homeostasis, cell – Morphology – Functions of organelles and Cell membrane, Transport mechanisms, Body fluid compartments.

Muscle nerve physiology

Neurons: Morphology, Action Potential, Neuroglia: Types & functions, Muscles: Types, structure of sarcomere. Neuromuscular junction, sliding filament mechanism of contraction.

Blood

Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis – stages, essential factors, regulation of Erythropoiesis, Hemoglobin: Functions, concentration, physiological variations. Fate of Hemoglobin – Jaundice, types, Color index, MCH, MCV, MCHC, PCV – normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood grouping. Landsteiner's laws, ABO system, determination of blood groups, blood transfusion, complications of incompatible blood transfusion, Rh group, erythroblastosis foetalis, prevention and treatment, Blood bank.

Haemostasis: Mechanisms. Clotting mechanism: factors, intrinsic and extrinsic pathways.
Disorders of clotting – hemophilia, vitamin K deficiency. Anticoagulants – mechanism of action and their uses, Anemia: Classification – Morphological and Etiological, Blood volume: normal values.

UNIT-II

Cardiovascular system

Organization of cardiovascular system, greater and lesser circulation, Physiological anatomy of the heart, nerve supply, Junctional tissues of heart (pacemaker), Cardiac cycle: Mechanical events, Heart sounds, causes, characteristics and significance, Normal ECG, clinical significance of ECG, Heart rate – Physiological variations, Cardiac output: Definitions, normal values, physiological variations, Arterial blood pressure: Definitions, normal values, physiological variations, factors maintaining blood pressure. Role of baroreceptors in regulation of blood pressure.

Respiratory system

Respiratory and Non-respiratory function of respiratory system. Physiological anatomy of respiratory system Functions of respiratory tract. Respiratory membrane. Respiratory muscles. Surfactant: functions, respiratory distress syndrome.
Definitions of terms used in respiratory physiology: Eupnea, Hyperpnoea, Tachypnea, Apnea, Dyspnea.
Mechanics of breathing – intrapulmonary and Intrapleural pressure changes during a respiratory cycle. Spirometry – Lung volumes and capacities. Vital capacity.
Oxygen transport: Role of hemoglobin, factors affecting, oxygen carrying capacity. Carbon dioxide transport: forms, chloride shift (Hamburgers phenomenon).Respiratory centers. Role of chemo receptors in regulation of respiration. Pulmonary ventilation and alveolar ventilation.Partial pressure of gases, Calculation of partial pressure of gasses in mixture. Arterial and venous blood gas concentrations and contents. Hypoxia: Types and effects Cyanosis, Asphyxia, Periodic Breathing, Acclimatization. Hyperbaric O2 therapy, Artificial respiration and Ventilators.

UNIT-III

Excretory system

Functions of kidneys. Nephrons – Juxta glomerular apparatus – functions, Steps in Urine formation – Ultrafiltration, Tubular Reabsorption, Tubular Secretion, GFR. Definition, normal values, factors affecting GFR, measurement of GFR, Renal threshold for glucose, tubular load for glucose, Role of aldosterone and ADH in urine formation, Micturition, Innervation of bladder. Diuresis, Renal functions tests – Based on analysis of urine and analysis of blood, Skin: Functions of skin. Sweat glands.

Digestive system

Introduction, structure of alimentary canal, Saliva: Composition, functions, Stomach: Functions. Gastric Juice: composition, functions, Pancreatic Juice: Composition and functions, Liver: Functions, Bile: composition, functions, Gall bladder: functions, Succusentericus: Composition, functions. Functions of large intestine, Movements of small intestines, Deglutition.

Reproductive system

Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system: Ovarian hormones functions – Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.

UNIT-IV

Endocrine system

Major endocrine glands- Hormone: Definition, Anterior pituitary: hormones and their functions, disorders – Giganitism, acromegaly, dwarfism, Posterior pituitary:
Hormones – diabetes insipidus, Thyroid: Hormones, normal values, functions, role of TSH. Disorders: simple goitre, myxoedema, cretinism, Grave's disease, Adrenal cortex: hormones, functions of cortisol and aldosterone. Addison's disease, Cushing's syndrome, Adrenal medulla: actions of adrenaline and noradrenaline, Endocrine pancreas: Insulin & glucagon, functions, Regulation of blood glucose level, diabetes mellitus, Parathyroid: Functions of PTH.

Nervous system
Synapse: Types, Transmission, Sensory receptors: Definition, Classification Organization of spinal cord, Functions of Dorsal column and Spinothalamic tract,Functions of Corticospinal tract, Reflex Action: Definition, reflex arc, Functions of Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Cerebral cortex:Lobes & functions. EEG – Definition and uses, Autonomic nervous system: Organization & functions, Cerebrospinal fluid: Composition and function.
Special senses Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & inner ear, cochlea, Deafness – types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell

S.No.	Title of Book	Author	Publication
1	Foundation of Anatomy and Physiology	Ross Wilson	Churchill Livingstone.
2	Physiology & Anatomy with Practical Considerations	Ester. M. Grishcimer	J.P. Lippincott. Philadelphia

Basics of Radiation Physics

Course Code	**BMRIT-003**
Course Title	Basics of Radiation Physics
Type of course	Theory
LTP	2 0 6
Credits	5
Course prerequisite	10+2 Medical
Course Outcomes	**CO1:** Describe general physics related to imaging. Identify construction of radiology equipment's **CO2:** Interpret quality of control of radiology equipment's. Describe production of x-rays **CO3:** Differentiate between x-ray equipment's and other radiology related equipment's **CO4:** Describe circuit system of radiology equipment's

UNIT-I

Basic concepts**:** Units and measurements-Force, work, power and energy- Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization- excitation-Binding energy-electron volt-Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence-Fluorescence-electromagnetic spectrum.

Electricity and magnetism: Electric charges, Coulomb's law-Unit of charge-Electricpotential,unitofpotential-Electricinduction,capacitance and Capacitors, series and parallel connection-electric current,unit,resistance,ohm'slaw,electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS valuesandcurrentandvoltage, circuitcontaining LR,CRand LCR-Powerfactor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current. Electromagnetic waves: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.

UNIT-II

Electronics

Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers. Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply.

Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback-negative feedback in amplifiers.

Heat

Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation in both stationary and rotating X-ray tubes).

UNIT-III

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. Interaction of ionizing radiation with matter-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.

Interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficient-coherent scattering- photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance.

UNIT-IV

Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.

Radiation intensity and exposure, photon flux and energy flux density. LET, range of energy relationship for alpha, beta particles with X-Rays.

Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit..

S.No.	TitleofBook	Author	Publication
1	Basic radiological physics	K.Thayalan	Jaypee Brothers Medical Publishers(P)Limited,2003
2	Christensen's physics of diagnostic radiology	Curry and Dowdey	Wolters Kluwer
3	X-Ray Equipment for Student	D.N. And M.O. Chesney	Blackwell Science Ltd

Introduction to Healthcare

Course Code	**BMRIT-004**
Course Title	**Introduction to Healthcare**
Type of course	Theory
LTP	1 0 0
Credits	1
Course prerequisite	10+2Medical
Course Objective	The students know about national policies
Course Outcomes	• The course provides the students a basic insight into the main features of the Indian healthcare delivery system and how it compares with The other systems of the world.

UNIT-I

Introduction to Health: Definition of Health, Determinants of Health, Health indicators of India, Health team concept National Health Policy National Health Programs (Brief objectives and scope) Family welfare programs in India

UNIT-II

Introduction to Nursing: Nursing and Nursing principles, Interpersonal relationships, Bandaging basic turns, Bandaging extremities, Triangular bandages and their applications.

Nursing position, bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's position, comfort measures, Aids, rest and sleep

UNIT-III

Lifting and transporting patients, Transferring patients to wheel chair, transferring from bed to stretcher

Bedside Management: Proper usage of bed pan, Observation of stools, urine, sputum. Understand the use and care of catheters. Enema procedures

UNIT-IV

Method of giving nourishment: Feeding, tube feeding, drips, transfusion, Monitoring and recording of vitals Simple aseptic techniques, sterilization and disinfection Observation of surgical dressings Concepts of First Aid

S.No.	Title of Book	Author	Publication
1	Principles and Practice of Nursing Management and Administration	Jogindra Vati	Jaypee Brothers Ltd
2	Textbook of Preventive and Social Medicine	K Park	Banarsidas Bhanot Publishers

Medical Terminologies and Record Keeping

Course Code	**BMRIT-005**
Course Title	**Medical Terminologies and Record Keeping**
Type of Course	Theory
LTP	1.0.0
Credits	1
Course Prerequisites	10+2(Science)
Course Objectives (CO)	The students know about • To memorize basic medical terms To interpret basic medical abbreviations

UNIT-I

1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.

UNIT-II

1. Basic medical terms.
2. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
   Interpret basic medical abbreviations/symbols.

UNIT-III

1. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.

UNIT-IV

1. Interpret medical orders/reports.
   Data entry and management on electronic health record system.

S.No.	Title of Book	Author	Publication
1	Medical Terminology, Documentation, and Coding	Anne P. Stich	Routledge Publisher
2	Medical Terminology for Health Professions	Ann Ehrlich, Carol L. Schroeder	Cengage Learning

Basic Computers and Information Science

Course Code	**BMRIT-006**
Course Title	Basic Computers and Information science
Type of Course	Theory
LTP	1.0.0
Credits	1
Course Prerequisites	10+2(Science)
Course Objectives (CO)	C01: Bridge the fundamental concepts of computers with the present level of knowledge of the students C02: Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet C03: Understand binary, hexadecimal and octal number systems and their arithmetic

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).

Processor and memory: The Central Processing Unit (CPU), main memory.

UNIT-II

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.).

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.

UNIT-III

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.

Introduction of Operating System: introduction, operating system concepts, types of operating system.

UNIT-IV

Computer networks: introduction, types of network (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.

S.No.	Title of Book	Author	Publication
1	Basic of Computer and Information Technology	Ashok Arora	Vikas
2	Computer and Information Science	Roger Lee (editor)	Springer
3	Computer and Information Sciences	Tadeusz Czachórski , Erol Gelenbe, Krzysztof Grochla, Ricardo Lent (Editor	Springer
4	Information science and computer basics: An introduction	Mitchell, Ruth K	Clive Bingley

Medical Law & Ethics

Course Code	**BMRIT-007**
Course Title	**Medical Laws& Ethics**
Type of Course	Theory
LTP	1.0.0
Credits	1
Course Prerequisites	10+2(Science)
Course Objectives (CO)	CO1: To make students aware about legal and ethical considerations. CO2: To increase awareness of human rights and changing moral principles of the community at large. CO3: To improve the quality of patient care by identifying, analyzing and attempting to resolve the ethical problems that arise in practice. CO5: Aware students to the Health Insurance Portability and Accountability Act of 1996.

UNIT-I

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

UNIT-II

Care of the terminally ill- Euthanasia, Organ transplantation, 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.

UNIT-III

Professional Indemnity insurance policy, The purpose of the Health Insurance Portability and Accountability Act of 1996 Development of standardized protocol to avoid near miss or sentinel events Obtaining an informed consent.

UNIT-IV

Malpractice and negligence - Rational and irrational drug therapy. Identify the problems associated with patient confidentiality

Description of information to which the Privacy Rule refers and how it applies to your profession, List which entities are affected by HIPAA. The penalties for noncompliance with HIPAA

Textbooks

S.No.	Title of Book	Author	Publication
1	Medical Law and Ethics	Bonnie F. Fremgen	Pearson
2	Medical Law and Ethics	Jonathan Herring	OUP UK
3	Medical Law and Ethics	Purosottam Behera	Mittal Publications
4	Reflections on Medical Law and Ethics in India	Bismi Gopalakrishnan, Mercy Khaute, B. Sandeepa Bhat	Eastern Law House

Professionalism and Values

Course Code	**BMRIT-008**
Course Title	**Professionalism and Values**
Type of course	Theory
LTP	1:0:0
Credits	1
Course Prerequisites	10+2(Science)
Course Objective (CO)	The module on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant is professionalism in terms of healthcare system and how it affects the overall patient environment

UNIT-I

Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality

UNIT-II

Personal values- ethical or moral values

Attitude and behavior- professional behavior, treating people equally

UNIT-II

Code of conduct, professional accountability and responsibility, misconduct

Differences between professions and importance of team efforts

UNIT-IV

Cultural issues in the healthcare environment

Misconduct

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Textbook of Medical Ethics	Erich H Loewy	Springer
2	Professionalism, Professional Values and Ethics in Nursing	Suresh K Sharma, Asha P Shetty	Jaypee Brothers Medical Publishers

Principals of Management

Course Code	BMRIT-009
Course Title	**Principals of Management**
Type of course	Theory
LTP	1:0:0
Credits	1
Course prerequisite	+2 in any stream
Course Objective (CO)	The course is intended to provide a knowledge about the basic principles of Management.

UNIT-I

Introduction to management
Strategic Management

UNIT-II

Foundations of Planning
Planning Tools and Techniques

UNIT-III

Decision Making, conflict and stress management
Managing Change and Innovation
Understanding Groups and Teams

UNIT-IV

Leadership
Time Management
Cost and efficiency

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Essentials of Professionalism, Professional Values & Ethics for BSc Nursing Students	Varinder Kaur	CBS Publishers and Distributors Pvt. Ltd
2	Professionalism Professional Values and Ethics in Nursing	Suresh K Sharma	Jaypee Brothers
3	Professionalism, Professional Values & Ethics	Shama Lohumi and Rakesh Lohumi	CBS publishers and Distributers PVT Ltd

English & Communication Skills

Course Code	**BMRIT-010**
Course Title	**English & Communication Skills**
Type of course	Theory
LTP	1:0:0
Credits	1
Course prerequisite	+2inanystream
Course Objective (CO)	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension. 2. Enable the learner with improved writing skills and command over official/corporate communication. 3. Enhance the learners'range of vocabulary and knowledge of the essentials of grammar.
Course Outcomes	At the conclusion of the course the learner will be able to: 1. Have good proficiency in reading comprehension. 2. Have enhanced writings kills and command in official/corporate communication. 3. Develop confidence in making presentation: oral or documentary.

UNIT-I

Language-Basic: Content: Review of grammar, Remedial study of grammar, building vocabulary Introduction Parts of speech, Exercise on use of grammar Tense, Number, Gender

Assessment methods: Objective type, Fill in the blanks. Content: Read and comprehend prescribed course books Reading, Summarizing, Comprehension

UNIT-II

Assessment methods: Fill in the blanks and one-mark questions, Content: Various Forms of Composition Letter writing, Note taking Precise, writings Diary, writing Reports on health problem etc. Official correspondence:

Outgoing correspondence, replying incoming correspondence, writing circulars, notices, charge memos, note taking, writing summaries, observation reports. Teaching learning activities: Exercise on writing: Letter writing, resume/CV Essay writing.

UNIT-III

Assessment methods: Applications, short reports to be written. Content: English- Spoken mode, Debates, Telephonic conversion, formal & informal conversation: Agreeing emphasizing, interrupting, politely, opinions, interviews, visual presentation. Teaching learning activities: Participating in seminar, Telephonic conversion, conversation in different situations, practice in public speaking

UNIT-IV

Assessment methods: Assessment of the skills based on the checklist. Content: Listening to comprehension media, audio, video, speeches, definition of listening, types of listening, purposes of listening, obstacles for listening, contexts of listening, to be a good listener, listening to a lecture etc. Teaching learning activities: Listening to audio, video tapes and identify the key points.

Assessment methods: Practical test of listening and filling out the blanks, essay type.

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Communicative Nursing Students English for General	Tom Koorkkakala	K.J. Publications
3	How to write and speak Better, Reader's	John Ellison Kahn	Reader's Digest Association
4	Communication Development And Soft Skill	Ashwini Deshpande	Career Publications

Basics of Radiation Physics Practical

Course Code	**BMRIT-003**
Course Title	**Basics of Radiation Physics Practical**
Type of course	Theory
LTP	2 0 6
Credits	5 (2+3)
Course prerequisite	10+2 Medical
Course Outcomes	Describe general physics related to imaging. Identify construction of radiology equipment's Interpret quality of control of radiology equipment's. Describe production of x-rays Differentiate between x-ray equipment's and other radiology related equipment's

LIST OF PRACTICAL

1. Basic concepts
2. Electricity and magnetism, Electromagnetic waves
3. Electronics
4. Discovery of x-rays-X-ray production and properties
5. Heat
6. Interaction of ionizing radiation with matter-
7. Exponential attenuation, Physical quantity, its unit and measurement

BMRIT Radiology Clinical Education–part I (studentship)

Course Code	**BMRIT-I**
Course Title	**BMRIT Radiology Clinical Education–part I (studentship)**
Type of course	Theory
LTP	0 0 15
Credits	5
Course prerequisite	10+2 Medical
Course Objective	• Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as student ship in every semester.
- Providesimulationandskilllabsforpracticingskillsspecifictotheprogramint heinitialyearsof observer ship/studentship.

Every semester must have seminars/workshops on new developments/technologies.

Check annexure for marking criteria.

SECOND SEMESTER

Basics of Microbiology

Course Code	**BMRIT-011**
Course Title	Basics of Microbiology
Type of course	Theory
LTP	2 0 0
Credits	2
Course prerequisite	10+2Medical
Course Objective	• Basics of Microbiology helps students to gain information about structure, metabolism reproduction, functionanddiseasescausedbybacteria,viruses,bacterialviruses,animalviruses,archaea,mycoplasma and Phyto plasma. It also makes students aware of the nature and other important aspects of the microorganisms
Course Outcomes	C01: Describe the structure, classification, morphology and growth of bacteria Describe the methods sterilization and disinfection and its applications CO2: Explain the concepts of immunity, hypersensitivity and immunization CO3: Describe Nosocomial infections and methods for prevention of Hospital acquired infections CO4: Describe the management of biomedical waste, List the common fungi and viruses and explain their importance

UNIT-I

Morphology of Bacteria: (Structure, size, shape, arrangement cell wall, flagella, spore, capsule, fimbria). Physiology of Bacteria: (Bacterial growth curve, Temp, O2, Co2, micro and macro nutrient growth requirements), Culture Media, Culture Methods Antimicrobial sensitivity tests,
Sterilization and Disinfections: Definition, Dry heat Sterilization, Moist heat Sterilization, Chemical disinfectants, Gaseous disinfection, Test for disinfection

UNIT-II

Infection: Classification, Sources of infection, Modes of transmission Nosocomial infection including biomedical waste management: Definition, Classification, Significance, Prevention and control, Biomedical waste management

UNIT-III

Immunology: Immunity, Antigen, Antibody, Hypersensitivity, General Properties of fungi. (General characters, classification, Morphology, Reproduction), General Properties of Viruses. (General character, classification based on Genome, Capsid, Envelope & replication and cultivation of virus).

UNIT-IV

Applied Microbiology: Pyrexia of unknown origin, Meningitis, Zoonotic infections, Hepatitis, HIV infection and AIDS, Food poisoning, Diarrhea, Urinary tract infections, Pulmonary Tuberculosis.

Text and Reference Book

S. No.	Title of Book	Author	Publication
1	Text book of Microbiology	Ananthnar ayana& Panikar	University Press
2	Text book of Microbiology	Baveja	Arya Publications
3	Text book of Microbiology	Sathish Gupte	JPB
4	Textbook of Microbiology	Dr Arora	CBS Publishers & Distributors Pvt. Ltd

Basics of Biochemistry

Subject Code	**BMRIT-012**
Course Title	**Basics of Biochemistry**
Type of Course	Theory
LTP	2:0:0
Credits	2
Course pre-requisite	10+2
Course Objectives(CO)	Biochemistry is a key component of all education programmes for MRITs and should have a strong focus on laboratory investigation with radiological procedures. The topics provide the student with an understanding of the blood investigation and relationships of the systems which are essential in patient preparation and procedures.
Course Outcomes	CO1: Understand the responsibility of health care personals and hazards faced in the clinical laboratory Explain the different types, use, care and maintenance of laboratory apparatus and instruments. Understand the fundamental chemistry and knowledge of different solutions CO2: Understand what acids, bases, salts and indicators are and also know about acid base balance Describe the sample collection procedure to analyse various biochemical parameters CO3: Describe assimilation of nutrients and consequences of malnutrition Understand the different functional tests like LFT (Liver function test), RFT (Renal function test) CO4: Understand the overview of tumor markers, cardiac markers, blood sugar and GTT, lipid profile and diagnostic enzymology Describe the applications of radioisotopes

UNIT-I

Nutrition, Calorific value, Nitrogen Balance, Respiratory quotient, BMR, Nutritional importance of carbohydrate, lipids, proteins, vitamins and minerals, Emphasis on parenteral nutrition

UNIT-II

Acid-Base Balance, Henderson, Hassel bach equation, Buffers of the body fluids, Ph regulation, Disturbance in acid base balance Aniongap, Basic principles & estimation of blood gases and ph.

Water & Electrolyte balance Over view of water and electrolyte balance Basic principles in estimation of Electrolyte Normal values and interpretation

UNIT-III

Clinical chemistry: Brief over view of normal values and interpretation of results Renal function Liver function tests Tumor markers Cardiac markers Diagnostic Enzymology Lipid profile Blood sugar and GTT Normal &Abnormal urine analysis

UNIT-IV

Radioisotopes: Definition, Application &Hazards Normal and abnormal urine analysis Clinical charts on LFT, RFT, and diagnostic enzymology

S.No.	Title of Book	Author	Publication
1	Text Book of biochemistry for dental students	Vasudevan, Sreekumari, Kannan Vaidyanathan	Jaypee Brothers
2	Biochemistry for Physiotherapy and allied health sciences students.	Nandini M, Beena V Shetty, Vinitha Ramanath Rai	Jaypee Brothers Medical Publisher (India)
3	Clinical chemistry	Varley	CBS Publishers & Distributors
4	Textbook of biochemistry for paramedical students	P Ramamoorthy	Jaypee Brothers Medical Publishers

Conventional Radiography and Equipment

Course Code	**BMRIT-013**
Course Title	**Conventional Radiography and Equipment**
Type of Course	Theory
L T P	4.0.2
Credits	4+1(5)
Course Prerequisites	10+2
Course Objectives (CO)	CO1: This course will provide students with practical and theoretical knowledge and analytical skills to obtain best diagnostic quality radiograph with minimal radiation dose to patient. CO2: Learning use of standardized techniques, measure each anatomic part to be radiographed, and practice the radiation dose- reduction procedures recommended. CO3: This course will provide students with practical and theoretical knowledge and analytical skills to obtain knowledge about special radiological equipments. CO4: To have knowledge about Picture archiving and communication system (PACS)

UNIT-I

X-ray tube: historical aspects, construction of X-ray tubes, requirements for X- ray production(Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes(Coolidge tubes, tube envelop and housing) cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulation and rotating tubes-line focus principle-space charge effect, tube cooling-Modern X-ray tubes-stationary anode, rotating anode, grid controlled X- ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating- Quality and intensity of x-rays-factors influencing them.

Production of x-rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart;
Rotating anode x - ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum.
Grid controlled and high speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation).Interlocking and X-ray tube overload protection.
Heat dissipation methods, tube rating, heat units, operating conditions and maintenance and Q.A procedures.

UNIT II

Filament current and voltage, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase

circuits. Types of generators, 3 phase, 6 and 12 pulse circuits-high frequency generators-falling load generators, Capacitors discharge and grid control systems.

X-ray generator circuits: Vacuum tube diodes-semi-conductor diodes- transistor-Rectification-half and full wave-self rectification-X-ray generator; filament circuit-kilo Voltage circuit-single phase generator-three phase generator- constant potential generator-Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing.

High tension circuits: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing quipment, mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation.

Interlocking circuits: Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.

UNIT III

Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer.

Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; Filters-inherent filters, added filters, heavy metal filters, grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.\

UNIT IV

Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid controlled x-ray tube.

Care and Maintenance of X-ray equipment;

General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.

S.No.	Title of Book	Author	Publication
1	Radiographic Imaging (Cbs)I.C.R.P.	D.N. Chesney & M.O Chesney	CBS Publishers & Distributors
2	An Introduction Of Physics to Diagnostic Radiography	Christensen, Curry & Dowdey	Lea & Febiger
3	Radiological Science for technologists	Stewart C Bushong	Mosby
4	Equipment for Diagnostic Radiography	E. Forster	Springer Dordrecht
5	The Physics Of Radiology And Imaging	K Thayalan	Jaypee

Clinical Radiography Positioning part I

Course Code	**BMRIT-014**
Course Title	**Clinical Radiography Positioning part I**
Type of Course	Theory
LTP	4.1.6
Credits	4+1+3 (8)
Course pre-requisite	10+2
Course Objectives	CO1: Understand the basic patient positioning during radiographic investigation. Apply special positioning skills for different pathological and physical conditions. CO2: Application of equipments while working in radiology departments. Choose proper position during radiography. CO3: Explain relative positions of x-ray tube and patient relevant exposure factors during radiography. Explain the use of accessories. CO4: Explain the anatomic and physiological basis of the procedure to be undertaken. Explain the radiographic appearances of both normal and common abnormal conditions.

UNIT-I

Principles of Radiography:

Preparation of the Room, Apparatus and Instruments Positions of the Patient: Erect, Sitting, Supine, Prone,
Lateral, Oblique, Decubitus Etc. Relative position of X-Ray tube and patient, relevant exposure factors. Use of accessories such as radiographic cones, grid and positioning aids. Anatomic and Physiological basis
of the procedure, Association with theory with practical work. Radiographic appearances, both normal and
common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and
types of subject. Radiation protection, use of gonad shield, practical methods of reducing radiation dose to the
patient.

UNIT-II

Upper limb:

Routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus. Supplementary projections for Scaphoid, Carpal tunnel, Ball Catchers projections, Head of the Radius, Supracondylar fracture and Olecranon process

Lower limb:

Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, knee- joint, patella and femurs. Supplementary projections for Talo-Calcaneal joint, Forced projections for torn ligaments, Flat Feet, Club Feet, Intercondylar projections for loose bodies in the knee, Axial projection for Patella

UNIT-III

Shoulder Girdle and Thorax:

Routine projections for the shoulder joint, Scapula, Acromio-Clavicular joint, Clavicle, Sternoclavicular joint, Sternum and Ribs. Supplementary projections for the axial projection of Clavicle, Bicipital groove, Coracoid process.

Vertebral Column:

Routine projections for Atlanto -Occipital joint, cervical spine, Cervico- thoracic Junction, thoracic Spine, lumbar Spine, Lumbo Sacral Region, Sacrum and Coccyx. Supplementary projections for the intervertebral foramina, posterior arch of Atlas, Flexion and Extension of Cervical Spine, Scoleosis and Kyphosis, Sacro Ileac Joint.

UNIT-IV-

Skull:

Routine projections for cranium and facial bones;Supplementary projections for trauma, Towne's method, Sellaturcica, Optic foramina, Jugular foramina, Temporal bones, Mastoids, Petrous bone, Zygomatic arches, Orbits, Maxillae, Nasal bones, Mandible, Temporomandibular joints.

Nasal Sinuses: Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, erect and horizontal projections for fluid levels.

Pelvic girdle and hip region:

Routine projections for the whole pelvis, Sacro-Ileac joints, hip joint and Neck of Femur. Supplementary projections for the greater and lesser trochanters of Femur. Frog leg projection, Ischeum, Symphysis Pubis, Ileum, Acetabulum and Congenital Dislocation of Hip, Arthrodesis.

Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.

RECOMMENDED BOOKS

S.No.	Author(s)	Title	Publisher
1	Clark	Radiography Positioning	
2	OPSharma	Radiology Of Positioning for Technician	
3	John Lampignano and Leslie E Kendrick	Bontrager'S Textbook Of Radiographic Positioning And Related Anatomy	Elsevier Science
4	Bruce W. Long &Jeannean Hall Rollins & Barbara J. Smith	Merrill's Atlas of Radiographic Positioning and Procedures	Mosby

Conventional Radiography and Equipment Practical

Course Code	BMRIT-013

Course Title	Conventional Radiography and Equipment
Type of Course	Theory
L T P	4.0.2
Credits	4+1(5)
Course Prerequisites	10+2
Course Objectives (CO)	CO1: This course will provide students with practical and theoretical knowledge and analytical skills to obtain best diagnostic quality radiograph with minimal radiation dose to patient. CO2: Learning use of standardized techniques, measure each anatomic part to be radiographed, and practice the radiation dose- reduction procedures recommended. CO3: This course will provide students with practical and theoretical knowledge and analytical skills to obtain knowledge about special radiological equipments. CO4: To have knowledge about Picture archiving and communication system (PACS)

LIST OF PRACTICALS

1. X-ray tube; Production of x-rays
2. Rotating anode x - ray tube; Grid controlled and high speed tubes; Heat dissipation methods
3. Filament current and voltage; X-ray generator circuits
4. High tension circuits; Interlocking circuits; Relays
5. Meters and exposure timers
6. Control of scattered radiation: Beam limiting devices
7. Fluoroscopy
8. Care and Maintenance of X-ray equipment

Clinical Radiography and Positioning part -I Practical

Course Title	**Clinical Radiography positioning part -I Practical**
Subject code	**BMRIT-014**
Type of Course	Theory
LTP	4.1.6
Credits	8(4+1+3)
Course pre-requisite	10+2
Course Objectives	Understand the basic patient positioning during radiographic investigation. Apply special positioning skills for different pathological and physical conditions. Application of equipments while working in radiology departments.Choose proper position during radiography. Explain relative positions of x-ray tube and patient relevant exposure factors during radiography. Explain the use of accessories. Explain the anatomic and physiological basis of the procedure to be undertaken. Explain the radiographic appearances of both normal and common abnormal conditions.

List of Experiments

Sr. No

1. Principles of Radiography
2. Upper limb
3. Lower limb
4. Shoulder Girdle and Thorax
5. Vertebral Column
6. Skull
7. Pelvic girdle and hip region, Skeletal survey

BMRIT Radiology Clinical Education–part II (studentship)

Course Code	**BMRIT-II**
Course Title	**BMRIT Radiology Clinical Education–part II (studentship)**
Type of course	Theory
LTP	0 0 15
Credits	5
Course prerequisite	10+2 Medical
Course Objective	• Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observer ship must include:

- Aminimumof14hoursperweekisconsideredasstudentshipineverysemesters.
- Providesimulationandskilllabsforpracticingskillsspecifictotheprogramintheinitialyearsof observership/studentship.

Every semester must have seminars/workshops on new developments/technologies.

Check annexure for marking criteria.

SEMESTER

THIRD

PATHOLOGY

Course Code	**BMRIT-015**
Course Title	**Pathology**
Type of Course	**Theory**
LTP	**2-0-0**
Credits	**2**
Course Objectives	**C0:1** Define the term "Disease" or concepts of Diseases. **C02:** Define, classify diseases and the medical terms used. Describe the cause and mechanism of a few common diseases they come across during their routine work. **CO3:** Names of the common laboratory tests done to diagnose the diseases like examination of urine, blood, other body fluids and tissues. **CO4:** Enumerate the proper methods of collection, preservation and delivery of the samples to the respective laboratories. Describe the procedures of procuring the whole blood or blood components from blood bank and the complications of blood transfusion.

UNIT-I

Introduction to Pathology, Cell membrane, Cytoplasm, contents and nucleus Various injuries – Cell changes – Reversible changes, fatty liver, hydropic changes and Irreversible changes

Irreversible changes – Necrosis. Types with examples. Apoptosis Pigments – Classification. Bilirubin, melanin, pathological calcification

Inflammation – Definition, classification, signs, vascular & cellular events in acute inflammation

Repair and wound healing, fracture healing, complications, factors influencing healing

Infectious diseases – Tuberculosis, leprosy, fungal diseases, malaria

UNIT-II

Blood collection for investigations, anticoagulant. Sample collection, labeling, transportation to labs

Common hematological tests – Peripheral blood smear, Haemoglobin, Packed cell volume, WBC count – variation of total and differential leukocyte count, Platelet count

Bone marrow Aspiration and biopsy; Indications, procedure, contraindications and complications

Anemias – Definition, classification, Iron deficiency anemia, causes, clinical features and lab diagnosis

Megaloblastic anemia – cause, classification, diagnosis. Briefly hemolytic anemia Leukemia – Definition, classification, lab diagnosis of Acute Leukemias (AML & ALL) and Chronic Leukemias (CML & CLL)

Bleeding disorders – Classification, Vascular, Platelet and coagulation factors contribution in clotting. Common Platelet disorders

Common coagulation disorders (Hemophilia, DIC). BT, CT, Prothrombin time and APTT for diagnosis

Blood grouping, cross matching, collection of blood from blood donors. Mandatory tests done in blood bank, blood components, complications of blood transfusion and its evaluation

UNIT-III

Osteomyelitis – Acute and chronic, Tubercular, causes,pathology & its complications

Diseases of joints – Osteoarthritis and Rheumatoid arthritis – causes, aetiopathogenesis, pathology, complications Metabolic disease of bones – Osteoporosis, Osteomalacia, Rickets

Cardiovascular diseases – Introduction, Atherosclerosis – definition, risk factors, sites/ organs, pathology manifestations, complications. Aneurysms – types, causes and complications

Ischemic heart disease (IHD) – Types, Pathogenesis of Angina, Myocardial infarctions and its complications Rheumatic heart disease – etiology, pathogenesis and morphology of the heart Hypertension – definition, causes, complications

Heart failure–Causes, pathophysiology, clinical manifestations and complications

UNIT-IV

Respiratory diseases – Chronic obstructive pulmonary airway diseases – causes, pathology and complications of each (asthma, bchronicbronchitis, emphysema, Broncheictasis in brief).

Pneumonia–classification, clinical features and morphology

Pulmonary tuberculosis – classification/ types, primary, complex, miliary TB and cavitatory TB, complications Pleural effusion – definition, causes, clinical features and diagnosis

Renal system; Glomerulonephritis, nephritic and nephrotic syndrome. Tubulointerstitial diseases, Renal failure – Acute and chronic. Pyelonephritis – Types, causes, organ changes and complications.

Renal stones – Causes, pathogenesis, clinical features. Hydronephrosis – causes, clinical features and diagnosis

BOOKS:

S.No.	Title of Book	Author	Publication
1	Textbook of Pathology with Pathology	Harsh Mohan	Jaypee Brothers Medical Publishers (P) Ltd
2	Pathology Basis of Disease	Robbins and Cotran	Saunders Elsevier
3	Text book on Pathology for DMLT & Paramedical Courses	Dr. I Clement	Emmess medical publishers
4	Text book of Pathology & Microbiology for Paramedical Students	Aruna Singh	Notion Press

Clinical Radiography Positioning Part-II

Course Code	**BMRIT-016**
Course Title	**Clinical Radiography Positioning Part-II**
Type of Course	**Theory**
LTP	**2-1-6**
Credits	**6 (3+3)**
Course-requisite	**10+2**
Course Objectives	**CO1:** Prepare management and positioning of patients. Correlate of indications, contraindications of the patient**:** Understand the patient preparations needed before any radiological examination. **CO2:** Generalize knowledge of post procedural care. Students will be able position the patients for radiological procedures. Knowledge of image quality in radiological images. **CO3** Management of patients in radiology department for various procedures. **CO4:** Ability to handle emergency situations in radiology department

UNIT-I

Dental Radiography

Technique for intra oral full mouth. - Occlusal projections. - Extra oral projections including orthopantomography. - Supplementary techniques.

Upper respiratory system

Technique for postnasal airways, larynx, trachea, thoracic inlet, Valsalva maneuver. - Phonation.

Lung and Mediastinum: 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.

UNIT-II

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**.**

Mammography: Basic views, special views, wire localization.

Localization of foreign bodies. Various techniques

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.

Trauma radiography/Emergency radiography.

UNIT-III

Neonatal and Pediatric Radiography, Forensic Radiography

Microradiography:

General principles, Requirement, Equipment, Technique.

Soft Tissue Radiography:

High and low kilo voltage technique; differential filtration. Non - screen technique - simultaneous screen and non –screen technique.

Multiple radiography.

Uses of soft tissue radiography.

UNIT-IV

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.

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.

Books Recommended

S.No.	Author(s)	Title	Publisher
1	John Lampignano), E. Kendric	Bontrager's Textbook of Radiographic Positioning and Related Anatom	mosby
2	Clark	A guide to radiological positioning	CBS publishers distributors pvt. Ltd

Radiography and image processing techniques

Course Code	**BMRIT-017**
Course Title	**Radiography and image processing techniques**
Type of Course	**Theory Core**
LTP	**2-0-2**
Credits	**3 (2+1)**
Course pre-requisite	**10+2 (Science)**
Course Objectives	**CO1:** Know basic physics of radiography processing system. Describe construction and working of film, intensifying screen, cassette, dark room and automatic processor **CO2:** Explain radiographic film Processing chemistry. Discuss the factors affecting image quality in radiographic image and their application **CO3:** Operate the workflow in x-ray imaging. Apply knowledge for the use of radiation factors. Demonstrate process the radiographic film in different systems **CO4:** Prepare care and maintenance of radiographic films, cassettes, intensifying screens, darkroom accessories and X-ray equipment

UNIT-I

Photographic Principles:

Radiographic film- construction and types; Photographic effect and latent image formation; Film density and log relative exposure; Characteristic curve – its formation and features; Spectral response; Film faults and Artifacts

Intensifying Screens: Luminescence-fluorescence and phosphorescence; Construction and types of Intensifying Screens; Intensification Factor, quantum detection and conversion efficiency; Film screen matching; Resolving power of Intensifying Screens; Speed of intensifying screen; Screen film contact tests; Advantages and limitations of Intensifying Screens

X-ray Cassette: Construction of X-ray cassettes; Types of cassettes; Mounting Intensifying Screens on cassettes; Care and maintenance of cassettes.

UNITII-

Dark Room – Planning & Construction: Planning for a small & large Hospital; Location of Dark Room; Construction of Dark Room; Ventilation; Wall Protection; Entrance to Dark Room - Single Door, Double Door, Labyrinth Dark Room Accessories: Dry bench; Hopper, Drawer.

Cupboard; Loading and unloading cassettes; Hangers, types of hangers and storage of hangers; Wet bench; Cleanliness, control of dust, dark room sinks; Hatches; Drier; Safe Lights-types and uses, factors affecting safelight performance, safelight Tests; Viewing room, Film dispensing

UNIT III-

Film Processing: Photochemistry; Principles: Acidity, alkalinity, pH,Developer; Rinsing; Fixer; Washing and drying;

Preparation of processing solutions; Manual processing apparatus; Effect of temperature in processing; Rapid processing

Automatic processor: Principle of working and features, thermal regulation and replenishment system; Care and maintenance of automatic processor; Advantages and limitations of automatic processor

UNITIV-

Day Light Film handling; Xeroradiography, Stereoscopy

The Radiographic Image: The emergent beam related to densities on film contrast – objective and subjective Radiation contrast, film contrast and Radiographic contrast- Density, Sharpness, Un sharpness

Resolution: Factors affecting resolution, choice of Kilovolt age and Mill amperage, Choice of Short Focus and Broad Focus, selection of Focus to Film Distance and Object to Film Distance selection of cassettes, Avoiding scatter radiation, magnification, distortion, penumbra

Reproduction of Radiographs: Copying Radiographs, Magnification and Minification Radiography Imaging Communication: Hospital Information System, Radiology Information System, PACS, DICOM

Books Recommended-

S.No.	Author(s)	Title	Publisher
1	D.N. Chesney & Chesney M.O	Radiographic Imaging (Cbs)I.C.R.P	Blackwell Scientific
2	Christensen, &Dowdey Curry	An Introduction Of Physics to Diagnostic Radiograph	Lea &Fibiger

Contrast & Special Radiological procedures

Course Code	**BMRIT-118**
Course Title	**Contrast Media & Special Radiological procedures**
Type of Course	**Theory(CC)**
LTP	2.1.6
Credits	**6 (3+3)**
Coursepre-requisite	**10+2**
Course Objectives	Prepare management and positioning of patients while performing radiological procedures. CO2: Correlate of indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for different radiological procedures. CO3: Understand the patient preparations needed before any radiological examination. Management of patients in radiology department for various procedures. CO4: Generalize knowledge of post procedural care. Precautions and care required in interventional suits.

UNIT I-

Introduction: General approach to Special Radiographic procedures, Responsibility of Radiology Technologist during radiological procedures, Preparation of patient for different procedures, Room layout in interventional radiology and fluoroscopy.

Contrast Media :Positive and Negative, Ionic & Non Ionic, Adverse Reactions to contrast media and patient management.

Emergency Equipments in the Radiology Department

UNIT -II-

Gastro Intestinal Tract: Barium Swallow; Barium Meal - Single and Double Contrast; Barium Meal Follow Through; Small Bowel Enema (Enteroclysis); Barium Enema - Gastrograffin Enema; Loopogram

Biliary Tract: Oral & Intravenous Cholecystography; Percutaneous Transhepatic Cholengiography; Percutaneous Transhepatic Biliary Drainage; Endoscopic Retrograde Cholangio pancreatography

UNIT- III-

Urinary System: IVU (Intravenous Urography), Retrograde Pyelo-uretero-graphy (RGU), Micturating Cysto-Urethrography, Ascending Urethrography

Reproductive System: Hysterosalpingogram, FTR (Fallopian Tube Recanalization)

UNIT-IV-

Central Nervous System: Cervical Myelography - Cisternal Puncture and Lateral Cervical Puncture, Lumbar Myelography, Myelography with water soluble and oily contrast media

Respiratory System: Bronchography, Percutaneous Lung Biopsy

Other procedures in radiology: Arthrography, Sialography, Lymphography, Sinography & Fistulography, Dacryocystography, Embolization & embolic agents

Books Recommended-

S. No.	Author(s)	Title	Publisher
1	Bhushan and Lakkhar	Radiographic Imaging (Cbs) I.C.R.P.	Arya Publications 2
2	Chapman	A guide to radiological procedures	Elsevier

Clinical Radiography Positioning Part-II Practical

Course Code	**BMRIT-016**
Course Title	**Clinical Radiography Positioning Part-II Practical**
Type of Course	**Theory**
LTP	**2-1-6**
Credits	**6 (3+3)**
Course pre-requisite	**10+2**
Course Objectives	The course provides knowledge of basic positioning techniques in radiology CO2: This course will provide knowledge on surface anatomy and positioning CO3: To provide knowledge about ward/ mobile radiography CO4: To provide knowledge about trauma/ emergency radiographic techniques

List of Experiments

1. Dental Radiography; Upper respiratory system
2. Lungs and Mediastinum; Abdominal viscera
3. Radiography in the ward; Mammography
4. Operation theatre techniques; C-arm
5. Neonatal and Paediatric Radiography; Forensic Radiography Microradiography
6. Soft Tissue Radiography Multiple radiography High kV Radiography

Scatter elimination; beam collimation; grid ratio Speed and type of grid movement Radiographic factor; application and uses

7. Localization of foreign bodies

Books Recommended-

S.No.	Author(s)	Title	Publisher
1	John Lampignano), E. Kendrick Leslie	Bontrager's Textbook of Radiographic Positioning and Related Anatomy	Mosby

SANT BABA BHAG SINGH
SBBSU
UNIVERSITY
KHIALA, DISTT. JALANDHAR (PUNJAB)

Radiography and image processing techniques practical

Course Code	**BMRIT-017**
Course Title	**Radiography and image processing techniques practical**
Type of Course	**Theory**
LTP	**2-0-2**
Credits	**3 (2+1)**
Course pre-requisite	**10+2**
Course Objectives	Enable the student/technologist to produce X-ray films of good quality and diagnostic value. Able to learn about Radiographic and Image processing Techniques. To learn about darkroom procedure To understand the construction and function of different components of cassettes

List Of practical

Demonstration of

1. Radiographic film; Intensifying Screens; X-ray Cassette

2. Dark Room – Planning & Construction

3. Film Processing; Photochemistry;

4. The emergent beam related to densities on film contrast – objective and subjective Radiation contrast, film contrast and Radiographic contrast- Density, Sharpness, Unsharpness; Factors affecting resolution; Reproduction of Radiographs

Contrast & Special Radiological procedures Practical

Course Code	**BMRIT-018**
Course Title	**Contrast Media & Special Radiological procedures Practical**
Type of course	**Theory**
LTP	2.1.6
Credits	**6 (3+3)**
Course prerequisite	NA
CourseObjective (CO)	To understand the contrast media, its types, allergic reactions CO2: To study the radiological procedures of GIT, Biliary, urinary, reproductive system etc. along with clinical indications, technique and post care.
Course Outcome	To study the contrast media, its types, allergic reactions CO2: To study the radiological procedures of GIT, Biliary, urinary, reproductive system etc. along with clinical indications, technique and post care. CO3: To outline the investigations to be done for the localization of foreign bodies. CO4: To understand high Kv radiographs

List of practical

1. General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures
2. Contrast media and their adverse reactions to contrast media and patient management
3. Procedures for gastrointestinal tract including barium studies

   Procedures for biliary tract, Procedures for urinary system and reproductive system
4. Procedures for central nervous system and respiratory system

BMRIT Radiology Clinical Education – part III (studentship)

Course Code	**BMRIT-III**
Course Title	**BMRIT Radiology Clinical Education – part III (studentship)**
Type of course	Theory
LTP	0 0 12
Credits	4
Course prerequisite	10+2 Medical
Course Objective	Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semesters.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.

Every semester must have seminars/workshops on new developments/ technologies.

Check annexure for marking criteria.

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FOURTH SEMESTER

Cross-Sectional Anatomy

Course Code	**BMRIT-019**
Course Title	**Cross-sectional Anatomy**
Type of Course	**Theory**
LTP	2.0.6
Credits	**5 (2+3)**
Course pre-requisite	**10+2 Medical**
Course Objectives	**CO1:** Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images. Describe anatomical structural relationships. **CO2:** Recognize normal anatomy and build a personal resource system for future study. Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy. **CO3:** On CT and MR images, identify anatomical structures of the body and of the head. **CO4:** Distinguish between arterial and venous anatomy of the entire body's vascular system. Classify the various sections of anatomical regions and their associated parts

UNIT I

Introduction to Sectional Anatomy & Terminology Sectional planes, Anatomical relationships/terminology Anatomy of the upper thorax-Surface anatomy relationships.

Bony structures and muscles, Blood vessels. Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Esophagus

UNIT-II

CT/MRI Images of the Thorax - Normal and abnormal imaging

Anatomy of the Abdomen Major organs and their accessories, Abdominal blood vessels

CT/MR Images of Abdomen –Normal and pathologic anatomy of the Pelvis- Bony structure and associated muscles, Digestive and urinary systems

Reproductive Organs - Normal and abnormal imaging

UNIT-III

CT/MR Images of the Male/Female Pelvis- Normal and pathologic Neuro Anatomy-Scan planes : Brain –Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves

UNITIV

CT/MR Images Spine- Vertebra and disc, Spinal cord and meninges

Neck- Arterial/venous systems, Muscles, Glands and pharynx

Textbooks:

S. No.	Title of Book	Author	Publication
1	Cross Sectional Anatomy CT & MR	G Bhavin Jhankaria	Jaypee Brothers Medical Publishers;
2	Step by step Cross-sectional Anatomy	D Karthikeyan	Jaypee brother medical publishers
3	Atlas of Cross Sectional Anatomy and Radiological Imaging	Dr David J. Jackowe	Anshan Ltd
4	Fundamentals of Sectional Anatomy: An Imaging Approach	Denise L. Lazo	Cengage Learning

Modern Radiological Imaging Equipment and Physics

Course Code	**BMRIT-020**
Course Title	Modern Radiological Imaging Equipment and Physics
Type of Course	**Theory**
LTP	2.1.2
Credits	**4**
Course pre-requisite	**10+2**
Course Objectives	CO1: Describe the special radiological equipment CO2: Describe PACS, RIS and HIS CO3: To learn about tele radiology. CO4: Describe the digital and computed radiography

UNIT-I

Modern x-ray tube. Digital Mammography and Tomosynthesis, Stitch radiography, Dual energy x-ray absorptionometry (DEXA) scan.

UNIT-II

Digital Radiography: its principle, physics & equipment. 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. Digital Portable and mobile x-ray units.

UNIT-III

Modern dental equipments. Cone beam dental CT.Fusion Imaging including PET-CT, PET- MRI. Digital Mammography, DEXA equipment- principle, advancements and applications

UNIT-IV

Tele radiology HIS,RIS and PACS. Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy system.

Recommended Books

S.No.	Author(s)	Title	Publisher
1	4th Edition by Jerrold T. Bushberg (Autho	The Essential Physics of Medical Imaging PDF,	

Interventional Radiography Techniques

Course Code	**BMRIT-021**
Course Title	**Interventional Radiography Techniques**
Type of Course	**Theory**
LTP	2.1.4
Credits	**5**
Course pre-requisite	**10+2**
	CO1:Know the basic principle and physics of interventional equipment. CO2:Know the management and positioning of patients while performing interventional radiological procedure. CO3Have knowledge about the indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for the different interventional radiological procedure.. CO4:Understand the patient preparation needed before any interventional radiological procedures. CO5:Have knowledge about the post procedural care and safety

UNIT-I

Introduction to interventional procedures DSA: basic principles and types Equipment: Basics of angiographic equipments, single and biplane angiographic equipments, angiographic table, image intensifier, flat panel detectors, recording systems, pulse oximetry, cardiac resuscitation measure-ECG, pressure injector, catheters, needle and other tools, 3D rotational angiography, image processing, patient monitor, CO2 angiography

UNIT-II

Interventional procedures: Catheter- classification, types and applications, Guide wire- classification, types and applications, Pressure Injector and Accessories, Percutaneous catheterization, Digital Subtraction Angiography, Catheterization Sites, Asepsis Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophysiology , Cardiac Catheterization procedures

UNIT-III

Arteriography: Head and Neck Arteriography, Pulmonary Arteriography, Coronary Arteriography, Ascending Aortography, Trans Lumbar Aortography, Renal Arteriography, Trans Femoral Arteriography Venography: Peripheral Venography- Lower Limb, Upper Limb, Central Venography, Superior Venacavography, Inferior Venacavography, Pelvic Venography

UNIT-IV-

Arthrography: Shoulder, Hip, Knee, Elbow

Safety considerations in angiography room; room design, protective devices, radiation monitoring

Care and maintenance tests: General care, functional test Quality assurance program: Acceptable limits of variation, corrective action

Books Recommended-

S.No.	Author(s)	Title	Publisher
1	EBIR Kessel, David, MB, BS, MA, MRCP, FRCR (Author), FRCR Robertson, Iain, MB, ChB, MRCP (Author	Interventional radiology: a survival guide	Elsevier Health Sciences
	davidKessel MB BS MA MRCP FRCR EBIR,Iain Robertson MB chb MRCP FRCR	Handbook of Interventional Radiologic Procedures	Elsevier Health Sciences

Patient care in Radiology

Course Code	**BMRIT-022**
Course Title	**Patient care in Radiology**

Type of Course	**Theory**
LTP	1.1.4
Credits	**4 (2+2)**
Course pre-requisite	**10+2**
Course objective	**CO1**: Understand the responsibility of the imaging technologist and other health care facility. Understand the management and care of patient during different procedures and emergency situations. **CO2**:Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination Differentiate the types of consent forms **CO3**: Know about infection control, infection source and isolation technique. Describe sterilization techniques. **CO4** Understand the radiation safety and protection

UNIT 1

Introduction to Patient Care: *Responsibilities of Medical Imaging Technologist, Obtaining Consents and history for different radiological examinations, Patient transfer and Restraining techniques, Obtaining vital signs, Ergonomics and body mechanism, Communication: Patient education, Communication with the patient, Professional role and behavior*

UNIT-II

Hospital procedure: *Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; outpatient and follow-up clinics; stock-taking and stock keeping.*

UNIT-III

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*

Nursing procedures in Radiology: *Injection- methods and their routes of administration, Clothing of patient, Administering rectal enema,*

First aid*: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.*

UNIT-IV-

Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only).

Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control

Departmental procedures: Department staffing and organisations; 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; appointments; organisations; minimizing waiting time; out-patient and follow-up clinics; stock taking and stock keeping

Drugs in the department and Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti-hypertensive etc. crash cart.

Medical ethics and records: Medico legal implication of MLC cases, Importance of consent, Consent in detail, Precaution while dealing with female patient, Medical records

Books Recommended-

S.No.	Author(s)	Title	Publisher
1	Ruth Ann Ehrlich, Dawn M Coake	Patient care in radiography	Mosby
	Ehrlich, Ruth Ann and joanA.daly	Patient care in radiography : with an introduction to medical imaging	st. Louis, Mo. : Mosby Elsevier

Cross-sectional Anatomy Practical

Course Code	**BMRIT-019**
Course Title	**Cross-sectional Anatomy Practical**

Type of Course	**Theory**
LTP	2.0.6
Credits	**5 (2+3)**
Course pre-requisite	**10+2**
Course Objectives	CO1: The course will facilitate vivid knowledge about the cross-sectional anatomy of whole body and various systems, like, Digestive System and Central Nervous System. CO2: The knowledge of the different systems in the body will enable the learners to appreciate the organization of the human body as a whole CO3:Know about normal and pathologic findings in the images in cerebral anatomy CO4:Know about Surface landmark-bony, muscular

LIST OF PRACTICALS

1. Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology

Anatomy of the upper thorax-Surface anatomy relationships, Bony structures and muscles, Blood vessels.

Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Esophagus

2. CT/MRI Images of the Thorax - Normal and abnormal imaging

Anatomy of the Abdomen-Major organs and their accessories, Abdominal blood vessels

CT/MR Images of Abdomen –Normal and pathologic anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems

Reproductive Organs - Normal and abnormal imaging

CT/MR Images of the Male/Female Pelvis- Normal and pathologic

3. Neuro Anatomy-Scan planes

Brain –Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves

Spine- Vertebra and disc, Spinal cord and meninges

Neck-Arterial/venous systems, Muscles, Glands and pharynx

Modern Radiological Imaging Equipment and Physics Practical

Course Code	**BMRIT-020**
Course Title	Modern Radiological Imaging Equipment and Physics Practical

Type of Course	**Theory**
LTP	2.1.2
Credits	**4**
Course pre-requisite	**10+2**
Course Objectives	Describe the special radiological equipments,Describe PACS, RIS and HIS To learn about tele radiology. Describe the digital and computed radiography

LIST OF PRACTICALS

1. Modern x-ray tube. Digital Mammography and Tomosynthesis, Stich radiography, Dual energy x-ray absorptionometry (DEXA) scan.

2. Computed radiography: its principle, physics & equipment. Digital Radiography: its principle, physics & equipment. 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. Digital Portable and mobile x-ray units.

3. Modern dental equipments. Cone beam dental CT.

4. Picture archiving and communication system (PACS), RIS and HIS.

Interventional Radiography techniques Practical

Course Code	**BMRIT-021**
Course Title	**Interventional Radiography Techniques Practical**
Type of Course	**Theory**
LTP	2.1.4
Credits	**5**
Course pre-requisite	10+2
Course Objectives	CO1:This course will provide students with introduction to radiology, diagnostic modalities and measures to produce a best diagnostic quality radiograph CO2:Students will be provided with learning activities appropriate to specific areas of responsibility as well as to the scope of practice CO3:Introduce students to immunology, bacteriology, parasitology, mycology

LIST OF PRACTICALS

1. *Basics of angiographic equipments*
2. *Catheter and guide wires*
3. *Arteriography and venography procedures*
4. *Safety considerations in angiography room*

Patient care in Radiology Practical

Course Code	**BMRIT-022**
Course Title	**Patient care in Radiology Practical**
Type of Course	**Theory**
LTP	1.1.4
Credits	**4 (2+2)**
Course pre-requisite	**10+2**
objective	Understand the responsibility of the imaging technologist and other health care facility. Understand the management and care of patient during different procedures and emergency situations. Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination Differentiate the types of consent forms

LIST OF Practical

1. Introduction to Patient Car and Communication

2. Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out- patient and follow-up clinics; stock-taking and stock keeping.

3. Care of the patient

4. Nursing procedures in Radiology and first aid

5. Infection and Principles of asepsis

6. Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control.

7. Drugs in the department and Storage and medical ethics and records

BMRIT Radiology Clinical Education – part IV (studentship)

Course Code	**BMRIT-IV**
Course Title	**BMRIT Radiology Clinical Education – part IV (studentship)**
Type of course	Theory
LTP	0 0 12
Credits	4
Course prerequisite	10+2 Medical
Course Objective	• Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semesters.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.

Every semester must have seminars/workshops on new developments/ technologies.

Check annexure for marking criteria.

FIFTH SEMESTER

Basics Techniques in CT Technology

Course Code	**BMRIT-023**
Course Title	**Basics Techniques in CT Technology**
Type of Course	**Theory**
LTP	4.1.8
Credits	**9(5+4)**
Course pre-requisite	**10+2**
Course Objectives	C01 Define basic principle and physics of Computed Tomography scan Recognize protocols needed for Computed Tomography examination CO2: Prepare and positioning for Computed Tomography examination Interpret post processing of raw Computed Tomography images Prepare and position the patients for Computed Tomography examination CO3: Categorize knowledge of improving image quality in Computed Tomography images. Plan of scanning with various Computed Tomography protocols for better representation of images CO4: Systematize post processing for Computed Tomography scan Management of patient for any post contrast reactions

UNIT-I

Introduction and history, CT principle, CT generations, CT Instrumentation, CT detectors, Axial & Helical CT – Slip ring technology Data acquisition, Image pre-processing/reconstruction techniques, Algorithms for image reconstruction, Image display, Image post-processing techniques, CT artifacts, Image quality

UNIT-II

CT Protocols for different body parts & Dental scan, CT Protocols for Angiography & Perfusion, CT contrast media and administration, CT guided interventional procedures

UNIT-III

Multi-detector CT Isotropic imaging, Cardiac CT, Flash CT, Advanced CT scanners, Dual energy & Dual Source Scanners, CT- fluoroscopy

UNIT-IV

Safety consideration,
Documentation in CT, Role of Medical Imaging technologist in CT scan procedures, Quality assurance in CT

Recommended Books

S. No.	Title of Book	Author	Publication
1	Computed Tomography: Physical Principles, Clinical Applications, and Quality Control	Euclid Seeram RT(R) BSc MSc FCAMRT (Author)	Saunders
2	Computed Tomography for Technologists: A Comprehensive Text	Lois Romans	Lippincott Williams and Wilkins;
3	Computed Tomography: Physics and Technology. A Self Assessment Guide	Euclid Seeram	Wiley-Blackwell
4	The CT Handbook: Optimizing Protocols for Today's Feature-Rich Scanners	Timothy P. Sz	Medical Physics Publishing Corporation
5	CT PROTOCOLS	Manjot Kaur, Maajid Mohi Ud Din Malik	JBD Publications

Radiation safety in diagnostic radiology

Course Code	**BMRIT-024**
Course Title	**Radiation safety in diagnostic radiology**
Type of Course	**Theory**
LTP	2.1.4
Credits	**5 (3+2)**
Course pre-requisite	**10+2**
Course Objectives	Aim and need of radiation protection CO2: Introduction to Radiation units and quantities CO3: Understanding of various Radiation protection regulations and the dose limits CO4: Radiation protection to patients, occupational workers and general public in Diagnostic Radiology. Layout of Radiology department Use of protective devices and awareness of radiation with radiation signages Dose reduction measures with technical protective considerations during radiology. Different radiation easuring devices Effects of radiation on biological tissue

UNIT-I

Radiation Quantities and Units: Radiation Radioactivity Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor – Flux Fluence-Kerma Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits Dose limits to public.

UNIT-II

Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry-Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effectsstochastic and deterministic effects-Acute exposure and chronic exposureLD50 - factors affecting radiosensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

UNIT-III

Radiation detection and Measurements: Ionization of gases Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters- scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical dosimeter- Thermoluminescent Dosimeter. Pocket dosimeter-Radiation survey meter- wide range survey meter -zone monitor- contamination monitor -their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography. Artificial Intelligence in Radiation Safety

UNIT-IV

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: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.

Recommended Books

S.No.	Author(s)	Title	Publisher
1	Euclid Seeram (Author), Patrick C. Brennan (Author)	Radiation Protection In Diagnostic X-Ray Imaging	Jones and Bartlett Publishers
2	Thayalan K	Textbook of Radiological Safety	Jaypee Brothers Medical Publishers

Quality Assurance in Diagnostic Radiology and Regulatory Requirements

Course Code	**BMRIT-025**
Course Title	Quality Assurance in Diagnostic Radiology and Regulatory Requirements
Type of Course	**Theory**
LTP	1.1.2
Credits	**3 (2+1)**
Course pre-requisite	**10+2**
Course Objectives	CO1: Aim and need of radiation protection. C02:Introduction to Quality assurance CO3: Understanding of regulatory requirements CO4: Follow radiation protection regulations and apply practically

UNIT I-

Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance. 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; 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 II-

QA in Diagnostic Radiology

Filtration Contact between film and intensifying screen, Contrast Verification of Optical and Radiation field congruence Beam alignment,Focal spot size,Linearity of tube current mA and Timer Applied potential, HVT and total tube Resolution,Grid alignment, QA in mammography, QA in CT QA in Digital Radiography.

UNIT III-

Regulatory requirements in Diagnostic Radiology

National Regulatory Body Responsibilities and organization Safety Standards

Codes and Guides

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

Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements

Role of technologist in radiology department 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 equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.

UNIT-IV

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.

S. No.	Title of Book	Author	Publication
1	Quality Assurance and Control in Diagnostic Radiology and Imaging	Bhargava	CBS Publishers and Distributors
2	Quality Assurance	Dr. R. Sundhararajan, M.V.Kumudhavalli, Minal T. Harde	Thakur Publications Pvt Ltd
3	Quality Assurance in Diagnostic Radiology	J. McLemore (Author	Imprint unknown
4	An Introduction to Quality Assurance in Radiology	Zafar Neyaz	JBD Publications

Basics Techniques in CT Technology Practical

Course Code	**BMRIT-023**
Course Title	**Basics Techniques in CT Technology Practical**
Type of Course	**Theory**
LTP	4.1.8
Credits	**9(5+4)**
Course pre-requisite	**10+2**
Course Objectives	C01 Define basic principle and physics of Computed Tomography scan Recognize protocols needed for Computed Tomography examination CO2: Prepare and positioning for Computed Tomography examination Interpret post processing of raw Computed Tomography images Prepare and position the patients for Computed Tomography examination CO3: Categorize knowledge of improving image quality in Computed Tomography images. Plan of scanning with various Computed Tomography protocols for better representation of images CO4: Systematize post processing for Computed Tomography scan Management of patient for any post contrast reactions

List of Practical

1. Introduction and history,

CT principle, CT generations, CT Instrumentation, CT detectors, Axial & Helical CT – Slip ring technology

2. Image post-processing techniques, CT artifacts

3. CT Protocols for different body parts & Dental scan,

CT Protocols for Angiography & Perfusion, CT contrast media and administration, CT guided interventional procedures

4. Multi-detector CT

5.Safety consideration,

Documentation in CT, Role of Medical Imaging technologist in CT scan procedures, Quality assurance in CT

Radiation safety in diagnostic radiology Practical

Radiation safety in diagnostic radiology Practical

Course Code	**BMRIT-024**
Course Title	**Radiation safety in diagnostic radiology Practical**
Type of Course	**Theory**
LTP	2.1.4
Credits	**5 (3+2)**
Course pre-requisite	**10+2**
Course Objectives	CO1: need of radiation protection CO2: Introduction to Radiation units and quantities CO3: Understanding of various Radiation protection regulations and the dose limits CO4: Radiation protection to patients, occupational workers and general public in Diagnostic Radiology. Layout of Radiology department Useofprotectivedevicesandawarenessofradiationwithradiationsignages Dosereductionmeasureswithtechnicalprotectiveconsiderationsdu ringradiology. Different radiation measuring devices

List of Practical

1. Radiation Quantities and Units
2. Biological Effects of radiation
3. Radiation detection and Measurements Survey meter and personal dosimeter
4. Artificial Intelligence in Radiation Safety
5. Radiation protection; Principles of radiation protection; ALARA
   Radiation Hazard evaluation and control

Quality Assurance in Diagnostic Radiology and Regulatory Requirements Practical

Course Code	**BMRIT-025**
Course Title	Quality Assurance in Diagnostic Radiology and Regulatory Requirements Practical
Type of Course	**Theory**
LTP	1.1.2
Credits	**3 (2+1)**
Course pre-requisite	**10+2**
Course Objectives	CO1:Aim and need of radiation protection. C02:Introduction to Quality assurance CO3:Understandingof regulatory requirements CO4:Follow radiation protection regulations and apply practically

List of practical

1. Quality assurance programme at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; 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

2. QA in Diagnostic Radiology

Filtration, Contact between film and intensifying screen

Contrast Verification of Optical and Radiation field congruence Beam alignment, Focal spot size

Linearity of tube current mA and Timer Applied potential

HVT and total tube Resolution

Grid alignment

QA in mammography QA in CT

QA in Digital Radiography

3. Regulatory requirements in Diagnostic Radiology

4. Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements

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.

BMRIT Radiology Clinical Education–part V (studentship)

Course Code	**BMRIT-V**
Course Title	**BMRIT Radiology Clinical Education–part V (studentship)**
Type of course	Theory
LTP	0 0 12
Credits	4
Course prerequisite	10+2 Medical
Course Objective	Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semesters.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.

Every semester must have seminars/workshops on new developments/ technologies.

Check annexure for marking criteria.

SIXTH SEMESTER

Basic techniques of Mri technology

Course Code	**BMRIT-026**
Course Title	**Basic techniques of Mri technology**
Type of Course	**Theory**
LTP	3.1.8
Credits	**8 (4+4)**
Course pre-requisite	**10+2 (Medical)**
Course Objectives	**CO1:** Define basic principle and physics of Magnetic Resonance Imaging. Recognize protocols needed for Magnetic Resonance Imaging examination. Prepare and positioning for Magnetic Resonance Imaging examination. **CO2:** Interpret post processing of Magnetic Resonance Imaging images. Prepare and position the patients for Magnetic Resonance Imaging examination. Categorize knowledge of improving image quality in Magnetic Resonance Imaging **CO3:** Scanning of patient with various Magnetic Resonance Imaging protocols for better representation of images. **CO4:** Plan of post processing for Magnetic Resonance Imaging data. Management of patient for any post contrast reactions.

UNIT-I

Introduction to MRI; Basic principle; Image weighting and contrast in MRI; Instrumentation of MRI-Magnets- classification, types, advantages, disadvantages, Gradient & Body Coils, RF coils, Shim coils, Ramping, Cryogen, RF shielding

UNIT-II

Encoding and Image formation-Encoding, K-Space; Parameters and Trade-offs; MRI Pulse sequences-Spin Echo pulse sequence, Gradient Echo pulse sequence; Fast imaging sequences

***UNIT*-III**

Flow phenomena; Flow phenomena compensation; Vascular Imaging- Digital Subtraction MRA, TOF-MRA, PC-MRA, Velocity Encoding, MR-Angiogram, MR- Venogr

UNIT IV

Cardiac Imaging; Whole body MRI Protocols; MRI Artifacts and their compensation; MRI contrast agents-T1 contrast agent, T2 contrast agent. MRI safety- Implants and pace-makers, Electrical safety, Metallic safety, Instrumental safety, Bio-effects of MRI; Documentation; Quality assurance in MRI

Recommended books

S.No.	Title of Book	Author	Publication
1	Tomography and Magnetic Resonance Imaging of the Whole Body (Vol.1& II) (Saunders).	John R. Haaga, Daniel Boll	Elsevier
2	MRI in Practice	Catherine Westbrook & Caralyn Kaut	Wiley–Blackwell
3	Protocols in MRI	Catherine Westbrook	Wiley-Blackwell
4	An Introduction to the Physics and Function of Magnetic Resonance Imaging	Dominik Weishaupt , Victor D. Koechli , Borut Marincek , J.M. Froehlich	Springer;
5	Concise Textbook of MRI Physics & Protocols	Maajid Mohi Ud Din Malik, Manjot Kaur	JBD Publications

Introduction to Nuclear Medicine Techniques

Course Code	**BMRIT-027**
Course Title	**Introduction to Nuclear Medicine Techniques**

Type of Course	**Theory**
LTP	1.1.2
Credits	**3 (2+1)**
Course pre-requisite	**10+2**
Course Objectives	CO1: Define basic principle and physics of nuclear medicine. CO2: Apply precautions while handling radiopharmaceuticals. CO3: Recognizing the artefacts associated with nuclear medicine. CO4: Assess the knowledge of improving image quality in nuclear medicine. Management of patient for any late reactions associated with radiotracers in nuclear medicine.

UNIT-1

History; Isotopes and Radionuclides- Production of Radionuclides, Transport of Radionuclides; Radio Activity-

Radio Active transformations, Specific Activity; Radiopharmaceuticals- Preparation, Precautions while handling

UNITII

Gamma Camera instrumentation - Collimator- classification and types;Single Photon Emission Computed Tomography (SPECT)

UNITIII

Positron Emission Tomography (PET); Advanced techniques in NM – SPECT-CT,PET-CT, PET-MRI

UNITIV

Safety Considerations & Radiation Dose in Nuclear Medicine; Room layout in nuclear medicine

Recommended Books

S.No.	Title of Book	Author	Publication
1	Nuclear Medicine Textbook: Methodology and Clinical Applications	DuccioVolterrani , Paola Anna Erba , IgnasiCarrió , H. William Strauss	Springer;
2	Nuclear Medicine Instrumentation	Jennifer Prekeges (Author)	Jones and Bartlett Publishers
3	Nuclear Medicine Physics: The Basics	Ramesh Chandra & Arman Rahmim	Wolters Kluwer
4	Nuclear Medicine Technology: Procedures and Quick Reference	Pete Shackett BA CNMT ARRT(N) (Author)	LWW;

5	A Concise Guide on Basic Radiation Physics, radiotherapy Physics & Nuclear Medicine	Lalit Agarwal, Dr. Arvind Shukla	JBD Publications

Ultrasound Techniques

Course Code	**BMRIT-028**
Course Title	**Ultrasound Techniques**
Type of Course	**Theory**
LTP	2.1.0
Credits	**3**
Course pre-requisite	**10+2**
Course Objectives	CO001: Describe the Ultrasound properties, interaction of ultrasound with matter CO2: Describe the transducer and types. Explain the concepts of image display CO3: Describe Doppler imaging and ultrasound contrast agents Describe the image characteristics and artefacts CO4: explain the safety considerations in ultrasound and protocols

UNIT-I

Ultrasound: Properties of ultrasound, interaction of ultrasound with matter. Transducers: Types of transducers,
advances in the design of modern ultrasound transducers

UNIT-II

Image display: Display modes, ultrasound instrumentation, controls, image storage, scan converter memory, photographic film, multi format camera,laser imager, colour and video thermal printer, computer
storage, pre and post processing techniques.

UNIT-III

Imaging: Doppler principles, continuous wave
Doppler and pulsed Doppler, duplex scanning, colour flow imaging, power doppler, harmonic imaging, extended field of view
Ultrasound contrast agents Doppler.

UNITIV

Image characteristics and artefacts: vascular,interventional, intraoperative and ophthalmic
ultrasonography, 3D and 4D ultrasound imaging.
Artificial Intelligence in Ultrasound Institutions for implementation: Violation by State, Violation by Individuals,
Nuclear Weapons and terrorism Safeguards.
Bio-effects and safety considerations in ultrasound, ultrasound system performance measurements, ultrasound equipment's quality assurance – conventional Doppler system testing and documentation

S.No.	Title of Book	Author	Publication
1	Ultrasound physics and technology	Vivien gibbs, davidcole, Antonio sassano	Churchill Livingstone;
2	Manual of Diagnostic Ultrasound	Philip E. S. Palmer (Author)	World Health Organization
3	Physics and Technical Aspects Diagnostic Ultrasound	DINESH K BAGHEL (Author	AITBS PUBLISHERS
4	Diagnostic Ultrasound	Carol M. Rumack (Author), Deborah Levine (Author)	Elsevier;
5	Ultrasound Imaging (1000 Multiple Choice Questions)	Yadav	JBD Publications

Biostatistics and Research Methodology

Course Code	**BMRIT-029**
Course Title	**Biostatistics and Research Methodology**
Type of Course	**Theory**
LTP	1.1.0
Credits	**2**
Course pre-requisite	**10+2**
Course Objectives(CO)	C01:The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings. C02:The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, C03:In addition to Being given information about the relation between data and variables. C04: Providing students the research Awareness.

UNIT-I

Introduction: Meaning, Definition, Characteristics of Statistics; Importance of the Study of Statistics. Branches

of Statistics; Descriptive and Inferential Statistics; Variables and Their Types. Measurement Scales

UNIT-II

Tabulation of Data: Raw Data, the Array, Frequency Distribution. Basic Principles of Graphical Representation; Types of Diagrams - Histograms, Frequency Polygons, Smooth Frequency Polygon, Commutative Frequency Curve, O give; Normal Probability Curve.

UNIT-III

Measure of Central Tendency: Need For Measures of Central Tendency; Definition and Calculation of Mean;

Ungrouped and Grouped Meaning,

Interpretation and Calculation of Median Ungrouped and Grouped; Meaning

Measure of Variability: Need For Measure of Dispersion. The Range, the Average Deviation, The Variance and Standard Deviation; Calculation of

Variance and Standard Deviation, Ungrouped and Grouped.

UNIT-IV

Probability and Standard Distributions: Meaning of Probability of Standard Distribution, The Binominal

Distribution. The Normal Distribution; Divergence from Normality - Skewness,Kurtosis

Sampling Techniques: Need For Sampling - Criteria for Good Samples. Application of Sampling in Community, Procedures of Sampling and Sampling Designs Errors. Sampling Variation and Tests of Significance

RECOMMENDEDBOOKS:

S. No.	Title of Book	Author	Publication
1	Elements of Health Statistics	Rao. N.S	
2	An introduction of Biostatistics	Sunder Rao	
3	Methods in Bio-Statistics	B.K. Mahajan	
4	Elementary Statistics in Medical Workers	Inderbir Singh	
5	An Introduction to. Statistical Methods, Ram Prasad &Sons	Gupta C.B	

Basic techniques of Mri technology Practical

Course Code	**BMRIT-026**
Course Title	**Basic techniques of Mri tecnology Practical**
Type of course	**Theory**
LTP	3.1.8
Credits	**8 (4+4)**
Course pre-requisite	**10+2**
course objectives	To understand the general considerations and principles of magnetic resonance imaging (MRI) in medical imaging.
	To demonstrate proficiency in performing and interpreting MRI scans of the head, neck, thorax, abdomen, and musculoskeletal system, including routine protocols and specialized techniques such as contrast-enhanced imaging and angiography.

LIST OF PRACTICALS

1. Instrumentation of MRI-Magnets- classification, types, advantages, disadvantages, Gradient & Body Coils, RF coils, Shim coils, Ramping, Cryogen, RF shielding

2. MRI Pulse sequences-Spin Echo pulse sequence, Gradient Echo pulse sequence; Fast imaging sequences

3. Flow phenomena; Flow phenomena compensation

4. Whole body MRI Protocols; MRI Artifacts and their compensation

5. MRI safety and Quality assurance in MRI

Introduction to Nuclear Medicine Techniques Practical

Course Code	**BMRIT-027**
Course Title	**Introduction to Nuclear Medicine Techniques Practical**
Type of Course	**Theory**
LTP	1.1.2
Credits	**3 (2+1)**
Course pre-requisite	**10+2**
Course Objectives	The objective is to learn basics about the radioactivity and radioactive nuclides. Assess the knowledge of improving image quality in nuclear medicine. Management of patient for any late reactions associated with radiotracers in nuclear medicine

LIST OF PRACTICALS

1. History; Isotopes and Radionuclides- Production of Radionuclides, Transport of Radionuclides; Radio Activity-

Radio Active transformations, Specific Activity; Radiopharmaceuticals- Preparation, Precautions while handling

2. Gamma Camera instrumentation - Collimator- classification and types;

3. Single Photon Emission Computed Tomography (SPECT); Positron Emission Tomography (PET);

Advanced techniques in NM - SPECT-CT, PET-CT, PET-MRI

Safety Considerations & Radiation Dose in Nuclear Medicine; Room layout in nuclear medicine

BMRIT Radiology Clinical Education – part VI (studentship)

Course Code	**BMRIT-VI**
Course Title	**BMRIT Radiology Clinical Education – part VI (studentship)**
Type of course	Theory
LTP	0 0 12
Credits	4
Course prerequisite	10+2 Medical
Course Objective	• Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semesters.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.

Every semester must have seminars/workshops on new developments/ technologies.

Check annexure for marking criteria.

SEVENTH & EIGTH SEMESTER

Internship

Course Code	**BMRIT-VII**
Course Title	**Internship**
Type of course	**Practical**
LTP	0.0.20
Credits	**20**
Course pre-requisite	**10+2**

INTERNSHIP – minimum 2400 hours (calculated based on 8 hours per day for one year of internship) Every candidate after passing all semesters examination is required to undergo compulsory internship to the satisfaction of the college authorities and University for a period of 1 year as to be eligible for the award of the degree. The internship is partial fulfillment of the requirements for the graduation and no candidate shall be declared to have completed the program otherwise. The internship shall be completed within 18 months of the date of passing final examination. Students must undertake the rotational postings during which students have to work under supervision of an experienced staff in the following areas: Students have to carry out a research project(on any topic related to radiology) under the supervision a faculty/hospital administration. The project report has to be prepared on the basis of the research work carried out. The assessment is done on the basis of the work done and the presentation and viva.

Internship

Course Code	**BMRIT-VIII**
Course Title	**Internship**
Type of course	**Practical**
LTP	0.0.20
Credits	**20**
Course pre-requisite	**10+2**

INTERNSHIP

INTERNSHIP– minimum 2400 hours (calculated based on 8 hours per day for one year of internship) Every candidate after passing all semesters examination is required to undergo compulsory internship to the satisfaction of the college authorities and University for a period of 1 year as to be eligible for the award of the degree. The internship is partial fulfillment of the requirements for the graduation and no candidate shall be declared to have completed the program otherwise. The internship shall be completed within 18 months of the date of passing final examination. Students must undertake the rotational postings during which students have to work under supervision of an experienced staff in the following areas: Students have to carry out a research project (on an topic related to radiology) under the supervision a faculty/hospital administration. The project report has to be prepared on the basis of the research work carried out. The assessment is done on the basis of the work done and the presentation and viva.

LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

Students have to do hands on practice on following Techniques:	
Exp. No.	**Name of Practical/ Exercise/ Assignment/ Case Study**
Seventh Semester	
1	Radiation Physics
2	Radiographic Positioning
3	Conventional Radiography and Equipment
4	Contrast Media& Special Radiological/ imaging procedures
5	Interventional Radiology/ imaging techniques
6	Patient Care in Radiology
Eighth Semester	
7	Basics Techniques in CT Imaging Technology
8	Radiation Safety in Diagnostic Radiology
9	Quality Assurance in Diagnostic Radiology and Regulatory Requirements
10	Basics Techniques in MRI Imaging Technology
11	Introduction to Nuclear Medicine Techniques* (if facility available)
12	Ultrasound Techniques

S.no	Posting	Duration
1	Conventional Radiography, Mammography, CR, DR and PACS	4months
2	Radiological Imaging & Special Procedures and Advanced Equipment's	2months
3	Ultrasonography & Doppler Imaging	1months
4	Interventional Radiology	1months
5	Computed Tomography	2months
6	Magnetic Resonance Imaging	2months