PRESIDENCY UNIVERSITY
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PROGRAMME REGULATIONS & CURRICULUM 2026-30

PRESIDENCY SCHOOL OF ALLIED AND HEALTHCARE PROFESSIONS

Bachelor of Medical Radiology and Imaging Technology (B.MRIT)

PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi | Approved By BCI
Bengaluru

Presidency School of Allied and Healthcare Professions

Program Regulations and Curriculum

Based on Competency Based Curriculum

Program: Bachelor of Medical Radiology and Imaging Technology

(B.MRIT)

2026-2030

Table of Contents

PART A – PROGRAMME REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 Vision of the University

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

1.2 Mission of the University

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- Impart globally applicable skill-sets to students through flexible course offerings, support industry's requirements, and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Allied and Healthcare Professions

To be a value-based, practice-oriented school committed to producing globally competent Allied Health Professionals who contribute to excellence in patient care, education, and community well-being.

1.4 Mission of Presidency School of Allied and Healthcare Professions

- Foster a dynamic learning environment that integrates theoretical knowledge with hands-on clinical practice.
- Attract and develop highly qualified faculty committed to excellence in teaching, research, and healthcare innovation.
- Establish state-of-the-art laboratories and clinical training facilities to enhance practical learning experiences.
- Encourage interdisciplinary collaboration to promote holistic patient care and inter-professional education.
- Instil leadership, ethical values, and a spirit of community service among students to meet global healthcare challenges.

1.5 Vision of the Programme – Bachelor of Medical Radiology and Imaging Technology (B.MRIT)

To cultivate globally competent, ethically grounded radiology and imaging technologists through excellence in education, innovation, and patient-centric practice, contributing to high-quality diagnostics and enhanced public health.

1.6 Mission of the Programme – Bachelor of Medical Radiology and Imaging Technology (B.MRIT)

- Deliver competency-based education combining core knowledge with advanced radiological techniques, ensuring ethical and safe clinical practice.
- Enhance hands-on learning through modern imaging laboratories, simulation facilities, and rigorous training in radiation protection.
- Foster innovation, research, and interdisciplinary collaboration to improve diagnostic care and integrated healthcare delivery.
- Develop leadership, integrity, and social responsibility to prepare graduates for global healthcare challenges.

2. Preamble to the Programme Regulations and Curriculum

This is the subset of the Curriculum and Regulations for the Bachelor in Medical Radiology and Imaging Technology (B.MRIT) as per the NCAHP Competency-Based Curriculum (CBC), 2025, and it is to be followed as a requirement for the award of the Bachelor of Medical Radiology and Imaging Technology (B.MRIT)degree. The curriculum is designed in alignment with the Choice Based Credit System (CBCS), emphasising practical and career-oriented learning. It incorporates Social Project-Based Learning, Industrial Training, and Clinical Internships to ensure that students gain real-world experience in clinical and diagnostic imaging settings. This practice-driven approach equips graduates with the necessary skills and competencies required for professional practice.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes, and the Curriculum and Regulations for the Bachelor in Medical Radiology and Imaging Technology (B.MRIT) as per NCAHP Competency-Based Curriculum (CBC), 2025, of the University, the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

- These Regulations shall be called the Bachelor of Medical Radiology and Imaging Technology (B.MRIT)Degree Programme Regulations and Curriculum, 2026–2030.
- These Regulations are subject to, and pursuant to, the Curriculum and Regulations for the Bachelor in Medical Radiology and Imaging Technology (B.MRIT) as per NCAHP Competency-Based Curriculum (CBC), 2025.
- These Regulations shall be applicable to the ongoing Bachelor of Medical Radiology and Imaging Technology (B.MRIT)Degree Programme of the 2026–2030 batch, and to all other Bachelor of Medical Radiology and Imaging Technology (B.MRIT)Degree Programmes which may be introduced in future.
- These Regulations shall supersede all earlier Bachelor of Medical Radiology and Imaging Technology (B.MRIT)Degree Programme Regulations and Curriculum, along with all amendments thereto.
- These Regulations shall come into force from the Academic Year 2026–2027.

4. Definitions

In these Regulations, unless the context otherwise requires:

a "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;

b "Academic Council" means the Academic Council of the University;

c *"*Curriculum and Regulations for the Bachelor in Medical Radiology and Imaging Technology (B.MRIT) as per NCAHP Competency-Based Curriculum (CBC), 2025.*" means the* Curriculum and Regulations for the Bachelor in Medical Radiology and Imaging Technology (B.MRIT) as per NCAHP Competency-Based Curriculum (CBC), 2025.*;*

d "Academic Term" means a Semester or Summer Term;

e "Act" means the Presidency University Act, 2013;

f "Basket" means a group of courses bundled together based on the nature/type of the course;

g "BOE" means the Board of Examinations of the University;

h "BOG" means the Board of Governors of the University;

i "BOM" means the Board of Management of the University;

j "BOS" means the Board of Studies of a particular Department/Program of Study of the University;

k "CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;

l "Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;

m "COE" means the Controller of Examinations of the University;

n "Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;

o "Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;

p "Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;

q "Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.

r "DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;

s "Dean" means the Dean / Director of the concerned School;

t "Degree Program" includes all Degree Programs;

u "Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;

v "Discipline" means specialization or branch of B.Sc. Degree Program;

w "HOD" means the Head of the concerned Department;

x "L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;

y "MOU" means the Memorandum of Understanding;

z "NCAHP" means National Commission for Allied Health Professionals;

aa "Parent Department" means the department that offers the Degree Program that a student undergoes;

bb "Program Head" means the administrative head of a particular Degree Program/s;

cc "Program Regulations" means the Bachelor of Science Degree Program Regulations and Curriculum, 2026-2030;

dd "Program" means the Bachelor in Medical Radiology and Imaging Technology (B.MRIT) Degree Program;

ee "PSoAHS" means the Presidency School of Allied and Healthcare Professions ;

ff "Registrar" means the Registrar of the University;

gg "School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;

hh "Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;

ii "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;

jj "Statutes" means the Statutes of Presidency University;

kk "Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;

ll "Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;

mm "UGC" means University Grant Commission;

nn "University" means Presidency University, Bengaluru; and

oo "Vice Chancellor" means the Vice Chancellor of the University.

5. Programme Description

- The Bachelor of Medical Radiology and Imaging Technology (B.MRIT)Degree Programme Regulations and Curriculum, 2026–2030, are subject to, and pursuant to, the NCAHP Competency-Based Curriculum (CBC), 2025. These Programme Regulations shall be applicable to the B.MRIT Degree Programme of 2026–2030 offered by the Presidency School of Allied and Healthcare Professions (PSoAHS).
- These Programme Regulations shall also be applicable to other similar programmes which may be introduced in future.

- These Regulations may evolve and be amended, modified, or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.
- The effect of periodic amendments or changes in the Programme Regulations on students admitted in earlier years shall be dealt with appropriately and carefully, to ensure that those students are not subjected to any unfair situation, although they are required to conform to these revised Programme Regulations, without any undue favour or consideration.

6. Minimum and Maximum Duration

6.1 Bachelor of Medical Radiology and Imaging Technology (B.MRIT)

The Bachelor of Medical Radiology and Imaging Technology (B.MRIT)Degree Programme is a Four-Year, Full-Time, Semester-Based Programme. The minimum duration of the programme is four (04) years, comprising eight (08) semesters – each academic year consisting of two semesters (Odd and Even).

The academic structure includes:

- Theory & Practical Classes: 2,115 Hours
- Internship: 2,400 Hours
- Total Hours: 4,515 Hours

6.2 Maximum Duration

- A student who, for any reason, is unable to complete the programme within the prescribed minimum duration may be granted an additional three (03) years beyond the normal period to fulfil the mandatory minimum credit requirements.
- In general, the maximum allowable duration for completion of the programme is defined as 'N + 3' years, where 'N' denotes the normal duration (i.e., 4 years). Therefore, the maximum duration to complete the B.MRIT programme is seven (07) years.
- The time taken by a student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (refer to the NCAHP CBC, 2025), shall be counted within the permissible maximum duration for completion of the Programme.
- In exceptional circumstances – such as temporary withdrawal for medical exigencies involving prolonged hospitalisation and/or treatment (certified through hospital/medical records), women students requiring an extended maternity break (certified by a registered medical practitioner), and outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sporting events – a further extension of one (01) year may be granted on the approval of the Academic Council.
- A student who fails to complete the mandatory requirements for the award of the Degree (refer to the NCAHP CBC, 2025) within the prescribed maximum duration shall have their enrolment terminated, and no Degree shall be awarded.

7. Programme Educational Objectives (PEO)

After four years of successful completion of the programme, the graduates shall be able to:

PEO No.	Programme Educational Objective
PEO1	Technical Proficiency: Graduates will possess a strong foundation in the principles and techniques of medical imaging, demonstrating competency in acquiring, processing, and interpreting radiological images.
PEO2	Patient Care and Safety: Graduates will prioritise patient safety and comfort, adhering to radiation protection guidelines and ethical practices in the delivery of diagnostic imaging services.

PEO3	Collaboration and Communication: Graduates will effectively collaborate with radiologists and other healthcare professionals, demonstrating clear and concise communication of imaging findings.
PEO4	Continuous Learning and Technological Adaptation: Graduates will be committed to lifelong learning and professional development, adapting to advancements in medical imaging technologies and methodologies.
PEO5	Quality Assurance and Improvement: Graduates will understand the principles of quality assurance in medical imaging and contribute to the continuous improvement of imaging protocols and practices.

8. Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme Outcomes (PO)

On successful completion of the programme, students shall be able to:

PO No.	Programme Outcome
PO1	Disciplinary Knowledge: Apply comprehensive knowledge of medical imaging physics, equipment operation, image acquisition techniques, and radiation safety protocols in clinical practice.
PO2	Critical Thinking: Analyse radiographic images and clinical information to contribute to accurate interpretations and informed diagnostic decisions.
PO3	Effective Communication: Communicate effectively with patients, radiologists, and other healthcare professionals regarding imaging procedures and findings.
PO4	Social Interaction: Collaborate effectively with multidisciplinary healthcare teams, demonstrating empathy and respect towards patients and colleagues in the imaging environment.
PO5	Effective Citizenship: Understand the role of medical imaging in public health and contribute to the well-being of the community through responsible professional practice.
PO6	Ethics: Uphold ethical principles, ensuring patient dignity, confidentiality, and informed consent.
PO7	Environment and Sustainability: Implement radiation safety practices and waste management protocols to minimise environmental impact in the medical imaging department.
PO8	Self-Directed and Lifelong Learning: Engage in continuous professional development to stay updated on advancements in medical imaging technologies, techniques, and clinical applications.
PO9	Research-Related Skills: Participate in basic research activities related to medical imaging and contribute to the advancement of imaging practices and patient care.
PO10	Scientific Interpretation: Interpret scientific literature and technical data related to medical imaging to inform clinical practice and problem-solving.
PO11	Information and Digital Literacy: Utilise digital imaging systems, medical databases, and information technology – including PACS and RIS – to manage patient data and enhance the efficiency and accuracy of imaging services.

8.2 Programme Specific Outcomes (PSO)

On successful completion of the programme, students shall be able to:

PSO No.	Programme Specific Outcome
PSO1	Diagnostic Imaging Execution: Apply knowledge of anatomy, physiology, pathology, and imaging protocols to accurately perform conventional and advanced diagnostic imaging procedures such as X-rays, CT, MRI, mammography, and fluoroscopy.
PSO2	Radiographic Equipment Handling: Safely operate, calibrate, and maintain a wide range of imaging equipment and accessories, including CR/DR systems, C-arm, ultrasound units, and digital fluoroscopy units.
PSO3	Radiation Safety and Protection: Implement radiation safety measures for self, patients, and staff in accordance with AERB and other national/international regulatory guidelines, using protective equipment and monitoring radiation exposure levels.
PSO4	Clinical Interpretation Support: Assist radiologists by acquiring optimal diagnostic images, managing contrast administration, positioning patients correctly, and recognising basic pathological findings relevant to imaging.
PSO5	Image Processing and Archiving: Perform digital image processing, quality control, and post-processing using PACS, RIS, and other imaging informatics and AI-assisted platforms, while ensuring patient data confidentiality and system integrity.
PSO6	Emergency and Trauma Imaging Support: Effectively perform imaging procedures in emergency and trauma situations, including mobile radiography and trauma CT protocols, ensuring speed, accuracy, and patient care.
PSO7	Ethical Practice and Professionalism: Demonstrate professionalism, empathy, communication skills, and ethical behaviour in patient interactions, interdisciplinary teamwork, and clinical decision-making in imaging settings.

9. Admission Criteria (as per the concerned Statutory Body)

- The University admissions shall be open to all persons irrespective of caste, class, creed, gender, or nationality. All admissions shall be made based on merit in the qualifying examinations and an entrance examination conducted by the University.
- An applicant who has passed the Higher Secondary (10+2) or equivalent examination, recognised by any Indian University or duly constituted Board, with Physics, Chemistry, and Biology (mandatory) and Mathematics (optional), securing a minimum of 50% marks in aggregate, shall be eligible for admission to the Programme. SC/ST candidates securing a minimum of 45% marks in aggregate shall be eligible for admission to the Programme.
- Candidates who have studied abroad and passed an equivalent qualification, as determined by the Association of Indian Universities, must have passed Physics, Chemistry, and Biology (mandatory) and Mathematics (optional) up to the 12th standard level.
- Foreign Nationals (FN), Persons of Indian Origin (PIO), and Children of Indian Workers in Gulf Countries (CIWGC) must have completed qualifying examinations considered equivalent by the Association of Indian Universities/Academic Council to be eligible for admission.
- Reservation for SC/ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.
- Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time by the Government of India.

- Candidates must fulfil the medical standards required for admission as prescribed by the University.
- If, at any time after admission, it is found that a candidate has not in fact fulfilled all the requirements stipulated in the offer of admission – in any form whatsoever, including possible misinformation or falsification – the Registrar shall report the matter to the Board of Management (BOM), recommending revocation of the candidate's admission.
- The decision of the BOM regarding admissions is final and binding.

10. Lateral Entry / Transfer Students Requirements

10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.MRIT Degree Programme as per the provisions/regulations of the Government and the National Commission for Allied and Healthcare Professions (NCAHP) pertaining to the "Lateral Entry" scheme, where such a scheme is permitted for the Programme. The general conditions and rules governing Lateral Entry are listed below:

10.1.1 Admission to the 2nd year (3rd Semester) of the Programme shall be open to candidates who have completed a minimum of two (02) years' full-time Diploma in Medical Radiology & Imaging Technology from a Government-recognised institution and who have secured a pass in the qualifying diploma examination.

10.1.2 Provided that such candidates must also have completed the Higher Secondary (10+2) or equivalent examination with Physics, Chemistry, and Biology as subjects.

10.1.3 Lateral Entry shall be permissible only if the subject studied at the Diploma level is the same as that in which admission is sought.

10.1.4 The number of students admitted under the Lateral Entry scheme shall not exceed twenty percent (20%) of the total annual intake for the Programme.

10.1.5 Eligibility of candidates for Lateral Entry shall be based on performance in the qualifying diploma examination and, where applicable, an entrance examination conducted in accordance with University admission procedure.

10.1.6 Candidates admitted under the Lateral Entry scheme must adhere to all programme-specific rules and regulations applicable from the 3rd Semester onwards, including curriculum structure and credit requirements.

10.1.7 Foreign Nationals and candidates qualified from foreign Universities/Boards must obtain equivalence certification from the Association of Indian Universities/competent equivalence authority prior to admission, confirming that their qualification is equivalent to the Indian diploma standard.

10.1.8 All existing University regulations, including any bridge courses prescribed by the University for Knowledge Alignment, shall be binding on students admitted through the Lateral Entry scheme. Such bridge courses, if prescribed, will not be included in CGPA calculations.

10.1.9 All courses (and the corresponding number of credits) prescribed for the 1st Year of the Programme shall be waived for students admitted through Lateral Entry. The Minimum Credit Requirements for the award of the B.MRIT Degree for a Lateral Entry student shall be calculated as: the Minimum Credit Requirements prescribed by these Regulations for the B.MRIT Degree, minus the number of credits prescribed for the 1st Year (1st and 2nd Semesters) of the Programme.

10.1.10 For instance, if the Minimum Credit Requirement for the award of the B.MRIT Degree as prescribed by these Regulations is 'N' credits, and the total credits prescribed for the 1st Year (1st and 2nd Semesters) of the Programme is 'M' credits, then the Minimum Credit Requirement for a student admitted through Lateral Entry shall be 'N – M' credits.

10.1.11 No waiver other than the courses prescribed for the 1st Year of the Programme shall be permissible for students admitted through Lateral Entry.

10.2 Transfer of Students from Another Recognised University to the 2nd Year (3rd Semester)

A student who has completed the 1st Year (i.e., passed in all courses/subjects prescribed for the 1st Year) of a Bachelor's Three/Four-Year Degree Programme from another recognised University may be permitted to transfer to the 2nd Year (3rd Semester) of the B.MRIT Degree Programme of the University, subject to the following:

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1, 10.1.2 and 10.1.3.

10.2.2 The student shall suBMRIT the Application for Transfer, along with a non-refundable Application Fee (as prescribed by the University from time to time), as notified by the University each academic year for admission to the 2nd Year (3rd Semester), commencing as notified by the University.

10.2.3 The student shall suBMRIT copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.2.4 The transfer may be granted on the condition that the courses and credits completed by the student in the 1st Year of the Bachelor's Degree Programme of the concerned University are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. The Equivalence Committee may also prescribe additional courses and credits that the student must mandatorily complete, if admitted to the 2nd Year of the B.MRIT Programme.

10.2.5 The Branch/Discipline allotted to the student shall be the decision of the University and binding on the student.

11. Specific Regulations regarding Assessment and Evaluation

(Including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment, and End Term Examination for various Course Categories)

11.1 The academic performance evaluation of a student in a course shall be in accordance with the University Letter Grading System, based on criterion-referenced assessment against defined Course Outcomes (COs), consistent with the competency-based nature of the B.MRIT programme.

11.2 Academic performance evaluation of every registered student in every registered course is carried out through various components of assessment spread across the semester. The nature of the components of Continuous Assessment, and the weightage given to each component, shall be clearly defined in the Course Plan for every course and approved by the DAC.

11.3 The format of the End-Term Examination shall be specified in the Course Plan.

11.4 Grading

Grading is the process of rewarding students for their overall performance in each course. For the B.MRIT programme, the University adopts an Absolute (criterion-referenced) Grading method throughout, under which a student's grade is determined by their attainment of defined competencies and Course Outcomes, and not by their performance relative to other students in the class. This applies uniformly to all categories of courses, including:

- Theory and Lab/Practice-based courses;
- Non-Teaching Credit Courses (NTCC);
- Clinical Education and Internship courses, where assessment is based on Clinical Competency Assessment, OSCE/OSPE, and skill checklists.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all prescribed components of assessment for the course. Letter Grades shall be awarded based on the student's attainment against the defined criteria for the course, and shall carry a quantitative (numeric) equivalent called the Grade Point.

11.5 Assessment Components and Weightage

Table 1: Assessment Components and Weightage for different category of Courses

Nature of Course	Evaluation Component	Weightage	Minimum Performance Criteria
Lecture-based Course(L component predominant; e.g., 3-0-0, 3-0-2, 2-1-0, 2-0-2)	Continuous Internal Evaluation (CIE):(a) 50% from two notified formative written tests;(b) 50% from internal assessments such as seminars, journal club presentations, case presentations, and assignments.	30% (CIE)	40% aggregate(refer Clause 10.3 / 11.7)
	End Semester Examination (ESE): University-conducted theory examination with pattern, type and weightage as per curriculum.	70% (ESE)	30% of ESE(refer Clause 11.7)
Lab/Practice-based Course(P component predominant; e.g., 0-0-4, 1-0-4, 1-0-2)	CIE: Laboratory work including records, performance, attendance, project reports, etc., along with two formative tests and internal assessments.	30% (CIE)	40% aggregate(refer Clause 10.3 / 11.7)
	ESE: Practical examination – spotters, equipment demonstration, case-based discussion, OSCE/OSPE, etc.	70% (ESE)	30% of ESE(refer Clause 11.7)
Skill-based Courses(Clinical Education, Internship, Capstone Project, Dissertation, Portfolio, NTCC)	Clinical Logbook, OSCE/OSPE, Clinical Competency Assessment Checklist, and Supervisor/Preceptor Evaluation, as specified in the Course Plan/PRC.	As specified(typically 40% CIE-equivalent)	As per Programme Regulations

The exact weightages of evaluation components shall be clearly specified in the respective Course Plan. For Practice/Skill-based Courses without a defined L-T-P credit structure (NTCC), evaluation shall be based only on Continuous Assessment; the components, their weightage distribution, and the method of evaluation shall be decided and indicated in the Course Plan/PRC and approved by the respective DAC.

Credit Transfer and MOOCs

Subject to verification and prior approval of NCAHP/the University, a student may be permitted to earn credit for courses completed through approved MOOC platforms (SWAYAM/NPTEL or equivalent), subject to a maximum of ten percent (10%) of the total credit requirement of the Programme, or such other percentage as may be prescribed by NCAHP from time to time. Credits so earned shall be mapped to an equivalent course in the Curriculum Structure by the concerned DAC and approved by the BOS, prior to being counted towards the Minimum Credit Requirement for the award of the Degree.

11.6 Minimum Performance Criteria

For Theory-only Courses and Lab/Practice-Embedded Theory Courses, a student shall satisfy the following minimum performance criteria to be eligible to earn the credits assigned to the course – these criteria, taken together, constitute the sole pass criterion referred to under the Criteria for Pass in Clause 10:

- A minimum of 30% of the total marks/weightage assigned to the End Term Examination in the concerned course; and

- A minimum of 40% of the aggregate of the marks/weightage of all assessment components (Continuous Assessment and End Term Examination, taken together) in the concerned course.

A student who fails to meet the above minimum performance criteria in a course shall be declared 'Fail' and awarded an 'F' grade in that course. For theory courses, the student shall re-appear in the 'Make-Up Examination' as scheduled by the University in a subsequent semester, or in the End Term Examination of the same course when next scheduled. Marks obtained in Continuous Assessment (other than the End Term Examination) shall be carried forward and included in computing the final grade, provided the student meets the minimum requirements in the Make-Up Examination. The student also has the option to re-register for the course and clear it in a subsequent semester or Summer Term, if offered.

Criteria for Pass

A candidate must secure a minimum of 40% in the aggregate of all assessment components (Continuous Internal Evaluation and End Semester Examination, taken together) in a course to be declared as having passed that course, subject to the minimum performance criteria specified in Clause 11.6. This is the sole and uniform pass criterion applicable throughout these Regulations; no separate or differing pass percentage shall apply under any other Clause.

Carry Over Benefit

For the purposes of this Clause, a 'backlog course' means a course in which a candidate has appeared for the End Semester Examination of a given semester but has not secured a pass as per the Criteria for Pass under Clause 10. A candidate who has appeared for all courses of a semester but has a backlog may avail of the carry-over benefit, subject to the following conditions:

- A candidate with a backlog of not more than two (02) courses in Semester I is allowed to proceed to Semester II, and shall clear the Semester I backlog course(s) concurrently with Semester II courses.
- A candidate with a backlog of not more than two (02) courses in Semester II is allowed to proceed to Semester III, provided all Semester I courses have been cleared.
- A candidate with a backlog of not more than two (02) courses in Semester III is allowed to proceed to Semester IV, provided all Semester II courses have been cleared.
- A candidate with a backlog of not more than two (02) courses in Semester IV is allowed to proceed to Semester V, provided all Semester III courses have been cleared.
- A candidate with a backlog of not more than two (02) courses in Semester V is allowed to proceed to Semester VI, provided all Semester IV courses have been cleared.
- Results of candidates shall be declared only at the end of Semester VI, once all backlog courses up to and including Semester V have been cleared.

Maximum Attempt

A candidate normally gets up to three (03) attempts to clear a course. However, this limit cannot cut short the candidate's full programme duration of 7 years total under Clause 6. If a candidate still has time left in this 7-year limit after using all three attempts, the DAC may recommend — and the Dean may approve — additional attempt(s), as per NCAHP norms. If the candidate still fails to clear the course even after all permitted attempts, the course will be treated as withdrawn.

Re-totaling

Re-totalling of marks is permitted only for theory papers. The University, on application within the stipulated time and on remittance of the prescribed fee, shall permit re-totalling of marks for the course(s) applied for. The marks obtained after re-totalling shall be final. No facility for re-evaluation of answer scripts is provided for any course.

Supplementary Examinations

Supplementary examinations shall be conducted by the University for the benefit of unsuccessful candidates. Lower-semester examinations shall be conducted by the University along with current-semester examinations, for the benefit of unsuccessful candidates.

A candidate detained for shortage of attendance shall be barred from appearing in any one or all course(s) for the supplementary examination, until the attendance requirement is satisfied.
A candidate permitted to appear for a supplementary examination may improve their Continuous Internal Evaluation marks prior to the supplementary examination only by undertaking a fresh internal assessment in the manner, and within the limits, prescribed by the concerned DAC for that course; such improvement is not permitted as a matter of right and shall not apply to components already certified as final (e.g., clinical logbook sign-off).

PART B: PROGRAMME STRUCTURE

12. Structure / Component with Credit Requirements – Course Baskets & Minimum Basket-wise Credit Requirements

The B.MRIT Programme Structure (2026–2030) totals 171 credits. Table 3 summarises the baskets and the credits mandatorily required for completion of the Degree; the basket-wise credits below have been verified against, and exactly match, the basket-wise credit distribution prescribed in the NCAHP Competency-Based Curriculum (CBC), 2025.

Table 3: Bachelor of Medical Radiology and Imaging Technology (B.MRIT): Summary of Minimum Credit Contribution from various Baskets

Sl. No.	Basket / Category	Credit Contribution
1	Foundation Courses (FC)	12
2	Core Courses (CC)	82
3	Programme Courses (PC)	9
4	Clinical Education (CE)	27
5	Internship	40
Total Credits		**170**

13. Minimum Total Credit Requirements for Award of Degree

The minimum total credit requirement for the award of the Degree is 170 credits, distributed across the baskets specified in Clause 12, in accordance with the guidelines of NCAHP/the Ministry of Health & Family Welfare (MoHFW).

14. Other Specific Requirements for Award of Degree, as prescribed by Statutory Bodies

- The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and the Board of Management of the University.
- A student shall be declared eligible for the award of the Degree if she/he:
- Has fulfilled the Minimum Credit Requirements and the minimum credit requirements under each basket specified in Clause 12;
- Has secured a minimum CGPA of 4.50 in the Programme at the end of the Semester/Academic Term in which all requirements for the award of the Degree are completed, as specified in the NCAHP CBC, 2025;
- Has satisfactorily completed the full 12-month (2,400-hour) clinical Internship prescribed under Clause 16, and has a duly certified Clinical Logbook and Clinical Competency Certification on record;
- Has no dues to the University, Departments, Hostels, Library, or any other Centre/Department of the University; and
- Has no disciplinary action pending against her/him.

Board of Examiners

The Examination Committee shall recommend, in the manner determined by the University/State Council examination regulations, names of suitable subject experts to chair the panels of the Board of Examiners for setting and moderating question papers, and shall constitute the panels of moderators, senior examiners and examiners, as per University/State Council examination regulations, for each semester (except the 7th and 8th Semesters, which are evaluated as per the Internship assessment scheme under Clause 16).

Role	Designation / Requirement
HOD of Radiology	Chairperson
Programme Co-ordinator / Course Co-ordinator / Chief of MRIT / In-charge of MRIT	Co-Chairperson
Subject Experts – External Examiner (two)	The examiner must be a subject expert.
Subject Experts – Internal Examiner (two)	The examiner must be a subject expert.

PART C: CURRICULUM STRUCTURE

15. Curriculum Structure – Basket-wise Course List

All courses are listed below, basket/category-wise, as per the credit distribution shown in Clause 12.

Table 3.1: Foundation Courses (FC)

S. No	Course Code	Course Name	L	T	P	C
1	BMRIT- 001	Human Anatomy	3	–	0	3
2	BMRIT -002	Physiology	3	–	0	3
3	BMRIT -015	Pathology	2	–	–	2
4	BMRIT -011	Basics of Microbiology	2	–	–	2
5	BMRIT -012	Basics of Biochemistry	2	–	–	2
Total No. of Credits						12

Table 3.2: Core Courses (CC)

S. No	Course Code	Course Name	L	T	P	C
1	BMRIT -003	Basic Radiation Physics	2	–	6	5
2	BMRIT -013	Conventional Radiography and Equipment	4	–	2	5
3	BMRIT -014	Clinical Radiography Positioning (Part I)	5	–	6	8
4	BMRIT- 016	Clinical Radiography Positioning (Part II)	3	–	6	6
5	BMRIT- 017	Radiography and Image Processing Techniques	2	–	2	3
6	BMRIT-018	Contrast Media and Special Radiological Procedures	3	–	6	6
7	BMRIT- 019	Cross-Sectional Anatomy	2	–	6	5
8	BMRIT-020	Modern Radiological Imaging Equipment and Physics	3	–	2	4
9	BMRIT- 021	Interventional Radiology Techniques	3	–	4	5
10	BMRIT- 022	Patient Care in Radiology	2	–	4	4
11	BMRIT- 023	Basic Techniques in CT Technology	5	0	8	9
12	BMRIT- 024	Radiation Safety in Diagnostic Radiology (incl. AERB Competencies)	3	–	4	5
13	BMRIT- 025	Quality Assurance in Diagnostic Radiology and Regulatory Requirements	2	–	2	3
14	BMRIT- 026	Basic Techniques in MRI Technology	4	0	8	8
15	BMRIT- 027	Introduction to Nuclear Medicine Techniques	2	–	2	3
16	BMRIT- 028	Ultrasound Techniques	3	–	–	3
Total No. of Credits						82

Table 3.3: Programme Courses (PC)

S. No	Course Code	Course Name	L	T	P	C
1	BMRIT- 004	Introduction to Healthcare	1	–	–	1
2	BMRIT- 005	Medical Terminology and Record Keeping	1	–	–	1
3	BMRIT- 006	Basic Computers and Information Science (incl. PACS/RIS Fundamentals)	1	–	0	1
4	BMRIT- 007	Medical Law and Ethics	1	–	–	1
5	BMRIT- 008	Professionalism and Values	1	–	–	1
6	BMRIT- 009	Principles of Management	1	–	–	1
7	BMRIT- 010	English and Communication Skills	1	–	–	1
8	BMRIT- 029	Biostatistics and Research Methodology	2	0	–	2
Total No. of Credits						9

Table 3.4: Clinical Education (CE)

Clinical Education postings are spread across Semesters I–VI and shall, in line with NCAHP requirements, cover rotations through Conventional Radiography (X-ray), CT, MRI, Mammography, Fluoroscopy, Operation Theatre (OT)/Interventional Radiology, and Emergency/Trauma Imaging, with attendance, clinical logbook entries and OSCE/OSPE-based competency sign-off maintained for each rotation.

S. No	Course Code	Course Name	L	T	P	C
1	–	B.MRIT Radiology Clinical Education – Part I (Studentship)	0	0	15	5
2	–	B.MRIT Radiology Clinical Education – Part II (Studentship)	0	0	15	5
3	–	B.MRIT Radiology Clinical Education – Part III (Studentship)	0	0	12	4
4	–	B.MRIT Radiology Clinical Education – Part IV (Studentship)	0	0	12	4
5	–	B.MRIT Radiology Clinical Education – Part V (Studentship)	0	0	12	4
6	–	B.MRIT Radiology Clinical Education – Part VI (Studentship)	0	0	15	5
Total No. of Credits						27

Table 3.5: Internship

S. No	Course Code	Course Name	L	T	P	C
1	–	Internship Clinical Posting (Part I) – 6 months (1,200 hours)	–	–	40	20
2	–	Internship Clinical Posting (Part II) – 6 months (1,200 hours)	–	–	40	20
Total No. of Credits						40

The Internship (Semesters VII–VIII) constitutes a single continuous, compulsory 12-month (2,400-hour) clinical internship under qualified supervision, as prescribed by NCAHP for the B.MRIT programme, divided into two parts of six months each for administrative and assessment purposes. This compulsory clinical internship is distinct from, and not to be confused with, the optional short-duration industry/academic internship referred to in Clause 16.

16. Practical / Skill-based Courses – Internship / Capstone Project / Portfolio

Practical/Skill-based Courses – such as project work, capstone project, research project/dissertation and similar courses where the pedagogy does not lend itself to a typical L-T-P-C structure – are assigned credits based on the quantum of work/effort required to fulfil the prescribed learning objectives and outcomes. Such courses are referred to as Non-Teaching Credit Courses (NTCC). For the B.MRIT programme, NTCC offerings include, by way of illustration:

- Clinical Logbook (continuous documentation of clinical procedures performed/assisted);
- Case Presentation;
- Clinical Portfolio;
- Clinical Competency Assessment / OSCE-OSPE-based skill checklists.

These courses are designed to provide students with hands-on experience and skills essential for professional development, equipping them with abilities in problem identification, root-cause analysis, problem-solving, and clinical decision-making through clinical exposure and project-based learning. The method of evaluation and grading for these courses shall be prescribed and approved by the concerned DAC and specified in the Course Handout.

Minor Project / Dissertation: A Minor Project or Dissertation does not form part of the NCAHP-prescribed B.MRIT curriculum and is not a mandatory requirement for the award of the Degree. Where offered by the School, it shall be treated strictly as an optional enrichment activity, carrying enrichment/co-curricular recognition only, and shall not be counted towards the Minimum Credit Requirement specified in Clause 12/13.

MOOC Courses

Students are encouraged to undertake additional MOOC courses (via SWAYAM/NPTEL or equivalent recognised platforms) relevant to the discipline, subject to the Credit Transfer and MOOCs conditions in Clause 11. Recommended areas for B.MRIT students include, in particular:

- Medical Imaging and Digital Imaging Informatics;
- Artificial Intelligence (AI) in Healthcare / Medical Imaging;
- Radiation Biology and Radiation Protection;
- Hospital Management;
- Patient Safety and Quality Management in Healthcare.

17. Recommended Semester-wise Course Structure / Flow

Semester I

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	BMRIT- 001	Human Anatomy	3	0	0	3	3	FC
2	BMRIT -002	Physiology	3	0	0	3	3	FC
3	BMRIT -003	Basic Radiation Physics	2	0	6	5	8	CC
4	BMRIT- 004	Introduction to Healthcare	1	–	–	1	1	PC
5	BMRIT- 005	Medical Terminology and Record Keeping	1	–	–	1	1	PC
6	BMRIT- 006	Basic Computers and Information Science	1	–	0	1	1	PC
7	BMRIT- 007	Medical Law and Ethics	1	–	–	1	1	PC
8	BMRIT- 008	Professionalism and Values	1	–	–	1	1	PC
9	BMRIT- 009	Principles of Management	1	–	–	1	1	PC
10	BMRIT- 010	English and Communication Skills	1	–	–	1	1	PC
11	–	BMRIT Radiology Clinical Education – Part I (Studentship)	–	–	15	5	15	CE
Total			**15**	**–**	**21 + 15**	**23**	**36**	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

Semester II

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	BMRIT-011	Basics of Microbiology	2	–	–	2	2	FC
2	BMRIT-012	Basics of Biochemistry	2	–	–	2	2	FC
3	BMRIT-013	Conventional Radiography and Equipment	4	–	2	5	6	CC
4	BMRIT-014	Clinical Radiography Positioning (Part I)	5	–	6	8	11	CC
5	–	B.MRIT Radiology Clinical Education – Part II (Studentship)	–	–	15	5	15	CE
Total			13	–	23 +15	22	36	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

Semester III

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	BMRIT-015	Pathology	2	–	–	2	2	FC
2	BMRIT-016	Clinical Radiography Positioning (Part II)	3	–	6	6	9	CC
3	BMRIT-017	Radiography and Image Processing Techniques	2	–	2	3	4	CC
4	BMRIT-018	Contrast Media and Special Radiological Procedures	3	–	6	6	9	CC
5	–	B.MRIT Radiology Clinical Education – Part III (Studentship)	–	–	12	4	12	CE
Total			10	–	14 +12	21	36	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

Semester IV

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	BMRIT-019	Cross-Sectional Anatomy	2	–	6	5	8	CC
2	BMRIT-020	Modern Radiological Imaging Equipment and Physics	3	–	2	4	5	CC
3	BMRIT-021	Interventional Radiology Techniques	3	–	4	5	7	CC
4	BMRIT-022	Patient Care in Radiology	2	–	4	4	6	CC
5	–	B.MRIT Radiology Clinical Education – Part IV (Studentship)	–	–	12	4	14	CE
Total			10	–	16 +12	22	38	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

Semester V

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	BMRIT-023	Basic Techniques in CT Technology	5	0	8	9	13	CC
2	BMRIT-024	Radiation Safety in Diagnostic Radiology (incl. AERB Competencies)	3	–	4	5	7	CC
3	BMRIT-025	Quality Assurance in Diagnostic Radiology and Regulatory Requirements	2	–	2	3	4	CC
4	–	B.MRIT Radiology Clinical Education – Part V (Studentship)	–	–	12	4	12	CE
Total			10	0	14 +12	21	36	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

Semester VI

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	BMRIT-026	Basic Techniques in MRI Technology	4	0	8	8	12	CC
2	BMRIT-027	Introduction to Nuclear Medicine Techniques	2	–	2	3	4	CC
3	BMRIT-028	Ultrasound Techniques	3	–	–	3	3	CC
4	BMRIT-029	Biostatistics and Research Methodology	2	0	0	2	2	PC
5	–	B.MRIT Radiology Clinical Education – Part VI (Studentship)	–	–	15	5	15	CE
Total			11	0	10 +15	21	36	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

Semesters VII and VIII – Compulsory Clinical Internship

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hrs	Basket
1	–	Internship Clinical Posting (Part I) – Compulsory Clinical Internship	–	–	–	20	–	Int.
2	–	Internship Clinical Posting (Part II) – Compulsory Clinical Internship	–	–	–	20	–	Int.
Total			–	–	–	40	–	

FC = Foundation Courses; CC = Core Courses; PC = Programme Courses; CE = Clinical Education; Int. = Internship.

18. Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Program Electives

SEMESTER I

Course Code: BMRIT-001	**Course Title:** Human Anatomy **Type of Course:** Foundation Course	**L-T-P-C**	3	0	0	3
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides a foundational understanding of the human anatomy including the structure and organisation of various organs and systems. It introduces the basic tissues, topography, surface markings and histological features of organs, and integrates embryology and basic clinical applications.					
Course Objectives	1. To familiarise students with the general and microscopic anatomy of the human body. 2. To understand the disposition and relations of different anatomical structures. 3. To introduce histological and radiographic appearances of normal anatomical features. 4. To provide basic knowledge of embryological development and key sensory organs.					
Course Outcomes	1. Describe the general anatomy of human body. 2. Explain normal disposition of various structures and organs in the body and its clinical correlation. 3. Describe the microscopic structure of various tissues. 4. Determine the topography of various structures on the surface of the body. 5. Identify and locate structures of the body. 6. Identify organs and tissues under microscope. 7. Point out various features of appearance of normal body in skiagrams.					
Course Content						
Module 1	**Human Body as a Whole**			**6 Sessions**		
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.						
Module 2	**Locomotion and Support**			**8 Sessions**		
Cartilage – types, examples and histology						

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

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

Important muscles of the body- Sternocleidomastoid, Trapezius, Muscles of tongue, Deltoid, Biceps brachii, Intercostal muscles, Thoracic diaphragm, Rectus abdominis, External oblique, Internal oblique, Transversus abdominis, Pelvic diaphragm, Gluteus maximus, Gluteus medius, Gluteus Minimus, Quadriceps femoris, Soleus.

Module 3	**Cardiovascular and Respiratory Systems**			**8 Sessions**

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 8 Sessions thoracic duct, Lymphatic tissues and its histology, Regional lymph nodes – cervical, axillary and inguinal lymph nodes.

Respiratory System

Parts of RS – nose, nasal cavity, paranasal air sinuses, larynx, trachea, lungs, pleura, bronchopulmonary segments, Histology of trachea and lungs.

Module 4	**Gastrointestinal System**			**6 Sessions**

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.

Module 5	**Urinary, Reproductive, and Endocrine Systems**			**8 Sessions**

Urinary System

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

Reproductive System

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

Endocrine Glands

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.

Module 6	**Nervous System, Sensory Organs and Embryology**			**7 Sessions**

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

	13. Capacity to integrate visual and tactile information for accurate identification 14. Ability to differentiate anatomical features on radiographic images (skiagrams)
Targeted Application and Tools that can be used	*1.* **Microscopic study of tissues and glands** – *Light microscope with stained histology slides.* 2. **Gross anatomy of bones, cartilage, and muscles** – *Bone specimens, fetal skull models, muscle dissections, and radiographs.* *3.* **Cardiovascular and lymphatic system** – *Preserved heart and vessels, angiograms, chest X-rays, and lymph node specimens.* 4. **Respiratory and gastrointestinal systems** – *Lung and GI tract specimens, radiographs, and histological slides.*
	5. **Urinary and reproductive systems** – *Organ specimens, radiographic imaging (IVP, cystogram, hysterosalpingogram), and histology slides*. 6. **Endocrine glands and nervous system** – *Gland specimens, brain and nerve models, histological slides*. *7.* **Sensory organs and embryology** – *Eye and ear models, histology slides, embryological charts and models.* *8.* **Surface anatomy and imaging correlation** – *Surface marking charts, anatomical models, and radiographs.*

Project Work:	1. **Construct a 3D model or interactive chart of the human organ systems, showing spatial relationships and structural divisions** (skeletal, muscular, nervous, cardiovascular, respiratory, digestive, urinary, reproductive, and endocrine). *(Type: Group Model-based Assignment)* 2. **Prepare a tissue atlas poster or digital flipbook showing classification, structure, and location of all four basic tissues of the body** (epithelial, connective, muscular, and nervous). *(Type: Individual Visual Assignment)* **3. Design a comparative table and flow diagram showing circulatory and lymphatic pathways, including major arteries, veins, and lymph nodes.** *(Type: Diagrammatic / Concept Mapping Assignment)* 4. **Develop a reproductive-endocrine connection chart linking glands** (e.g., pituitary, thyroid, adrenal) with their hormonal roles and influence on male and female reproductive systems. *(Type: Research-based Assignment / Infographic Presentation)* 5. **Create an embryology timeline poster from gametogenesis to placental development**, highlighting key stages like fertilisation, implantation, early embryonic layers, and development of major systems. *(Type: Visual Timeline Assignment / Individual Project)*
Text Book(s) / Reference Book(s):	1. B.D. Chaurasia – *Human Anatomy, Vol.1–3*, 5th ed., CBS Publishers 2. E.M. Grishcimer – *Physiology & Anatomy with Practical Considerations*, Lippincott 3. Sampath Madhyastha – *Manipal Manual of Anatomy*, CBS 4. Shobha & Shivlal Rawlani – *Textbook of General Anatomy*, Jaypee 5. T.W. Sadler – *Langman's Medical Embryology*, 11th ed., Wolters Kluwer
Online learning resources: 1. EBook: https://presiuniv.knimbus.com/user#/home 2. https://puniversity.informaticsglobal.com/ 3. https://www.visiblebody.com 4. https://www.kenhub.com	
5. https://www.aheducation.co.in 6. https://www.anatomyzone.com	
Topics relevant to "SKILL DEVELOPMENT": 1. Skill development through experiential learning via anatomical model handling and surface tracing 2. Identification and differentiation of human bones and organs 3. Radiological anatomy interpretation 4. Application of anatomical knowledge in real-life clinical environments such as operating theatres and diagnostic labs.	

Course Code: BMRIT-002	**Course Title:** Physiology **Type of course:** Foundation Course	**L-T-P-C**	3	0	0	3
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides comprehensive knowledge of the normal functions of the human body, focusing on the physiological mechanisms at cellular, tissue, organ, and system levels. Emphasis is placed on homeostasis, organ interrelationships, and the physiological basis of health and disease.					
Course Objectives	1. Understand the functions of cells, tissues, organs, and systems of the human body. 2. Analyse physiological processes essential for homeostasis. 3. Apply physiological principles in understanding health and disease. 4. Support clinical decision-making through knowledge of normal functions. 5. Develop the foundation for advanced studies and research in healthcare sciences					
Course Outcomes	1. Explain the normal functioning of organs and systems. 2. Understand interrelationships and interactions among various organs and systems for maintaining homeostasis. 3. Assess contribution of organ systems to internal environment. 4. Differentiate between normal and abnormal organ function. 5. Understand pathophysiology of diseases. 6. Apply physiological principles in allied health care.					
Course Content						
Module 1	**Cellular Physiology & Blood**			**8 Sessions**		
General physiology						

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

Muscle nerve physiology

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

Blood

Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis – stages, essential factors, regulation of Erythropoiesis, Hemoglobin: Functions, concentration, physiological variations. Fate of Hemoglobin – Jaundice, types, Color index, MCH, MCV, MCHC, PCV – normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood 10 15 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.

Module 2	**Cardiovascular Physiology**			**5 Sessions**

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.

Module 3	**Respiratory Physiology**			**6 Sessions**

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 term 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.

Module 4	**Excretory Physiology**			**6 Sessions**

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.

Module 5	**Digestive Physiology**			**5 Sessions**

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.

Module 6	**Endocrine Physiology**			**8 Sessions**

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.

Module 7	**Neurophysiology, Special Senses & Reproduction**			**7 Sessions**

Special senses- Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & VII inner ear, cochlea, Deafness – types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell

Reproductive system - Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system:

Ovarian hormones functions – Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.	
Targeted Applications and Tools that can be used:	1. **Cellular & blood studies:** *Microscope, stained slides, hemocytometer, hemoglobinometer, blood collection kits, centrifuge* 2. **Blood analysis & typing:** *Blood grouping kits, RBC/WBC slides, bleeding time apparatus* 3. **Neurophysiology & muscle:** *Nerve stimulators, muscle models, microscope*
	4. **Cardiovascular:** *ECG, sphygmomanometer, stethoscope, pulse oximeter* 5. **Respiratory:** *Spirometer, gas analysers, lung models* 6. **Renal:** *Urine collection kits, GFR test kits* 7. **Digestive:** *GI tract models, pH meters, enzyme kits* 8. **Endocrine:** *Hormone assay kits, gland models* 9. **Special senses & reproduction:** *Eye/ear models, histology slides, microscope* 10. **Lab skills:** *Microscope use, blood sample handling, counts, bleeding time tests*
Project Work:	1. **Create an illustrated 3D chart or working model of blood physiology**, showing major components (RBCs, WBCs, platelets, plasma), their functions, haemostasis mechanisms, and clotting pathways. *(Type: Group Model-based Assignment)* 2. **Develop a multi-panel infographic or animation explaining the cardiac cycle, ECG interpretation, and regulation of blood pressure.** *(Type: Individual Visual Assignment)* 3. **Design a comparative analysis chart that outlines respiratory, renal, and endocrine mechanisms for maintaining homeostasis.** *(Type: Research-based Assignment / Poster Presentation)* 4. **Prepare a concept map of neurophysiology integrating sensory inputs, CNS processing, and motor outputs, including autonomic regulation.** *(Type: Diagrammatic / Concept Mapping Assignment)* 5. **Create a physiological timeline and cycle tracker covering human reproduction: hormonal changes, gametogenesis, menstrual cycle, fertilisation, and early pregnancy.** *(Type: Visual Timeline Assignment / Individual Project)*
Text Book(s) / Reference Book(s):	1. *Foundation of Anatomy and Physiology* – Ross & Wilson, Churchill Livingstone. 2. *Physiology & Anatomy with Practical Considerations* – Ester M. Grishcimer, J.P. Lippincott. 3. *Text Book of Physiology* – A.P. Krishna, Suman Publication. 4. *Text Book of Physiology* – A.K. Jain, Avichal Publishing Company.

Online Learning Resources

1. EBook**:** https://presiuniv.knimbus.com/user#/home
2. https://puniversity.informaticsglobal.com/
3. https://www.visiblebody.com
4. https://www.kenhub.com
5. https://www.aheducation.co.in
6. https://www.anatomyzone.com

Topics Relevant to "Skill Development"

1. **Skill development through experiential learning** via physiological experiments and simulation-based case studies
2. **Interpretation of vital physiological data**, including ECG, blood pressure, respiration rate, and blood gas values
3. **Identification and analysis of normal vs abnormal physiological responses**
4. **Application of physiological principles in real-life healthcare scenarios**, such as patient monitoring, understanding drug actions, and managing clinical conditions like anemia, diabetes, and respiratory distress

Course Code: BMRIT-003	**Course Title:** Basic Radiation Physics **Type of Course:** Core Course	**L-T-P-C**	2	0	6	5
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces the fundamental principles of physics as applied in radiology. Topics include basic mechanics, electricity and magnetism, electronics, production of X-rays, radiation interactions with matter, and radiation measurement. Emphasis is placed on understanding the working principles of radiology equipment and ensuring radiation safety in diagnostic imaging.					
Course Objectives	1. Understand core physical principles relevant to diagnostic radiology. 2. Learn the basics of electricity, magnetism, and electronics as applied to imaging equipment. 3. Explain the production and properties of X-rays. 4. Explore radiation-matter interaction and measurement techniques. 5. Develop practical skills in handling radiology instrumentation and safety tools.					

Course Outcomes	1. Describe general physics related to imaging. 2. Differentiate between principles within general radiation. 3. Identify construction of radiology equipment. 4. Interpret quality control of radiology equipment. 5. Differentiate between X-ray equipment and other imaging equipment. 6. Describe production of X-rays. 7. Describe circuit systems of radiology equipment.

Course Content

Module 1	**Basic Concepts in Physics**			**3 Sessions**

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.

Module 2	**Electricity and Magnetism**			**5 Sessions**

Electricity and magnetism:- Electric charges, Coulomb's law-Unit of charge- Electric potential, unit of potential-Electric induction, capacitance and Capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR- Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current.

Electromagnetic waves:- Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.

Module 3	**Basic Electronics**			**5 Sessions**

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**.**

Module 4	**X-ray Production**			**5 Sessions**

Bremsstrahlung IV 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.

Module 5	**Heat and Thermodynamics**			**3 Sessions**
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).				
Module 6	**Radiation Interaction with Matter**			**3 Sessions**
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.				
Module 7	**Radiation Measurement and Quantities**			**6 Sessions**
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.				

Basic skill sets required for the laboratory:	1. Understanding of basic physical principles through practical demonstrations 2. Skills in identifying parts and functions of radiological equipment 3. Familiarity with the setup and operational checks of X-ray machines 4. Confidence in handling instruments for radiation detection and measurement 5. Ability to observe and record properties of X-rays and their interaction with matter 6. Precision in using voltmeters, ammeters, and basic circuit components 7. Safe handling practices for radiation-producing equipment 8. Knowledge of basic quality control procedures in radiological imaging 9. Ability to differentiate circuit systems used in various radiology instruments 10. Observation of electromagnetic principles in imaging technology 11. Judgement in interpreting and troubleshooting equipment performance 12. Understanding and application of radiation protection protocols
	13. Awareness of hazards associated with ionising radiation and how to mitigate them 14. Structured recording and interpretation of lab experiments involving electronics and X-rays

List of Laboratory Tasks:	**Experiment No. 1: *Basic concepts*** (Measurement of physical quantities such as force, work, energy, temperature, and heat using basic instruments.) **Experiment No. 2: *Electricity and magnetism, Electromagnetic waves*** (Construction and analysis of simple electric circuits to demonstrate Ohm's law, AC/DC behaviour, and electromagnetic wave concepts.) **Experiment No. 3: *Electronics*** (Study of semiconductor devices including diodes and transistors, and demonstration of rectifier circuits.) **Experiment No. 4: *Discovery and production of X-rays*** (Demonstration of X-ray generation and factors affecting intensity and quality of X-ray beams.) **Experiment No. 5: *Heat*** (Demonstration of heat transfer methods and thermal conductivity using suitable materials and temperature sensors.) **Experiment No. 6: *Interaction of ionizing radiation with matter*** (Observation of X-ray attenuation through different materials to study photoelectric and Compton effects.) **Experiment No. 7: *Radiation measurement and units*** (Measurement of exposure and attenuation using dosimeters and calculation of half-value layer (HVL) and linear attenuation coefficient.)
Targeted Applications and Tools that can be used:	1. **Basic Physics measurements:** *Force meters, calorimeters, thermometers, energy meters, timers, measurement scales* 2. **Electricity & Magnetism:** *Multimeters, power supplies, resistors, capacitors, inductors, oscilloscopes, circuit boards, electromagnets* 3. **Basic Electronics:** *Semiconductor kits (diodes, transistors), breadboards, signal generators, rectifier circuits, oscilloscopes* 4. **X-ray Production:** *X-ray tubes, HVL measurement devices, filtration materials, detectors, dosimeters* 5. **Heat and Thermodynamics:** *Thermal conductivity apparatus, heat sensors, temperature probes, black body simulators* 6. **Radiation Interaction:** *Attenuation measurement setups, absorbers (bone, fat, tissue simulants), gamma/X-ray sources* 7. **Radiation Measurement:** *Dosimeters, ionization chambers, Geiger counters, scintillation detectors, HVL calculators*
Project Work:	***1.*** **Create a visual portfolio or working model demonstrating the principles of electromagnetic radiation and its applications in diagnostic imaging.** *(Type: Group Visual/Model-Based Assignment)*

	2. **Design a poster or animation explaining the production, quality control, and modification of X-rays in diagnostic radiology.** *(Type: Individual/Pair Assignment – Visual/Research-Based)* 3. **Develop a comparative concept map or digital booklet on interaction of radiation with matter in different tissues and media.** *(Type: Diagrammatic Concept Map/Booklet)* 4. **Construct an interactive simulation or spreadsheet model showing current, voltage, and resistance behaviour in LR, CR, and LCR circuits.** *(Type: Simulation-Based or Spreadsheet-Based Assignment)* 5. **Prepare a mini-project report on radiation measurement techniques and quantities in diagnostic radiology.** *(Type: Research-Based Individual Assignment)*
Text Book(s) / Reference Book(s):	1. *Basic Radiological Physics* – K. Thayalan, Jaypee Brothers 2. *Christensen's Physics of Diagnostic Radiology* – Curry and Dowdey, Wolters Kluwer 3. *X-Ray Equipment for Student Radiographers* – D.N. & M.O. Chesney, Blackwell Science 4. *A Textbook of Radiation Physics* – Surendra Maharjan & Suraj Sah, Samiksha Publications 5. *A Concise Guide on Basic Radiographic Physics* – Lalit Agarwal, JBD Publications

Online Learning Resources (Radiation Physics-Specific)

1. ***EBook Access:*** *https://presiuniv.knimbus.com/user#/home*
2. *https://puniversity.informaticsglobal.com/*
3. *https://www.khanacademy.org/science/physics*
4. *https://ocw.mit.edu/courses/8-02sc-physics-ii-electricity-and-magnetism-fall-2010/*
5. *https://radiopaedia.org/articles/radiology-basics*
6. *https://www.xrayphysics.com/*
7. *https://nptel.ac.in/courses/115/106/115106118/*

Topics Relevant to "Skill Development"

1. ***Skill development through hands-on application*** *of radiation physics concepts in imaging equipment*
2. ***Identification and differentiation*** *of components in X-ray machines and basic electronic circuits*
3. ***Interpretation and measurement of radiation parameters****, including half-value layer, radiation intensity, and dose units*
4. ***Application of physical principles in radiology****, such as X-ray production, radiation safety, heat dissipation, and quality control in imaging environments*

Course Code: BMRIT-004	**Course Title:** Introduction to Healthcare **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides students with a basic insight into the main features of the Indian healthcare delivery system and how it compares with healthcare systems globally. It introduces basic concepts of health, nursing principles, patient care, bedside procedures, and basic first aid practices.					
Course Objectives	1. To understand the basic determinants and indicators of health in India. 2. To explore key national health policies and programmes. 3. To familiarise with fundamental nursing principles and patient care techniques. 4. To apply safe patient handling and bedside procedures. 5. To develop awareness of asepsis, monitoring, and emergency response.					
Course Outcomes	CO1: Define health and explain its determinants and indicators. CO2: Describe the goals of National Health Policy and identify key national health programmes. CO3: Demonstrate understanding of basic nursing principles including bandaging and positioning. CO4: Safely perform techniques of patient transfer, bed making, and nourishment. CO5: Monitor vital signs and apply basic aseptic and first aid procedures.					
Course Content						
Module 1	**Foundations of Health Systems**			**4 Sessions**		
- Definition of health, determinants and health indicators in India - Health team concept - Overview of National Health Policy - National Health Programmes and Family Welfare Programmes (brief objectives and scope)						
Module 2	**Basic Nursing and Patient Care**			**4 Sessions**		
- Principles of nursing and interpersonal relationships - Bandaging (basic turns, extremities, triangular bandages and uses) - Patient positions (prone, lateral, dorsal, recumbent, Fowler's) - Comfort measures, rest, sleep, aids						

Module 3	**Bedside Procedures & Vital Signs**			**4 Sessions**
- Lifting and transporting patients - Transferring patients to wheelchair and stretcher - Bedpans and excretion observation - Catheter care, enema procedures - Feeding techniques, drips and transfusions - Monitoring and recording vital signs				
Module 4	**Asepsis and First Aid**			**3 Sessions**
- Simple aseptic techniques - Sterilisation and disinfection - Observation of surgical dressings - Basic concepts of first aid				
Targeted Applications and Tools that can be used:	1. **Health Systems:** *Government health reports, National Health Policy documents, programme guidelines, community health surveys* 2. **Basic Nursing:** *Bandages, slings, nursing kits, patient positioning aids, comfort devices (pillows, cushions)* 3. **Asepsis and First Aid:** *Sterilisation equipment (autoclave, chemical disinfectants), surgical dressing kits, first aid boxes, gloves, masks, antiseptics*			
Project Work:	1. **Create a comparative infographic on health indicators and National Health Programmes in India.** (*Type: Individual/Pair Visual-Research Assignment*) 2. **Develop a first-aid manual or emergency response flipbook based on aseptic techniques and wound care.** (*Type: Individual Visual/Simulation-Based Assignment*)			
Text Book(s) / Reference Book(s):	1. *Principles and Practice of Nursing Management and Administration* – Jogindra Vati, Jaypee Brothers 2. *Textbook of Preventive and Social Medicine* – K. Park, Banarsidas Bhanot Publishers 3. *Introduction to Healthcare* – Dakota Mitchell and Lee Haroun, Delmar 4. *Introduction to Healthcare and Careers* – Roxann Delaet, Jones and Bartlett Learning			
Online Learning Resources 1. *https://presiuniv.knimbus.com/user#/home* 2. *https://www.nhp.gov.in* 3. *https://www.who.int/india* 4. *https://www.registerednursern.com*				

5. *https://www.redcross.org/take-a-class/first-aid* 6. *https://www.youtube.com/c/AIIMSNewDelhiOfficial*
Topics Relevant to "Skill Development" 1. ***Skill development through demonstration and practice*** *of patient transfer techniques, bed-making, and positioning* 2. ***Monitoring and documentation of vital signs*** *such as temperature, pulse, respiration, and blood pressure* 3. ***Practice of aseptic techniques and sterilisation procedures*** *in basic clinical settings* 4. ***Application of bandaging, catheter care, feeding techniques, and comfort measures*** *in simulated bedside care* 5. ***Implementation of basic first aid procedures and emergency response protocols*** *in classroom drills*

Course Code: BMRIT-005	**Course Title:** Medical Terminology and Record Keeping **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides students with an understanding of the structure, usage, and interpretation of medical terminologies. It covers word roots, prefixes, suffixes, abbreviations, system-specific terms, and documentation practices including electronic health record systems. Emphasis is placed on spelling, comprehension, and application in clinical contexts.					
Course Objectives	1. Understand the origin and derivation of medical terms. 2. Define and identify medical word roots, prefixes, and suffixes. 3. Apply rules for combining morphemes and forming plurals. 4. Recognize and use basic medical vocabulary. 5. Construct medical terms correctly. 6. Interpret medical abbreviations and symbols. 7. Use system-specific medical terms. 8. Interpret medical orders and reports. 9. Manage patient data in electronic health record systems.					
Course Outcomes	CO1: Explain the derivation and components of medical terms. CO2: Identify and apply common word roots, prefixes, and suffixes. CO3: Use correct spelling and pluralisation rules for medical terms. CO4: Demonstrate understanding of clinical abbreviations and symbols. CO5: Apply terminology for major body systems.					

	CO6: Accurately interpret medical orders and documentation. CO7: Perform basic data entry and information management using EHR systems.			
Course Content				
Module 1	**Basics of Medical Terminology**			**4 Sessions**
1. Derivation and origin of medical terms 2. Word roots, prefixes, and suffixes 3. Rules for combining morphemes and forming plurals				
Module 2	**Building and Understanding Terms**			**4 Sessions**
4. Basic medical terms 5. Constructing medical terms using roots, prefixes, suffixes, combining roots 6. Interpretation of medical abbreviations and symbols				
Module 3	**System-Based Terminology**			**4 Sessions**
7. Terminology and abbreviations related to integumentary, musculoskeletal, respiratory, cardiovascular, nervous, and endocrine systems				
Module 4	**Medical Documentation & Records**			**3 Sessions**
8. Reading and interpreting medical orders and reports 9. Data entry and management on electronic health record systems				
Targeted Applications and Tools that can be used:	1. **Medical Terminology Construction:** *Medical dictionaries, terminology textbooks, flashcards, word-building software* 2. **Abbreviations and Symbols:** *Standardised medical abbreviation lists, reference charts, clinical shorthand guides* 3. **System-Based Terms:** *Anatomy atlases, system-specific glossaries*			
Project Work:	1. **Create a visual root-prefix-suffix tree or chart to demonstrate how medical terms are derived.** (*Type: Individual Visual-Based Assignment*) 2. **Prepare a system-wise illustrated glossary of key medical terms and abbreviations.** (*Type: Individual Visual-Diagrammatic Assignment*)			
Text Book(s) / Reference Book(s):	1. *Medical Terminology, Documentation, and Coding* – Anne P. Stich, Routledge			

	2. *Medical Terminology for Health Professions* – Ann Ehrlich, Carol L. Schroeder, Cengage Learning 3. *Medical Terminology* – M. Mastenbjörk, S. Meloni, David Andersson, Medical Creations 4. *Medical Records: Organization and Management* – G.D. Mogli, Jaypee Brothers Medical Publishers

Online Learning Resources

1. EBook Access *https://presiuniv.knimbus.com/user#/home*

2. https://my.clevelandclinic.org/health/articles/9959-medical-terminology

3. https://medlineplus.gov/medicalwords.html

4. https://alison.com/course/introduction-to-medical-terminology

5. https://www.practicefusion.com

6. https://www.youtube.com/@LevelUpRN

Topics Relevant to "Skill Development"

1. ***Skill development in forming and interpreting medical terms*** *using correct morpheme combinations*
2. ***Practice in identifying abbreviations and symbols*** *in clinical documentation and prescriptions*
3. ***Use of system-specific medical vocabulary*** *for interpreting diagnostic and procedural records*
4. ***Hands-on training in reading and understanding medical orders and discharge summaries***
5. ***Basic data entry and navigation of Electronic Health Record (EHR) systems*** *for patient data management*

Course Code: BMRIT-006	**Course Title:** Basic Computers and Information Science **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the fundamentals of computers and their use in healthcare. It covers basic computer hardware and software concepts, operating systems, MS Office tools, internet applications, computer networks, and clinical applications like data entry and patient record management.					
Course Objectives	1. Understand basic computer concepts, components, generations, and languages.					

	2. Identify and explain functions of input/output devices, CPU, memory, and storage systems. 3. Operate Windows OS and use MS Word, Excel, and PowerPoint. 4. Describe fundamentals of operating systems, networks, and internet services. 5. Apply computer skills in clinical documentation and patient data management.			
Course Outcomes	CO1: Describe the components and functions of a computer system. CO2: Identify input/output devices and memory types. CO3: Perform basic tasks using Windows OS, MS Word, Excel, and PowerPoint. CO4: Explain computer networks and internet use in healthcare. CO5: Apply digital tools for patient record-keeping and clinical documentation.			
Course Content				
Module 1	**Computer Basics & Components**			**4 Sessions**
- Introduction to computers: definition, characteristics, block diagram, generations, languages - Input/output devices - CPU and memory - Storage devices (magnetic, optical, mass storage)				
Module 2	**Operating Systems & Windows Interface**			**3 Sessions**
- Windows OS: desktop, taskbar, folders, file management - Operating system: concepts and types				
Module 3	**Microsoft Office Applications**			**4 Sessions**
- MS Word: editing, formatting, spell check, tables, mail merge - MS Excel: entering data, formatting, formulas, graphs - PowerPoint: creating slides, text formatting, adding graphs				
Module 4	**Networks, Internet & Clinical Apps**			**4 Sessions**
- Network types (LAN, MAN, WAN), topologies, components - Internet history and services (email, FTP, WWW, browsers) - Application of computers in clinical settings (data entry, documentation, electronic health records)				
List of Practical:	**Practical No. 1: Use of MS Office**: Word, PowerPoint, Excel (Create documents, spreadsheets, and presentations using key features relevant to academic or clinical tasks.) **Practical No. 2: Software installation** (Install essential software like MS Office and antivirus with basic configuration steps.)			

	Practical No. 3: Data entry efficiency exercises (Practise fast and accurate data entry with basic formulas using MS Excel or clinical data tools.)
Targeted Applications and Tools that can be used:	1. **Microsoft Office:** *MS Word, Excel, PowerPoint with templates and practice exercises* 2. **Networking & Internet:** *Network simulators, browser tools, email clients* 3. **Clinical Applications:** *Electronic Health Record (EHR) software demos, clinical data entry systems*
Project Work:	**1. Prepare a sample report using MS Word, a patient data sheet in MS Excel, and a health education presentation in PowerPoint.** (*Type: Individual Practical Assignment*) **2. Develop a flowchart or concept map showing types of networks and internet tools used in hospitals.** (*Type: Group Research/Visual Assignment*)
Text Book(s) / Reference Book(s):	1. *Basic of Computer and Information Technology* – Ashok Arora, Vikas Publishing 2. *Computer and Information Science* – Roger Lee (Ed.), Springer 3. *Computer and Information Sciences* – Tadeusz Czachórski, Erol Gelenbe, Krzysztof Grochla, Ricardo Lent (Eds.), Springer 4. *Information Science and Computer Basics: An Introduction* – Ruth K. Mitchell, Clive Bingley

Online Learning Resources

1. *EBook Access: https://presiuniv.knimbus.com/user#/home*
2. *https://learn.microsoft.com/en-us/training/paths/digital-literacy/*
3. *https://edu.gcfglobal.org/en/*
4. *https://support.microsoft.com/en-us/office*
5. *https://skillsforall.com*
6. *https://www.healthit.gov/topic/health-it-and-health-information-exchange-basics*

Topics Relevant to "Skill Development"

1. ***Proficiency in using Windows operating system and managing files/folders***
2. ***Hands-on skills in MS Word, Excel, and PowerPoint*** *for clinical and administrative tasks*
3. ***Basic troubleshooting and system navigation using input/output and storage devices***
4. ***Understanding and working with network connections and internet services*** *in healthcare environments*
5. ***Application of computer skills in clinical documentation and electronic record systems***

Course Code: BMRIT-007	**Course Title:** Medical Law and Ethics **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides foundational knowledge of medical ethics and legal responsibilities in the healthcare profession. Students will explore core ethical principles, legal frameworks, patient rights, and documentation standards that govern clinical practice. Emphasis is placed on informed consent, confidentiality, malpractice, medico-legal documentation, and ethical dilemmas related to end-of-life care and organ transplantation. Through real-world scenarios and professional standards, students will develop an ethically sound and legally compliant approach to patient care.					
Course Objectives	1. Understand the key principles, goals, and scope of medical ethics and professional conduct. 2. Identify legal rights of patients and the importance of informed consent in clinical decision-making. 3. Analyse common medico-legal cases, negligence issues, and professional responsibilities in healthcare. 4. Interpret protocols for documentation, record ownership, confidentiality, and medical disclosures. 5. Recognise ethical concerns related to end-of-life decisions, organ donation, and interprofessional collaboration. 6. Apply ethical reasoning in preventing malpractice, managing risks, and complying with legal standards in healthcare practice.					
Course Outcomes	CO1**:** Understand the definition, goal, and scope of medical ethics. CO2**:** Explain the basic principles of medical ethics, including confidentiality and informed consent. CO3**:** Identify and interpret medico-legal aspects of healthcare documentation and patient rights. CO4**:** Recognize malpractice, negligence, and professional accountability. CO5**:** Apply ethical decision-making in terminal care, organ transplantation, and professional conduct.					
Course Content						
Module 1	**Medical Ethics**			**3 Sessions**		
• Definition, goals, scope • Code of conduct						

• Basic principles of medical ethics: autonomy, beneficence, non-maleficence, justice, and confidentiality				
Module 2	**Legal Aspects of Practice**			**4 Sessions**
• Malpractice and negligence • Rational and irrational drug therapy • Autonomy and informed consent • Rights of patients • Care of the terminally ill and euthanasia • Organ transplantation laws and ethics				
Module 3	**Medico-Legal Aspects of Records**			**4 Sessions**
• Medico-legal cases and types • Records and documents related to MLCs • Ownership and confidentiality of medical records • Privileged communication • Release of medical information and unauthorized disclosure • Retention of medical records				
Module 4	**Risk and Insurance**			**2 Sessions**
• Professional indemnity insurance policy • Standardized protocols to avoid near-miss or sentinel events				
Module 5	**Consent and Documentation**			**2 Sessions**
• Importance and procedure for obtaining informed consent • Legal and ethical implications				
Targeted Applications and Tools that can be used:	1. **Case Libraries & Legal Databases:** Real-world malpractice and medico-legal case repositories for analysis 2. **Awareness and Policy Builders:** Patient rights modules, insurance overviews, and interdisciplinary collaboration tools			
Project Work:	1. **Design an awareness campaign (brochure/poster/video) explaining patient rights and the importance of informed consent.** *Type: Group/Creative-Visual Project* 2. **Ethical Dilemmas in Advanced Practice – Role-play and Reflection** *Type: Group/Simulation + Reflective Writing* Perform short role plays on ethical issues in organ donation, end-of-life care, or reporting sensitive cases. Each member then writes an individual reflection analysing the ethical complexities and decision-making process.			
Text Book(s) / Reference Book(s):	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 3. *Essentials of Professionalism, Professional Values & Ethics for BSc Nursing Students* – Varinder Kaur, CBS Publishers and Distributors 4. *Textbook of Professional Ethics and Human Values* – R. S. Naagarazan, New Age International Publishers
Online Learning Resources 1. *EBook Access:* https://presiuniv.knimbus.com/user#/home 2. *https://www.wma.net/what-we-do/medical-ethics/* 3. *https://www.nhp.gov.in/medical-ethics-and-laws_pg* 4. *https://depts.washington.edu/bioethx/topics/index.html* 5. *https://www.ima-india.org/ima/pdf/code-of-medical-ethics.pdf* 6. https://www.coursera.org/courses?query=medical%20law	
Topics Relevant to "Skill Development" 1. ***Understanding and applying ethical decision-making frameworks*** *in clinical scenarios* 2. ***Ability to identify and address patient rights and consent procedures*** *in real-time healthcare practice* 3. ***Competency in preparing, maintaining, and handling medico-legal documentation*** *with legal compliance* 4. ***Skill in recognising malpractice risks and implementing preventive protocols*** *(e.g., standardised documentation, communication)* 5. ***Application of ethical principles in sensitive issues*** *like euthanasia, organ donation, and end-of-life care* 6. ***Familiarity with professional indemnity and risk coverage tools*** *in healthcare setups*	

Course Code: BMRIT-008	**Course Title:** Professionalism and Values **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to essential professional and personal values in healthcare. It develops awareness of ethical behaviour, accountability, teamwork, and cultural competence needed for respectful and responsible conduct in clinical settings.					

Course Objectives	1. Identify and explain key professional values such as integrity, objectivity, competence, and confidentiality. 2. Understand the role of personal ethical or moral values in professional practice. 3. Demonstrate appropriate professional behaviour and respectful attitude toward all individuals. 4. Describe the code of conduct, professional accountability, and types of misconduct. 5. Recognise the importance of teamwork and understand cultural sensitivity in healthcare settings.			
Course Outcomes	CO1: Describe professional values such as integrity, objectivity, competence, and confidentiality. CO2: Reflect on the importance of personal ethics in professional roles. CO3: Display respectful and unbiased professional behaviour in clinical and institutional settings. CO4: Explain professional accountability, code of conduct, and identify misconduct. CO5: Demonstrate understanding of team dynamics and cultural issues in healthcare.			
Course Content				
Module 1	**Professional and Personal Values**			**4 Sessions**
- Professional values: Integrity, Objectivity, Professional competence and due care, Confidentiality - Personal values: Ethical or moral values				
Module 2	**Professional Behaviour & Ethics**			**4 Sessions**
- Attitude and behaviour: Respectful conduct, treating all individuals equally - Professional accountability, responsibility, code of conduct, and misconduct				
Module 3	**Teamwork and Interprofessionalism**			**4 Sessions**
- Differences between professions - The role and significance of teamwork in healthcare				
Module 4	**Cultural Competence in Healthcare**			**3 Sessions**
- Cultural diversity and related issues in the healthcare environment - Sensitivity to cultural differences in care				
Targeted Applications and Tools that can be used:	1. **Case Discussions:** Explore real-world scenarios on professional and personal values 2. **Role-Play Exercises:** Simulate ethical behaviour and accountability in healthcare settings			

	3. Reflective Writing: Encourage personal insight into ethics and cultural sensitivity
Project Work:	1. **Create a digital poster or infographic illustrating key professional and personal values in healthcare.** (*Type: Individual Visual-Based Assignment*) 2. **Develop a group chart or comparison table on interprofessional roles and teamwork benefits.** (*Type: Group Research/Visual Assignment*)
Text Book(s) / Reference Book(s):	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 3. *Essentials of Professionalism, Professional Values & Ethics for BSc Nursing Students* – Varinder Kaur, CBS Publishers and Distributors 4. *Textbook of Professional Ethics and Human Values* – R. S. Naagarazan, New Age International Publishers

Online Learning Resources

1. *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5345448/*
2. *https://www.coursera.org/learn/healthcare-communication*
3. *https://depts.washington.edu/bioethx/topics/profess.html*
4. *https://www.who.int/publications/i/item/9789241501958*
5. *https://med.stanford.edu/cme/CulturalCompetence.html*
6. *https://www.mededportal.org/*

Topics Relevant to "Skill Development"

1. ***Professional communication and respectful behaviour*** *across clinical and institutional settings*
2. ***Ethical reflection and personal responsibility*** *in decision-making and patient interaction*
3. ***Team collaboration and role clarity*** *in interdisciplinary healthcare delivery*
4. ***Awareness and mitigation of professional misconduct*** *through understanding codes of conduct*
5. ***Cultural sensitivity and adaptation*** *in diverse patient care environments*
6. ***Development of a patient-first mindset*** *built on trust, integrity, and competence*

Course Code: BMRIT-009	**Course Title:** Principles of Management **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					

Course Pre-requisites	None			
Anti-requisites	None			
Course Description	This course provides a foundational understanding of the principles and practices of management relevant to healthcare and radiology settings. It aims to equip students with essential skills in planning, decision-making, leadership, and time management. The course also addresses modern challenges such as conflict resolution, change management, cost efficiency, and working effectively in teams.			
Course Objectives	1. To introduce students to the fundamentals of management and its strategic role in healthcare. 2. To develop skills in planning, organising, and implementing management tools. 3. To cultivate effective decision-making, leadership, and time management strategies. 4. To familiarise students with cost control, conflict handling, innovation, and team dynamics in clinical environments.			
Course Outcomes	CO1: Understand the basic concepts of management.. CO2: Apply planning tools and decision-making strategies.. CO3: Manage stress, conflict, change, and innovation effectively. CO4: Demonstrate leadership and team collaboration skills. CO5: Optimise time and cost efficiency in a professional healthcare setting.			
Course Content				
Module 1	Introduction to Management			**3 Sessions**
• Definition, nature, and scope of management • Functions of management (Planning, Organising, Leading, Controlling) • Importance of management in healthcare and hospital settings • Levels of management and roles of managers • Principles of effective management				
Module 2	**Strategic Planning and Foundations**			**3 Sessions**
• Meaning and importance of strategic management • Strategic planning process • Vision, mission, objectives, and goals • SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) • Basics of healthcare planning systems				

• Role of planning in decision-making and success				
Module 3	**Planning Tools and Decision Making**			**3 Sessions**
• Tools used in planning: Gantt chart, PERT, CPM (overview) • Types of plans: strategic, tactical, operational, contingency • Steps in effective decision-making • Types of decisions (routine and strategic) • Sources and types of conflict in the workplace • Conflict resolution techniques				
Module 4	**Organisational Development**			**3 Sessions**
• Managing organisational change: meaning, need, resistance to change • Techniques for managing and implementing innovation • Importance of creativity and innovation in healthcare • Definition and characteristics of a group and a team • Stages of group development • Teamwork in radiology and healthcare departments • Characteristics of an effective team				
Module 5	**Leadership and Efficiency**			**3 Sessions**
• Definition and importance of leadership • Leadership styles: autocratic, democratic, laissez-faire • Qualities of a good leader in healthcare • Time management: importance and techniques (prioritisation, scheduling, delegation) • Cost management and resource utilisation • Efficiency and effectiveness in healthcare services				
Project Work:	• **Conduct and record a mock public speech or role-played healthcare conversation.** (*Type: Individual/Pair Speaking-Based Assignment*) • **Compile a portfolio of professional writing samples related to healthcare settings.** (*Type: Individual Writing-Based Assignment*)			
Text Book(s) / Reference Book(s):	1. *Principles of Management* - P.C. Tripathi & P.N. Reddy – McGraw Hill Education 2. *Principles and Practices of Management* - L.M. Prasad – Sultan Chand & Sons 3. *Management for Nurses and Health Professionals* - Peter Ellis & Shirley Bach – SAGE Publications 4. *Hospital Administration and Management* - C.M. Francis & Mario C. de Souza – Jaypee Brothers Medical Publishers			
Online Learning Resources				

1. *EBook Access**:** https://presiuniv.knimbus.com/user#/home* 2. *https://www.open.edu/openlearn/money-business/introduction-management/content-section-overview* 3. *https://www.coursera.org/learn/foundations-of-management* 4. *https://ocw.mit.edu/courses/sloan-school-of-management/* 5. *https://www.youtube.com/results?search_query=Gantt+Chart+PERT+CPM* 6. *https://hbr.org/* 7. *https://www.who.int/publications/i/item/9241545262*
Topics Relevant to "Skill Development" 1. ***Strategic planning and SWOT analysis** for goal-oriented management* 2. ***Use of planning tools** like Gantt charts, PERT, and CPM for time-bound execution* 3. ***Effective decision-making and conflict resolution** in healthcare settings* 4. ***Leadership and team-building skills** tailored for healthcare environments* 5. ***Time and cost management techniques** to enhance operational efficiency* 6. ***Change management and innovation** in hospital systems* 7. ***Understanding and applying different leadership styles** to boost team performance* 8. ***Developing interpersonal communication and collaboration skills** for interdisciplinary teamwork*

Course Code: BMRIT-010	**Course Title:** English and Communication Skills **Type of Course:** Programme Course	**L-T-P-C**	1	0	0	1
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course aims to strengthen foundational English skills in grammar, vocabulary, comprehension, writing, and communication. It includes both written and spoken English, focusing on healthcare-specific scenarios and official correspondence.					
Course Objectives	1. Strengthen foundational English grammar skills through remedial instruction. 2. Build and expand vocabulary for written and verbal communication. 3. Develop comprehension through structured reading activities. 4. Improve writing through varied composition practices. 5. Familiarise with official and formal correspondence.					

	6. Enhance spoken English and listening comprehension for professional contexts.			
Course Outcomes	CO1: Apply grammar accurately using parts of speech, tenses, number, and gender. CO2: Use an improved vocabulary in written and verbal tasks. CO3: Demonstrate reading comprehension and summarisation skills. CO4: Compose formal letters, reports, précis, and diary entries. CO5: Prepare professional documents including memos, notices, CVs, and circulars. CO6: Communicate effectively in spoken English and demonstrate listening comprehension.			
Course Content				
Module 1	**Grammar and Vocabulary**			**3 Sessions**
- Basic grammar: parts of speech, tense, number, gender - Vocabulary building - Grammar exercises and objective assessments				
Module 2	**Reading and Comprehension**			**3 Sessions**
- Reading prescribed texts - Summarising and comprehension activities - Fill-in-the-blank and one-mark assessments				
Module 3	**Writing Skills and Composition**			**3 Sessions**
- Letter writing, note taking, précis writing, diary entries, and health reports - Short reports, applications - Resume and CV writing				
Module 4	**Official Correspondence & Reports**			**3 Sessions**
- Drafting official communication: outgoing/incoming correspondence - Circulars, notices, memos, observation reports				
Module 5	**Speaking and Listening Skills**			**3 Sessions**
- Public speaking, debates, formal/informal conversation - Listening to media (audio/video) - Assessment through checklists and listening tests				
Targeted Applications and Tools that can be used:	1. **Reading & Comprehension:** Practice with short health-related passages, news articles, and worksheets 2. **Writing Exercises:** Draft CVs, letters, and reports using *MS Word* templates, *Canva* templates. 3. **Official Communication Tools:** Learn formal formats via printed samples and *Google Docs* collaboration			

Project Work:	**1. Conduct and record a mock public speech or role-played healthcare conversation.** (*Type: Individual/Pair Speaking-Based Assignment*) **2. Compile a portfolio of professional writing samples related to healthcare settings.** (*Type: Individual Writing-Based Assignment*)
Text Book(s) / Reference Book(s):	1. *Communicative English for General Nursing Students* – Tom Koorkkakala, K.J. Publications 2. *How to Write and Speak Better* – John Ellison Kahn, Reader's Digest Association 3. *Communication and Soft Skill Development* – Ashwini Deshpande, Career Publications

Online Learning Resources

1. *EBook Access**:** https://presiuniv.knimbus.com/user#/home*
2. *https://www.bbc.co.uk/learningenglish*
3. *https://learnenglish.britishcouncil.org/*
4. *https://owl.purdue.edu/*
5. *https://www.coursera.org/learn/careerdevelopment*
6. *https://www.youtube.com/results?search_query=spoken+english+for+healthcare+professionals*
7. *https://www.grammarly.com/blog/*

Topics Relevant to "Skill Development"

1. ***Grammar proficiency and sentence construction*** *for clear communication*
2. ***Healthcare-specific vocabulary building*** *for writing and speaking tasks*
3. ***Reading comprehension and summarisation*** *for academic and practical texts*
4. ***Writing formal documents*** *like CVs, letters, and reports*
5. ***Mastering official correspondence*** *such as memos, notices, and circulars*
6. ***Spoken English practice*** *through structured speaking activities and roleplay*
7. ***Listening comprehension enhancement*** *using multimedia tools*
8. ***Public speaking and formal conversation skills*** *tailored to healthcare contexts*
9. ***Editing, proofreading, and formatting*** *professional English content*

SEMESTER II

Course Code: BMRIT-011	**Course Title:** Basics of Microbiology **Type of Course:** Foundation Course	**L-T-P-C**	2	0	0	2
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the foundational concepts in microbiology. It covers bacterial morphology, classification, and growth; sterilisation and disinfection methods; principles of immunology; nosocomial infections and biomedical waste management; and applied aspects including major microbial diseases.					
Course Objectives	1. Understand the morphology, physiology, and growth of bacteria. 2. Learn methods of sterilisation, disinfection, and their applications. 3. Describe immunological concepts including hypersensitivity and immunity. 4. Identify nosocomial infections and preventive measures. 5. Understand biomedical waste management. 6. Recognise the importance of fungi, viruses, and applied microbiology in clinical settings.					
Course Outcomes	CO1: Describe the structure, classification, and physiology of bacteria. CO2: Explain sterilisation and disinfection methods. CO3: Describe immunity, antigens, antibodies, and hypersensitivity reactions. CO4: Identify nosocomial infections and preventive strategies. CO5: Explain biomedical waste handling. CO6: Describe the significance of fungi and viruses in healthcare. CO7: Relate microbial causes to common infectious conditions.					
Course Content						
Module 1	**Bacteriology and Sterilisation**			**6 Sessions**		
- 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 / Sterilization control				
Module 2	**Infection and Hospital Hygiene**			**6 Sessions**
- Infection: Classification, Sources of infection, Modes of transmission - Nosocomial infection including biomedical waste management: Definition, Classification, Significance, Prevention and control - Biomedical waste management				
Module 3	**Immunology**			**6 Sessions**
- Immunity types, antigens, antibodies - Hypersensitivity reactions				
Module 4	**Mycology and Virology**			**6 Sessions**
- General properties, morphology, and classification of fungi - General features of viruses, genome types, replication, cultivation				
Module 5	**Applied Microbiology**			**6 Sessions**
- Common microbial infections: PUO, meningitis, zoonosis, hepatitis, HIV/AIDS, food poisoning, diarrhoea, UTI, tuberculosis				
Targeted Applications and Tools that can be used:	1. **Microscopy:** *Light microscopes, staining kits* 2. **Culture Techniques:** *Agar plates, incubators, autoclaves* *3.* **Sterilisation:** *Autoclaves, chemical disinfectants, UV sterilizers* *4.* **Microbial Testing:** *Antibiotic sensitivity kits* 5. **Infection Control:** *PPE, biomedical waste bins* 6. **Immunology:** *ELISA kits, antigen-antibody tests* 7. **Virology & Mycology:** *Viral/fungal culture media* 8. **Diagnostics:** *Rapid infection test kits* *9.* **Data Recording:** *Laboratory info systems, electronic health records*			
Project Work:	**1. Design a sterilisation and disinfection protocol chart for a hospital department.** (*Type: Group Practical/Research-Based Assignment*)			

	2. **Develop a case-based report on nosocomial infections with emphasis on biomedical waste handling.** (*Type: Individual/Pair Case Study Assignment*)
Text Book(s) / Reference Book(s):	1. *Textbook of Microbiology* – Ananthanarayan & Paniker, University Press 2. *Textbook of Microbiology* – Baveja, Arya Publications 3. *Textbook of Microbiology* – Sathish Gupte, Jaypee Brothers (JPB) 4. *Textbook of Microbiology* – Dr. Arora, CBS Publishers & Distributors Pvt. Ltd

Online Learning Resources

1. *EBook Access**:** https://presiuniv.knimbus.com/user#/home*
2. *https://microbiologyonline.org*
3. *https://www.cdc.gov/infectioncontrol/basics/index.html*
4. *https://www.khanacademy.org/science/health-and-medicine/infectious-diseases*
5. *https://www.who.int/teams/integrated-health-services/infection-prevention-control*
6. *https://www.youtube.com/results?search_query=practical+microbiology+sterilizati on+technique*

Topics Relevant to "Skill Development"

1. ***Hands-on practice of sterilisation and disinfection methods**, including autoclaving and chemical agents*
2. ***Microscopic identification of bacterial morphology and culture techniques***
3. ***Application of immunological assays to understand antigen–antibody interactions and hypersensitivity***
4. ***Detection, prevention, and control of nosocomial infections and clinical infection hygiene***
5. ***Practical handling and disposal of biomedical waste following standard protocols***
6. ***Diagnostic recognition of pathogens** in applied settings (e.g. urine, stool, blood cultures)*
7. ***Awareness of fungal and viral properties** and methods for cultivation and identification*

Course Code: BMRIT-012	**Course Title:** Basics of Biochemistry **Type of Course:** Foundation Course	**L-T-P-C**	2	0	0	2
Version no.	1.0					
Course Pre-requisites	None					

Anti-requisites	None			
Course Description	This course provides students with essential knowledge of biochemical principles, laboratory procedures, clinical chemistry, and their relevance to diagnostic and health sciences.			
Course Objectives	1. Understand the roles and responsibilities of healthcare professionals in a clinical lab setting. 2. Operate and maintain basic lab equipment. 3. Comprehend basic biochemical principles and solution chemistry. 4. Understand acid-base balance and electrolyte regulation. 5. Learn proper sample collection and testing for biochemical parameters. 6. Describe biochemical roles of nutrients and effects of malnutrition. 7. Understand liver and renal function tests. 8. Identify clinical markers and enzymology tests. 9. Understand the uses and hazards of radioisotopes.			
Course Outcomes	CO1: Understand the responsibility of healthcare personnel and laboratory hazards. CO2: Explain types, use, care, and maintenance of lab equipment. CO3: Understand fundamental chemistry and solution concepts. CO4: Describe acids, bases, indicators, and acid-base balance. CO5: Describe sample collection for biochemical analysis. CO6: Understand nutrient assimilation and malnutrition effects. CO7: Understand functional tests like LFT and RFT. CO8: Interpret tumour markers, cardiac markers, sugar, lipid profile, and enzymology. CO9: Describe radioisotope applications.			
Course Content				
Module 1	**Nutrition**			**07 Sessions**
Calorific value, nitrogen balance, respiratory quotient, BMR. Nutritional importance of carbohydrate, lipids, proteins, vitamins and minerals. Emphasis on parenteral nutrition.				
Module 2	**Acid–Base and Electrolyte Balance**			**08 Sessions**
Henderson–Hasselbalch equation, buffers of body fluids, pH regulation, disturbances in acid-base balance, anion gap. Basic principles and estimation of blood gases and pH. Overview of water and electrolyte balance. Estimation principles, normal values, and interpretation.				
Module 3	**Clinical Chemistry**			**07 Sessions**
Overview of normal values and their interpretation. Renal function tests, liver function tests, tumour markers, cardiac markers, diagnostic enzymology, lipid profile, blood sugar and GTT. Normal and abnormal urine analysis.				

Module 4	**Radioisotopes and Diagnostic Applications**			**08 Sessions**
Radioisotopes – Definition, applications, and hazards. Normal and abnormal urine analysis. Clinical charts on LFT, RFT, and diagnostic enzymology.				
Targeted Applications and Tools that can be used:	1. **Nutritional Analysis:** *Calorimeters, nitrogen analyzers, respiratory quotient measurement devices* 2. **Acid-Base & Electrolyte Balance:** *Blood gas analyzers, pH meters, electrolyte analyzers* 3. **Clinical Chemistry:** *Automated analyzers for liver, renal, cardiac markers, lipid profile, glucose tests* 4. **Urine Analysis:** *Urine dipsticks, microscopy, biochemical test kits* 5. **Radioisotope Applications:** *Gamma counters, scintillation detectors, radiation safety monitors*			
Project Work:	**1. Develop a concept map or infographic explaining acid–base balance and common disturbances.** (*Type: Individual/Pair Diagrammatic Assignment*) **2. Develop a safety and application guide for the use of radioisotopes in diagnostics.** (*Type: Group Research/Visual Assignment*) **3. Design an interactive chart or digital poster illustrating the nutritional roles of macronutrients and micronutrients.** (*Type: Individual Visual/Research Assignment*)			
Text Book(s) / Reference Book(s):	1. *Textbook 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 R. Rai, Jaypee Brothers Medical Publisher 3. *Clinical Chemistry* – Varley, CBS Publishers & Distributors 4. *Textbook of Biochemistry for Paramedical Students* – P. Ramamoorthy, Jaypee Brothers Medical Publishers			
Online Learning Resources 1. EBook Access**:** https://presiuniv.knimbus.com/user#/home 2. https://www.khanacademy.org/science/biology/macromolecules 3. https://chem.libretexts.org/Bookshelves/Biochemistry 4. https://www.labce.com 5. https://nptel.ac.in/courses/104/108/104108016/ 6. https://www.iaea.org/resources/rpop/health-professionals				
Topics Relevant to "Skill Development" 1. **Operation and maintenance of basic laboratory equipment** (e.g., centrifuges, spectrophotometers)				

Preparation and analysis of solutions and buffer systems using metrics like Henderson–Hasselbalch equation

Conducting and interpreting acid-base and electrolyte tests (blood gases, anion gap)

Collection, handling, and analysis of clinical samples for LFT, RFT, lipid profile, blood sugar, urine analysis

Performing and interpreting enzymology assays and tumour/cardiac marker tests

Understanding nutrition measurement protocols such as caloric calculation and nitrogen balance

Safe handling and use of radioisotopes in diagnostic laboratory settings

Course Code: BMRIT-013	**Course Title:** Conventional Radiography and Equipment **Type of Course:** Core Course	**L-T-P-C**	4	0	2	5
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides foundational and advanced knowledge of the principles, design, and operations of radiotherapy equipment used in conventional diagnostic and therapeutic radiology. Emphasis is placed on the x-ray production process, various x-ray tube technologies, generator circuits, fluoroscopy systems, and the maintenance protocols essential for safe and efficient radiographic practice.					
Course Objectives	1. Understand the working principles and construction of x-ray tubes and their variations. 2. Explain generator circuit designs and safety measures for radiographic equipment. 3. Gain insights into fluoroscopy and its applications in clinical settings. 4. Identify and implement equipment maintenance and quality assurance techniques. 5. Apply knowledge of scattered radiation control and interlocking mechanisms.					
Course Outcomes	CO1: Describe the structure and working of x-ray tube, production of x-rays. CO2: Describe the types of x-ray tube and heat dissipation methods. CO3: Explain the x-ray generator circuits. CO4: Describe the different circuit types.					

	CO5: Describe the meters and exposure timers. CO6: List the control of scattered radiation. CO7: Describe the fluoroscopy. CO8: Explain the care and maintenance of x-ray equipment.

Course Content

Module 1	**X-ray Tube and Production of X-rays**			**10 Sessions**

- 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 envelope 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.

Module 2	**Rotating and Grid-Controlled Tubes**			**7 Sessions**

- 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 characteristic 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.

Module 3	**Generator Circuits and Rectification**			**10 Sessions**

- Filament current and voltage, x-ray circuits (primary circuit, autotransformer), 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, three-phase, 6 and 12 pulse circuits, high-frequency generators, falling load generators, capacitor discharge and grid control systems.
- X-ray generator circuits: vacuum tube diodes, semiconductor diodes, transistor, rectification (half and full wave), self-rectification, x-ray generator; filament circuit, kilovoltage circuit, single-phase generator, three-phase generator, constant potential generator, fuses, switches and interlocks, exposure switching and timers, HT cables, earthing.

Module 4	**High Tension and Interlocking Circuits**			**10 Sessions**
• High tension circuits: H.T. generator for x-ray machines, three-phase rectifier circuits, three-phase six rectifier circuit, three-phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment. • 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 overload protection, circuit diagram, simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.				
Module 5	**Meters and Exposure Timers**			**5 Sessions**
• Moving coil galvanometer: construction and working/conversion to milliammeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre-reading kV meter and milliammeter, digital panel meters. • Clockwork timers, synchronous motor timer, electronic timers, photometric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer.				
Module 6	**Scattered Radiation Control**			**5 Sessions**
• 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, gridded cassettes, stationary and moving grid, Potter-Bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement				
Module 7	**Fluoroscopy and Image Intensification**			**10 Sessions**
• 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 visualizing 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.				
Module 8	**Care and Maintenance**			**3 Sessions**

• 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.	
List of Experiments:	**Experiment No. 1:** X-ray tube; Production of X-rays (Study of construction and working of stationary anode and gas-filled X-ray tubes, and demonstration of the basic principle of X-ray production.) **Experiment No. 2:** Rotating anode X-ray tube; Grid-controlled and high-speed tubes; Heat dissipation methods (Study of anode rotation mechanism, line focus principle, anode heel effect, and interpretation of tube rating and cooling charts.) **Experiment No. 3:** Filament current and voltage; X-ray generator circuits (Demonstration of the filament circuit, autotransformer-based primary circuit, and types of rectification used in X-ray generators.) **Experiment No. 4:** High tension circuits; Interlocking circuits; Relays (Tracing of HT generator circuits, three-phase rectifier circuits, and demonstration of relay-based interlocking and overload protection.) **Experiment No. 5:** Meters and exposure timers (Study of construction and working of galvanometers, kV/mA meters, and various types of exposure timers used in X-ray equipment.) **Experiment No. 6:** Control of scattered radiation: Beam limiting devices (Demonstration of light beam collimators, filters, and grids used to restrict the X-ray beam and reduce scattered radiation.) **Experiment No. 7:** Fluoroscopy (Study of fluoroscopic screens and image intensifier construction, and demonstration of the image intensification pathway.) **Experiment No. 8:** Care and Maintenance of X-ray equipment (Performance of routine functional and quality assurance checks on diagnostic X-ray equipment.)

Targeted Applications and Tools that can be used:	1. Diagnostic X-ray machine (mobile and fixed units) for hands-on identification of tube, generator, and control panel components. 2. Cut-section/demonstration models of stationary anode, rotating anode, and gas-filled X-ray tubes. 3. Tube rating charts and cooling charts (manufacturer samples) for interpreting safe exposure parameters. 4. X-ray generator circuit trainer kits/simulators for tracing primary, filament, and HT circuits. 5. kV and mA test meters (non-invasive kVp meter, mA linearity test tool) for equipment QA practice. 6. Focal spot test tools (pinhole camera, star pattern, slit camera). 7. Beam alignment and collimator test tools (coin test, beam alignment test tool). 8. Sample grids (parallel, focused, crossed) and Potter–Bucky mechanism demonstration unit. 9. Image intensifier cut-section model and CCTV/CCD camera demonstration setup. 10. Exposure timer test tools and dosimetry equipment for timer accuracy verification. 11. Relay and interlocking circuit demonstration kits. 12. Charts, block diagrams, and simulation software/apps for visualizing circuit flow and waveform rectification (where institutional access permits). 13. Equipment maintenance logbooks/QA checklists for documentation practice.
Project Work:	1. Preparation of a comparative chart/model on stationary anode vs. rotating anode X-ray tube construction and performance. 2. Case study/report on interpretation of tube rating and cooling charts for different clinical workloads. 3. Design and presentation of a block diagram tracing the complete circuit pathway from mains supply to controlled X-ray emission, including interlocking and safety features. 4. Preparation of a quality assurance (QA) protocol/checklist for routine testing of exposure timers, kV/mA accuracy, and focal spot size for a diagnostic X-ray unit. 5. Comparative study/report on grid types (parallel, focused, crossed) and their effect on scatter reduction and image quality. 6. Project on evolution of fluoroscopy technology — from fluorescent screens to image intensifiers and digital fluoroscopy systems. 7. Group project on preventive maintenance scheduling and troubleshooting common faults in X-ray generator/control circuits.

Text Book(s) / Reference Book(s):	1. *Radiographic Imaging (CBS)* – 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

Online Learning Resources

1. *EBook Access**:** https://presiuniv.knimbus.com/user#/home*
2. *https://radiopaedia.org/articles/x-ray-tube*
3. *https://www.iaea.org/resources/rpop/health-professionals*
4. *https://www.youtube.com/results?search_query=basic+radiography+x-ray+tube*
5. *https://ocw.jhsph.edu/index.cfm/go/viewCourse/course/physicsmedicalimaging*
6. *https://www.spiedigitallibrary.org/journals/medical-imaging*
7. *https://www.aapm.org/pubs/reports/*

Topics Relevant to "Skill Development"

1. ***Practical operation and evaluation of X-ray tubes**, including Coolidge and rotating-anode technologies*
2. ***Hands-on experience with generator circuits**, rectification systems, exposure timers, and AEC*
3. ***Implementation of interlocking mechanisms, safety protocols, and scattered radiation control** (grids, collimators, filters)*
4. ***Fluoroscopy skills**, including image intensifier handling, brightness control, and cine vs serial techniques*
5. ***Care, preventive maintenance, and quality assurance procedures**: timer testing, kV/mA validation, focal-spot measurement*
6. ***Use of beam-limiting devices and verification of beam alignment and centring mechanisms***

Course Code: BMRIT-014	**Course Title:** Clinical Radiography Positioning (Part-1) **Type of Course:** Core Course	**L-T-P-C**	5	0	6	8
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course offers foundational knowledge and practical skills in radiographic positioning essential for clinical radiography. Emphasis is laid on proper patient positioning, anatomical correlation, radiation protection, and the usage of various radiological accessories and techniques. Students will gain both theoretical and hands-on experience to proficiently perform radiographic procedures of different body parts under various clinical conditions.					

Course Objectives	1. Comprehend fundamental principles and techniques of patient positioning in clinical radiography. 2. Utilize radiographic equipment and accessories effectively during procedures. 3. Demonstrate the ability to adapt positioning techniques for patients with diverse physical and pathological conditions. 4. Identify and apply appropriate radiographic projections based on clinical requirements. 5. Understand and implement radiation protection protocols to minimize exposure risks. 6. Correlate anatomical and physiological knowledge with radiographic techniques.			
	7. Recognize radiographic appearances of both normal and pathological conditions. 8. Integrate theoretical knowledge with practical applications in real-world clinical settings.			
Course Outcomes	CO1: Understand the basic patient positioning during radiographic investigation. CO2: Apply special positioning skills for different pathological and physical conditions. CO3: Apply the use of equipment while working in radiology departments. CO4: Choose proper positions during radiographic procedures. CO5: Explain the relative positions of the x-ray tube and patient and relevant exposure factors. CO6: Explain the use of accessories. CO7: Explain the anatomic and physiological basis of the procedure to be undertaken. CO8: Explain the radiographic appearances of both normal and common abnormal conditions.			
Course Content				
Module 1	**Principles of Radiography**			**11 Sessions**
Preparation of the room, apparatus, and instruments; positions of the patient: erect, sitting, supine, prone, lateral, oblique, decubitus, etc.; relative position of the x-ray tube and patient, relevant exposure factors; use of accessories such as radiographic cones, grids, and positioning aids. Anatomic and physiological basis of the procedure. Association of theory with practical work. Radiographic appearances—normal and common abnormal conditions. Modifications in technique for various disabilities and subject types. Radiation protection, gonadal shielding, and practical dose-reduction methods.				

Module 2	**Upper Limb**			**11 Sessions**
Routine projections for the hand, fingers, wrist joint, forearm, elbow joint, and humerus. Supplementary projections for the scaphoid, carpal tunnel, ball catcher's view, head of radius, supracondylar fracture, and olecranon process.				
Module 3	**Lower Limb**			**11 Sessions**
Routine projections for the foot, toes, calcaneum, ankle joint, leg, knee joint, patella, and femur. Supplementary projections for the talo-calcaneal joint, forced views for torn ligaments, flat feet, club feet, intercondylar projections, and axial view of the patella.				
Module 4	**Shoulder Girdle and Thorax**			**11 Sessions**
Routine projections for shoulder joint, scapula, acromioclavicular joint, clavicle, sternoclavicular joint, sternum, and ribs. Supplementary projections for axial view of clavicle, bicipital groove, and coracoid process.				
Module 5	**Vertebral Column**			**9 Sessions**
Routine projections for atlanto-occipital joint, cervical spine, cervico-thoracic junction, thoracic spine, lumbar spine, lumbosacral region, sacrum, and coccyx. Supplementary projections for intervertebral foramina, posterior arch of atlas, flexion and extension views of cervical spine, scoliosis and kyphosis, and sacroiliac joints.				
Module 6	**Skull**			**11 Sessions**
Routine projections for cranium and facial bones. Supplementary projections for trauma, Towne's method, sella turcica, optic and jugular foramina, temporal bones, mastoids, petrous bone, zygomatic arches, orbits, maxillae, nasal bones, mandible, and temporomandibular joints. Nasal sinuses: techniques for frontal, maxillary, ethmoidal, and sphenoid sinuses, including erect and horizontal beam projections for fluid levels.				
Module 7	**Pelvic Girdle and Hip Region**			**11 Sessions**
Routine projections for the pelvis, sacroiliac joints, hip joint, and neck of femur. Supplementary projections for greater and lesser trochanters, frog leg projection, ischium, symphysis pubis, ilium, acetabulum, congenital dislocation of hip, and arthrodesis. Skeletal survey for metabolic bone disease, metastases, hormonal disorders, and renal disorders.				

Basic skill sets required for the laboratory:	The students shall be able to develop: 1. Skills in accurate patient positioning for various radiographic procedures 2. Ability to correlate anatomical landmarks with appropriate radiographic projections 3. Proficiency in aligning the X-ray tube, detector, and patient to ensure diagnostic image quality 4. Competence in handling radiographic equipment and positioning accessories 5. Adaptability in modifying positioning techniques for different physical and pathological conditions 6. Understanding and application of radiation safety and protection protocols during positioning 7. Observation and interpretation of normal and abnormal radiographic appearances 8. Effective communication and patient handling during imaging procedures 9. Integration of theoretical knowledge with practical radiographic skills in clinical settings
List of Laboratory task:	**Experiment No. 1:** Demonstrate the principles of radiography: Positioning techniques, radiation protection, and practical approaches to room and patient preparation. **Experiment No. 2:** Positioning of the upper limb: Routine and supplementary projections including fingers, hand, wrist, forearm, and elbow. **Experiment No. 3:** Positioning of the lower limb: Routine and special views for foot, ankle, knee, and femur including club foot and flat foot. **Experiment No. 4:** Shoulder girdle and thorax positioning: Imaging techniques for shoulder, clavicle, scapula, and rib cage. **Experiment No. 5:** Vertebral column positioning: Radiographic views from cervical to coccyx including scoliosis and flexion/extension studies. **Experiment No. 6:** Skull radiography: Techniques for cranium, facial bones, and sinuses with trauma and special projections. **Experiment No. 7:** Pelvic girdle and hip region: Routine and specialized projections including frog leg view and skeletal survey.

Targeted Applications and Tools that can be used:	1. **Radiographic Positioning Aids:** *Positioning blocks, sponges, sandbags, radiographic cones, lead shields, gonadal protectors* 2. **X-Ray Equipment & Accessories:** *Digital/analogue x-ray units, bucky tables, collimators, grids, beam restrictors, cassette holders* 3. **Radiation Protection Tools:** *Lead aprons, thyroid shields, dosimeters, lead-lined gloves, mobile shielding screens* 4. **Contrast and Exposure Tools:** *Exposure calculators, technique charts, contrast media simulators, phantom models* 5. **Image Evaluation Tools:** *PACS systems, DICOM viewers, image annotation software, reference atlases of normal vs. pathological images* 6. **Skull & Spine Positioning Tools:** *Head clamps, cervical support rolls, scoliosis boards, spine alignment pads* 7. **Lower & Upper Limb Tools:** *Positioning aids for club foot, flat foot, scaphoid view, and supracondylar fracture simulations* 8. **Practical Training Simulators:** *Virtual radiography software, anatomical mannequins, fluoroscopy practice units*
Project Work:	***1.*** **Radiation Safety Protocol Poster** *Type: Group/Visual-Safety Assignment* ***2.*** **Video Demonstration of Patient Positioning Techniques** *Type: Pair/Practical-Simulation Assignment*
	3. **Comparative Table on Routine vs Supplementary Views** *Type: Individual/Research-Based Assignment*
Text Book(s) / Reference Book(s):	1. *Atlas of Radiographic Positioning and Radiological Procedures* – Philip W. Ballinger, Eugene D. Frank, Mosby 2. *Clark's Positioning in Radiography* – R.A. Swallow, E. Naylor, Lippincott Williams and Wilkins 3. *Merrill's Atlas of Radiographic Positioning and Procedures* – Bruce W. Long, Jeannean Hall Rollins, Barbara J. Smith, Mosby 4. *Bontrager's Textbook of Radiographic Positioning and Related Anatomy* – John Lampignano, Leslie E. Kendrick, Elsevier Science 5. *Radiology of Positioning and Applied Anatomy for Students and Practitioners* – Garkal G.S., Jaypee Brothers Medical Publishers 6. *A Guide on Special Radiographic Investigations & Techniques* – Lalit Agarwal, JBD Publications
Online Learning Resources 1. *EBook Access**:** https://presiuniv.knimbus.com/user#/home* 2. *https://radiopaedia.org/articles/radiographic-positioning* 3. *https://www.imagegently.org* 4. *https://www.arrt.org/earn-credentials/education/* 5. *https://www.aapm.org/pubs/reports/RadiationProtection.asp*	

Topics Relevant to "Skill Development"

1. ***Practical positioning skills****: erect, supine, prone, lateral, oblique, decubitus, and sitting setups*
2. ***Use of positioning aids****: cones, grids, gonadal shields, tabletop adjustments for diverse patient conditions*
3. ***Projection techniques for limbs and skeletal regions****: hand, wrist, elbow, shoulder, spine, skull, pelvis*
4. ***Radiation safety practices****: dose reduction methods, gonadal protection, beam collimation, accessory handling*
5. ***Exposure factor adjustment and equipment usage****: tube alignment, exposure timers, grid positioning, kVp/mA settings*
6. ***Recognition of anatomical landmarks and pathological appearances*** *in radiographs*
7. ***Modifying techniques*** *for trauma, disability, paediatric, and geriatric cases*
8. ***Integration of anatomy-physiology knowledge*** *to ensure accurate positioning and optimal image quality*

SEMESTER III

	Course Title: Pathology	**L-T-P-C**	2	0	0	2
Course Code: BMRIT-015	**Type of Course:** Foundation Course					
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course familiarises students with the basic pathological processes and mechanisms of disease, enabling them to understand common laboratory diagnostic tests and procedures relevant to healthcare practice.					
Course Objectives	1. Define disease and related medical terminology. 2. Describe cellular responses to injury and mechanisms of disease. 3. Identify common pathological conditions and diagnostic methods. 4. Learn procedures for specimen collection, transport, and analysis. 5. Understand blood grouping, transfusion, and complications.					
Course Outcomes	CO1: Define the term "Disease" or concepts of diseases. CO2: Define, classify diseases and the medical terms used. CO3: Describe the cause and mechanism of a few common diseases encountered during routine work. CO4: Identify common pathological changes in tissues, organs, and fluids. CO5: List common diagnostic laboratory tests. CO6: Explain sample collection, preservation, and delivery methods. CO7: Describe procedures for obtaining blood components and transfusion-related complications.					
Course Content						
Module 1	**Cell Injury, Inflammation and Infectious Diseases**			**6 Sessions**		

Introduction to Pathology, Cell membrane, Cytoplasm, contents and nucleus.

Various injuries – Cell changes – Reversible changes, fatty liver, hydropic changes and 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.

Module 2	**Circulatory, Growth, Neoplastic and Genetic Disorders**			**6 Sessions**

Oedema – Definition, classification, causes, pathogenesis. Pulmonary oedema, cardiac oedema, renal oedema, lymphedema.

Thrombosis – Definition, classification, pathogenesis, venous and arterial thrombosis, fate of thrombus.

Embolism – Definition, classification and clinical manifestations – Infarction, gangrene.

Growth disorders: Atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia.

Neoplasia – Definition, nomenclature, differences between benign and malignant tumours, metastasis, carcinogens.

Cancer – Clinical features and lab diagnosis. Genetic diseases – Klinefelter, Down's, Turner's syndrome.

Urine examination – physical, chemical, microscopy. LFT, RFT, Cytology, FNAC, Surgical pathology, biopsy, specimen preservation, fixation, request form.

Module 3	**Haematology and Blood Disorders**			**6 Sessions**

Blood collection, anticoagulants, sample labelling and transport. Common haematological tests – Peripheral blood smear, haemoglobin, PCV, WBC (total and differential), platelet count.

Bone marrow aspiration – indications, procedure, contraindications, complications. Anaemias – iron deficiency, megaloblastic, haemolytic – causes, diagnosis. Leukaemia – AML, ALL, CML, CLL.

Bleeding disorders – platelet and coagulation factor disorders. BT, CT, PT, APTT. Blood grouping, cross-matching, blood collection, mandatory tests, components, transfusion complications.

Module 4	**Bone, Joint, and Cardiovascular Disorders**			**6 Sessions**

Osteomyelitis – Acute, chronic, tubercular.

Joint diseases – Osteoarthritis, Rheumatoid arthritis – causes, pathology, complications.

Metabolic bone diseases – Osteoporosis, Osteomalacia, Rickets.

Cardiovascular disorders – Atherosclerosis, aneurysms, IHD – Angina, MI, Rheumatic heart disease, Hypertension, Heart failure.

Module 5	**Respiratory and Renal System Disorders**			**6 Sessions**

COPD (Asthma, Bronchitis, Emphysema, Bronchiectasis), Pneumonia – classification, features.

Pulmonary TB – types, complications.

Pleural effusion – causes, features, diagnosis.

Renal diseases – Glomerulonephritis, nephritic and nephrotic syndrome, pyelonephritis, renal failure (acute/chronic), renal stones, hydronephrosis.

Targeted application and Tools that can be used:	1. **Microscopic identification of pathological changes** – Using light microscope, stained histology slides, and cover slips. 2. **Gross examination of organs and lesions** – Using preserved specimens in formalin jars and specimen trays. 3. **Blood collection and basic haematology tests** – Using syringes, EDTA vials, ESR tubes, Hb pipettes, and centrifuge. 4. **Cytological sampling and evaluation** – Using FNAC needles, smear slides, Leishman/Giemsa stains, and microscopy. 5. **Histopathology processing and documentation** – Using fixatives (formalin/alcohol), biopsy samples, and request forms. 6. **Blood grouping and transfusion-related testing** – Using blood grouping kits/cards, test tubes, and reagents. 7. **Identification of anaemias and leukaemias on slides** – Using stained blood smears and differential cell counters. 8. **Observation of cardiovascular and renal lesions** – Using labelled organ specimens and anatomical models for orientation. 9. **Study of lung infections and TB pathology** – Using preserved lung specimens, microscopy, and staining techniques.

Project Work:	**1. Develop a digital booklet or poster on inflammation and wound healing.** (*Type: Group Visual Assignment*) **2. Present a case-based assignment on respiratory and renal pathologies.** (*Type: Individual Clinical Case Summary*
Text Book(s) / Reference Book(s):	*1. Textbook of Pathology with Pathology Quick Review and MCQs* – Harsh Mohan, Jaypee Brothers Medical Publishers (P) Ltd 2. *Pathologic Basis of Disease* – Robbins and Cotran, Saunders Elsevier 3. *Textbook on Pathology for DMLT & Paramedical Courses* – Dr. I. Clement, Emmess Medical Publishers 4. *Textbook of Pathology & Microbiology for Paramedical Students* – Aruna Singh, Notion Press
Online Learning Resources 1. EBook Access (University Resource) – https://presiuniv.knimbus.com/user#/home 2. Pathology Outlines – https://www.pathologyoutlines.com/ 3. NCBI Bookshelf – https://www.ncbi.nlm.nih.gov/books/NBK538516/ 4. Lecturio Medical Video Lectures – Pathology – https://www.lecturio.com/medical-courses/pathology.course	
5. Khan Academy – Health and Medicine – https://www.khanacademy.org/science/health-and-medicine/human-anatomy-and-physiology	
Topics Relevant to "Skill Development" 1. Specimen collection, labelling, and transport procedures 2. Preparation and analysis of peripheral blood smear 3. Basic urine examination – physical, chemical, and microscopic 4. Performing blood counts (HB, WBC, PCV, Platelet count) 5. Interpretation of LFT, RFT, and coagulation tests (BT, CT, PT, APTT)	

Course Code: BMRIT-016	**Course Title:** Clinical Radiography Positioning (Part II) **Type of Course:** Core Course	**L-T-P-C**	3	0	6	6
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides advanced knowledge and skills in radiographic positioning for specialised examinations, patient preparation and handling, emergency care in radiology, and operating imaging equipment in diverse clinical scenarios.					

Course Objectives	1. Understand patient management and positioning during radiographic procedures. 2. Prepare patients and equipment before procedures. 3. Apply safety measures and aseptic techniques. 4. Demonstrate handling of mobile and OT-based radiographic techniques. 5. Recognise image quality and patient care standards. 6. Respond to radiological emergencies.
Course Outcomes	CO1: Prepare management and positioning of patients. CO2: Correlate indications and contraindications of radiological procedures. CO3: Understand patient preparations before radiological examinations. CO4: Explain post-procedural care. CO5: Position patients accurately for radiographic procedures. CO6: Assess image quality in radiological images. CO7: Manage patients in radiology departments. CO8: Handle emergency situations in radiology settings.

Course Content

Module 1	**Dental Radiography & Upper Respiratory System**			**7 Sessions**

Dental Radiography: Technique for intraoral full mouth. Occlusal projections. Extraoral projections including orthopantomography. Supplementary techniques.

Upper Respiratory System: Technique for postnasal airways, larynx, trachea, thoracic inlet, Valsalva manoeuvre. 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.

Module 2	**Abdominal Viscera**			**6 Sessions**

Technique for plain film examination. Projection for acute abdomen patients.
Technique to demonstrate: Foreign bodies, imperforate anus.

Module 3	**Mobile Radiography, Mammography & Foreign Body Localization**			**7 Sessions**

Radiography using mobile X-ray equipment: Radiography in the ward.
Radiography in the specialised unit, such as: Intensive care unit, coronary care, neonatal unit. Radiography in the operating theatre.
Mammography: Basic views, special views, wire localisation.

Localization of foreign bodies. Various techniques.

Module 4	**OT & Trauma Radiography**			**7 Sessions**

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.				
Module 5	**Neonatal, Paediatric, Forensic & Microradiography**			**6 Sessions**
Neonatal and Paediatric Radiography, Forensic Radiography, Microradiography: General principles, requirement, equipment, technique.				
Module 6	**Soft Tissue & High kV Radiography**			**6 Sessions**
screen/non-screen methods High kV Radiography: Patient dose, contrast, collimation, grids, beam quality Uses of soft tissue imaging				
Module 7	**Foreign Body Localization**			**6 Sessions**
General principles of locating foreign bodies Ingested, inhaled, embedded, and inserted objects Projections and preparation of the area				
Basic skill sets required for the laboratory:	1. Proficiency in advanced patient positioning for specialized radiographic procedures 2. Skills in patient preparation and management before and after imaging 3. Competence in using mobile and operation-theatre-based radiographic equipment 4. Application of aseptic techniques and safety protocols during procedures 5. Ability to assess and ensure radiographic image quality 6. Preparedness to handle emergency situations in radiology settings 7. Effective patient communication and care during radiographic procedures 8. Coordination and teamwork in clinical radiotherapy environments 9. Integration of theoretical knowledge with practical radiographic techniques and patient management			

List of Laboratory task:	**Experiment No. 1:** Dental and upper airway imaging – *Using intraoral X-ray units, panoramic radiography, and lateral cephalograms.* **Experiment No. 2:** Thoracic and abdominal radiographic interpretation – *Using chest X-rays, abdominal plain films, and contrast media techniques.* **Experiment No. 3:** Ward and mammographic radiography – *Using portable X-ray units and dedicated mammography machines with compression paddles.* **Experiment No. 4:** Intraoperative imaging techniques – *Using mobile C-arm fluoroscopy units and sterile imaging protocols.* **Experiment No. 5:** Paediatric and forensic radiography – *Using low-dose paediatric protocols, forensic imaging methods, and microradiography tools.* **Experiment No. 6:** Advanced radiographic methods and quality control – *Using high kV settings, collimators, grids with variable ratios, and beam scatter control devices*. **Experiment No. 7:** Foreign body localisation – *Using localisation markers, fluoroscopy, and multiple projection techniques.*
Targeted application and Tools that can be used:	1. **Dental Imaging Tools:** *Intraoral X-ray units, orthopantomography (OPG) machines, bitewing holders, occlusal film cassettes* 2. **Upper Respiratory & Thoracic Imaging:** *Lateral soft tissue neck devices, phonation and Valsalva positioning tools, expiratory technique setups* 3. **Abdominal Radiography:** *Acute abdomen simulators, radiopaque markers, positioning aids for foreign body detection* 4. **Mobile & OT Imaging:** *Portable X-ray machines, mobile radiation shields, C-arm fluoroscopy units, sterile drapes for OT use* 5. **Mammography Equipment:** *Dedicated mammography machines, compression paddles, wire localisation kits* 6. **Paediatric & Neonatal Imaging:** *Paediatric immobilisation tools, low-dose X-ray protocols, neonatal incubator X-ray holders* 7. **Forensic & Microradiography:** *Forensic radiography markers, specimen microradiography units, high-detail film/sensors* 8. **High kV & Soft Tissue Imaging:** *High voltage-capable X-ray units, enhanced contrast tools, beam filtration devices* 9. **Foreign Body Localization Aids:** *Radiopaque grids, skin markers, fluoroscopy for dynamic tracking, multiple angle projection tools*

Project Work:	1. ***Comparative Study on Radiographic Techniques for Dental and ENT Imaging*** *Type: Individual/Research-Based Assignment* 2. **Mini-Review: Advances in Microradiography and Forensic Imaging** *Type: Individual/Research-Based Assignment*
Text Book(s) / Reference Book(s):	1. *Radiological Positioning* – Merrill's, Mosby 2. *A Guide to Radiological Positioning* – Clark's, CBS Publishers and Distributors Pvt. Ltd 3. *Radiology of Positioning and Applied Anatomy for Students and Practitioners* – Garkal GS, Jaypee Brothers Medical Publishers 4. *Bontrager's Textbook of Radiographic Positioning and Related Anatomy* – John Lampignano, Leslie E. Kendrick, Mosby 5. *A Concise Guide on Basic Radiographic Physics, Darkroom Procedures, Radiographic Positioning & Techniques* – Lalit Agarwal, JBD Publications
Online Learning Resources 1. Radiopaedia – https://radiopaedia.org/ 2. e-Learning for Healthcare (NHS) – https://portal.e-lfh.org.uk/ 3. Statdx (Clinical Decision Support for Radiology) – https://www.statdx.com/	
4. RSNA Education Resources – https://www.rsna.org/education 5. EBook Access (University Resource) – https://presiuniv.knimbus.com/user#/home	
Topics Relevant to "Skill Development" 1. Patient positioning for trauma and surgical imaging 2. Mobile radiography in ICU and OT settings 3. Aseptic techniques and safety protocols in operation theatre 4. Foreign body localisation and special projections 5. Handling paediatric and neonatal radiographic techniques	

Course Code: BMRIT-017	**Course Title:** Radiography and Image Processing Techniques **Type of Course:** Core Course	**L-T-P-C**	2	0	2	3
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides comprehensive knowledge of radiographic film and image processing systems, including darkroom design, processing chemistry, image quality factors, and film handling techniques. Students will learn both manual and automated processing systems, as well as imaging communication systems.					

Course Objectives	A. Understand basic physics of radiography processing systems. B. Describe components such as film, intensifying screens, cassettes, and darkroom. C. Explain processing chemistry and equipment maintenance. D. Assess image quality and apply related techniques. E. Learn imaging workflow and communication systems.
Course Outcomes	CO1: Know basic physics of radiography processing system. CO2: Describe construction and working of film, intensifying screen, cassette, dark room and automatic processor. CO3: Explain radiographic film processing chemistry. CO4: Discuss the factors affecting image quality in radiographic image and their application. CO5: Operate the workflow in x-ray imaging. CO6: Apply knowledge for the use of radiation factors. CO7: Demonstrate process the radiographic film in different systems. CO8: Prepare care and maintenance of radiographic films, cassettes, intensifying screens, darkroom accessories and X-ray equipment.

Course Content

Module 1	**Photographic Principles, Intensifying Screens, X-ray Cassette**			**6 Sessions**

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.

Module 2	**Dark Room – Planning & Construction, Dark Room Accessories**			**6 Sessions**

Planning for a small and 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.

Module 3	**Film Processing – Manual & Automatic**			**6 Sessions**

Photochemistry: 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.

Module 4	**Daylight Film Handling, Xeroradiography, Stereoscopy**			**6 Sessions**

Daylight Film Handling, Xeroradiography, Stereoscopy

Module 5	**Radiographic Image Quality & Communication**			**6 Sessions**

The emergent beam related to densities on film contrast – objective and subjective radiation contrast, film contrast and radiographic contrast.

Density, sharpness, unsharpness.

Resolution: Factors affecting resolution, choice of kilovoltage and milliamperage, 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 (HIS), Radiology Information System (RIS), PACS, DICOM.

Basic skill sets required for the laboratory:	1. Skills in handling and processing radiographic films using manual and automatic systems 2. Understanding of the construction and maintenance of darkroom facilities and accessories 3. Competence in mixing, using, and managing film processing chemicals 4. Ability to identify and apply factors affecting radiographic image quality 5. Proficiency in operating intensifying screens, cassettes, and processors 6. Familiarity with image workflow, PACS, and communication systems in radiology 7. Awareness of radiation safety and darkroom safety protocols 8. Routine care and maintenance of radiographic imaging equipment and accessories 9. Capacity to troubleshoot common issues in image processing and improve image outcomes

List of Laboratory task:	**Experiment No. 1:** Handling radiographic film, screens, and cassettes – Using single/double-emulsion films, intensifying screens, cassettes, and screen-film contact tests. **Experiment No. 2:** Designing and equipping a radiographic darkroom – Using layout plans, safelights, hangers, driers, and loading/unloading stations. **Experiment No. 3:** Manual and automatic film processing – Using developer/fixer solutions, wet benches, manual tanks, and automatic processors with thermal regulation. **Experiment No. 4:** Evaluating radiographic image quality and reproduction – Using radiographs to assess contrast, density, sharpness, resolution, and magnification tools.
Targeted application and Tools that can be used:	• **Radiographic Film & Cassettes:** *Single/double emulsion films, screen-film contact testing tools, film densitometers, X-ray cassettes (rigid, flexible), cassette cleaners* • **Intensifying Screens:** *Rare earth and calcium tungstate screens, screen speed testers, film-screen matching charts* • **Darkroom Equipment:** *Safelights, hoppers, manual processing tanks, hangers, film dryers, wet/dry benches, ventilation and dust control units*
	4. **Film Processing Systems:** *Developer and fixer mixing apparatus, manual and automatic processors, temperature regulation devices, replenishment systems* *5.* **Daylight Film Handling & Advanced Imaging:** *Daylight loaders, xeroradiography plates, stereoscopy viewers* 6. **Image Quality Assessment:** *Step wedges, resolution phantoms, contrast/detail test tools, penumbra measurement aids* *7.* **Digital Imaging & Communication:** *HIS/RIS access software, PACS viewers, DICOM image file handling tools, radiograph scanners and copiers*
Project Work:	*1.* **Construction Plan for an Ideal Dark Room** *Type: Group/Design-Based Assignment* *2.* **Comparative Chart of Film Processing Techniques** *Type: Individual/Research-Based Assignment* 3. **Demonstration Report: Image Quality Parameters in Radiography** *Type: Individual/Observation-Based Assignment*
Text Book(s) / Reference Book(s):	1. *Radiographic Imaging (CBS)* – I.C.R.P., D.N. Chesney & M.O. Chesney, Blackwell Scientific 2. *An Introduction of Physics to Diagnostic Radiography* – Christensen, Curry & Dowdey, Lea & Febiger 3. *Radiological Science for Technologists* – Stewart C. Bushong, Mosby 4. *A Concise Guide on Basic Radiographic Physics, Darkroom Procedures, Radiographic Positioning & Techniques* – Lalit Agarwal, JBD Publications

Online Learning Resources
1. Radiopaedia – https://radiopaedia.org 2. eRADIMAGING – https://www.eradimaging.com 3. IAEA Human Health Campus – https://humanhealth.iaea.org 4. RSNA (Radiological Society of North America) – https://www.rsna.org/education 5. Image Wisely (Radiation Safety) – https://www.imagewisely.org
Topics Relevant to "Skill Development"
1. Manual and automatic film processing techniques 2. Safe handling and maintenance of dark room equipment 3. Evaluation and correction of film artifacts and image faults 4. Patient communication in radiographic procedures 5. Efficient use of HIS, RIS, PACS and DICOM in clinical imaging workflow

Course Code: BMRIT-018	**Course Title:** Contrast Media and Special Radiological Procedures **Type of Course:** Core Course	**L-T-P-C**	3	0	6	6

Version no.	1.0
Course Pre-requisites	None
Anti-requisites	None
Course Description	This course equips students with knowledge and practical skills to perform special radiographic procedures using contrast media. It covers patient positioning, procedural indications and contraindications, contrast media types, and safety protocols. The course also addresses pre- and post-procedural care, emergency preparedness, and specialized procedures involving gastrointestinal, biliary, urinary, reproductive, central nervous, and respiratory systems. Emphasis is placed on image quality, radiation protection, and professional responsibilities in interventional settings.
Course Objectives	1. Understand patient management and positioning during radiological procedures. 2. Learn contrast media usage, indications, contraindications, and safety. 3. Understand patient preparation and post-procedural care. 4. Gain knowledge in handling radiological emergencies and interventional procedures.

Course Outcomes	CO1: Prepare management and positioning of patients while performing radiological procedures. CO2: Correlate indications, contraindications, contrast media, radiation dose, exposure timing and safety measures. CO3: Understand patient preparation for radiological examinations. CO4: Generalize post-procedural care. CO5: Position patients for radiological procedures. CO6: Knowledge of image quality in radiological images. CO7: Manage patients for various radiological procedures. CO8: Handle emergency situations in radiology. CO9: Understand precautions and care in interventional suits.

Course Content

Module 1	**Introduction and Contrast Media**			**12 Sessions**

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 and non-ionic, adverse reactions to contrast media and patient management.

Emergency equipment in the radiology department.

Module 2	**Gastrointestinal and Biliary Tract Procedures**			**13 Sessions**

Gastrointestinal Tract: Barium Swallow; Barium Meal – Single and Double Contrast; Barium Meal Follow Through; Small Bowel Enema (Enteroclysis); Barium Enema – Gastrografin Enema; Loopogram.

Biliary Tract: Oral & Intravenous Cholecystography; Percutaneous Transhepatic Cholangiography; Percutaneous Transhepatic Biliary Drainage; Endoscopic Retrograde Cholangiopancreatography.

Module 3	**Urinary and Reproductive System Procedures**			**10 Sessions**

Urinary System: IVU (Intravenous Urography), Retrograde Pyeloureterography (RGU), Micturating Cysto Urethrography, Ascending Urethrography.

Reproductive System: Hysterosalpingogram, FTR (Fallopian Tube Recanalization).

Module 4	**CNS, Respiratory System & Miscellaneous Procedures**			**10 Sessions**

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.	
Basic skill sets required for the laboratory:	1. Proficiency in positioning and managing patients during contrast-based radiological procedures 2. Knowledge of types, uses, and safety measures related to contrast media 3. Skills in patient preparation and post-procedural care 4. Competence in assisting with gastrointestinal, urinary, biliary, and CNS contrast studies 5. Ability to assess and ensure image quality in specialised procedures 6. Application of radiation protection and aseptic techniques in interventional settings 7. Familiarity with managing emergencies and adverse contrast reactions 8. Effective communication and patient care during special procedures 9. Maintenance of professional conduct and responsibilities in interventional radiology labs
List of Laboratory task:	**Experiment No. 1:** Handling special radiographic procedures and contrast media – Using fluoroscopy setup, ionic/non-ionic contrast agents, patient prep kits, and emergency equipment. **Experiment No. 2:** Performing gastrointestinal and biliary tract
	procedures – Using barium/gastrografin contrast, enema kits, compression devices, and fluoroscopy guidance. **Experiment No. 3:** Conducting urinary and reproductive system procedures – Using IVU kits, urethrography catheters, contrast injectors, and hysterosalpingography equipment. **Experiment No. 4:** Executing CNS and respiratory procedures – Using water-soluble/oily contrast for myelography, biopsy needles, bronchography tools, and ancillary systems for lymphography and embolization.

Targeted application and Tools that can be used:	1. **Special Radiographic Procedures:** *Fluoroscopy units, interventional radiology suites, patient preparation kits, room layout optimisation tools* 2. **Contrast Media:** *Ionic and non-ionic contrast agents, barium sulfate preparations, gastrografin, contrast injectors, emergency resuscitation equipment* 3. **Gastrointestinal & Biliary Procedures:** *Barium swallow/meals, double contrast kits, enema sets, compression devices, cholangiography instruments* 4. **Urinary & Reproductive System Procedures:** *IVU kits, urethrography catheters, cystography setups, hysterosalpingography equipment, fallopian tube recanalization tools* 5. **CNS & Respiratory Procedures:** *Myelography kits (water-soluble and oily contrast), bronchography apparatus, biopsy needles, arthrography and sialography equipment, embolization agents and delivery systems* 6. **Emergency Management:** *Contrast reaction monitoring kits, emergency drug trays, oxygen supply and suction devices*
Project Work:	1. **Contrast Media Classification and Safety Poster** *Type: Group/Visual-Safety Assignment* 2. **Gastrointestinal and Biliary Radiographic Procedure Guide** *Type: Individual/Clinical-Technical Assignment* 3. **rinary and Reproductive System Radiography Table** *Type: Individual/Comparative Assignment* 4. **CNS and Respiratory Radiographic Procedures Summary** *Type: Individual/Descriptive Assignment*
Text Book(s) / Reference Book(s):	1. *Radiographic Imaging (CBS)* – I.C.R.P., D.N. Chesney & M.O. Chesney, Blackwell Scientific 2. *An Introduction of Physics to Diagnostic Radiography* – Christensen, Curry & Dowdey, Lea & Febiger 3. *Radiological Science for Technologists* – Stewart C. Bushong, Mosby 4. *A Concise Guide on Basic Radiographic Physics, Darkroom Procedures, Radiographic Positioning & Techniques* – Lalit Agarwal, JBD Publications
Online Learning Resources	
1. https://www.msdmanuals.com/professional/diagnostic-procedures/imaging-techniques/contrast-media 2. e-Radiology Learning (by the Royal College of Radiologists, UK): https://www.e-lfh.org.uk/programmes/radiology/ 3. StatDx (by Elsevier) : https://www.statdx.com 4. RSNA (Radiological Society of North America) Education Portal: https://www.rsna.org/education 5. YouTube Channel – Philips Radiology Education: https://www.youtube.com/c/PhilipsRadiologyEducation	

Topics Relevant to "Skill Development"

1. **Film Handling and Darkroom Practice** – Enhances manual dexterity, attention to cleanliness, and technical consistency in traditional radiographic processes.
2. **Contrast Media Preparation and Injection Techniques** – Builds hands-on competence in patient safety, IV access, dosage handling, and emergency readiness.
3. **Radiographic Patient Positioning for GI, Urinary, and CNS Procedures** – Develops practical alignment skills for accurate imaging and patient comfort.
4. **Radiographic Image Quality Assessment** – Trains students to evaluate sharpness, contrast, and resolution for diagnostic effectiveness.
5. **Emergency Management in Radiology** – Focuses on rapid response skills to adverse reactions during contrast-enhanced procedures or interventions.

SEMESTER IV

Course Code: BMRIT-019	**Course Title:** Cross-Sectional Anatomy **Type of Course:** Core Course	**L-T-P-C**	2	0	6	5
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course offers a foundational understanding of cross-sectional human anatomy through the interpretation of CT and MRI images. Students will explore anatomical structures in sagittal, coronal, and axial planes and relate them to clinical and diagnostic radiology. Emphasis is placed on structural relationships, normal versus pathological findings, and the ability to recognise detailed anatomy of the thorax, abdomen, pelvis, brain, spine, and neck.					
Course Objectives	1. To introduce students to the principles and terminology of sectional anatomy. 2. To develop the ability to identify major anatomical structures in cross-section on CT and MRI. 3. To correlate anatomical structures with clinical and radiological imaging. 4. To build spatial understanding of internal anatomy using advanced imaging techniques. 5. To facilitate recognition of normal and abnormal patterns in diagnostic images.					

Course Outcomes	CO1: Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images. CO2: Describe anatomical structural relationships. CO3: Recognize normal anatomy and build a personal resource system for future study. CO4: Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy. CO5: On CT and MR images, identify anatomical structures of the body and of the head. CO6: Distinguish between arterial and venous anatomy of the entire body's vascular system. CO7: Classify the various sections of anatomical regions and their associated parts.

Course Content

Module 1	**Fundamentals of Sectional Anatomy and Upper Thorax**			**10 Sessions**

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.

Module 2	**Imaging and Anatomy of Thorax, Abdomen and Pelvis**			**20 Sessions**

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

Module 3	**Pelvic and Neuroanatomy in Cross Section**			**10 Sessions**

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
Spine- Vertebra and disc, Spinal cord and meninges
Neck-Arterial/venous systems, Muscles, Glands and pharynx

Basic skill sets required for the laboratory:	1. Ability to identify anatomical structures in sagittal, coronal, and axial planes on CT and MRI 2. Skills in interpreting cross-sectional images of the brain, thorax, abdomen, pelvis, and spine 3. Spatial understanding of internal anatomical relationships in diagnostic imaging 4. Competence in distinguishing between normal and pathological structures 5. Familiarity with arterial and venous anatomy in cross-sectional views 6. Visual correlation of imaging findings with theoretical anatomical knowledge 7. Proficiency in navigating digital imaging systems and radiological software 8. Systematic approach to classify anatomical sections and related structures 9. Attention to anatomical detail for clinical and diagnostic application
List of Laboratory task:	**Experiment No. 1:** Identification of sectional planes and anatomical terminology – Using cross-sectional atlases, labelled diagrams, and digital anatomy software. **Experiment No. 2:** Study of upper thorax anatomy and surface relations – Using thoracic models, anatomical charts, and dissection videos. **Experiment No. 3:** Visualisation of mid-thorax divisions, heart, and vessels – Using 3D heart models, CT/MRI thorax datasets, and interactive anatomy tools. **Experiment No. 4:** Interpretation of CT/MRI images of thorax – Using DICOM viewers and annotated normal vs. pathological image sets. **Experiment No. 5:** Identification of abdominal organs and vascular structures – Using abdominal cross-sections, virtual dissectors, and labelled CT/MRI images. **Experiment No. 6:** Study of CT/MR images of abdomen – Using radiological archives, DICOM software, and side-by-side normal/pathology comparison. **Experiment No. 7:** Study of pelvic anatomy and bony structures – Using pelvis models, MRI cross-sections, and schematic diagrams. **Experiment No. 8:** Observation of male/female reproductive systems on imaging – Using MR images and anatomical overlays for pathology recognition.

	Experiment No. 9: Interpretation of CT/MR images of pelvis – Using gender-specific scans, pathological image sets, and comparative anatomy tools. **Experiment No. 10:** Orientation to neuroanatomy and scan planes – Using neuroanatomy atlases, cross-sectional software, and scan-plane simulators. **Experiment No. 11:** Brain anatomy – hemispheres, sinuses, ventricles, brainstem, vessels – Using brain models, axial/sagittal imaging, and vascular charts. **Experiment No. 12:** Study of spine, vertebrae, and spinal cord structures – Using spine models, sagittal CT/MRI slices, and interactive modules. **Experiment No. 13:** Identification of neck anatomy – vessels, muscles, glands – Using transverse CT/MRI sections, neck models, and labelled diagrams.
Targeted application and Tools that can be used:	1. **Sectional Anatomy Learning:** *Digital anatomy atlases, virtual dissection tables, 3D reconstruction software, anatomical terminology databases* 2. **Thorax and Upper Thorax Imaging:** *CT/MRI viewers, cross-sectional imaging simulators, thoracic pathology image banks* 3. **Abdominal and Pelvic Imaging:** *DICOM-based radiology viewers, contrast-enhanced CT/MRI for gastrointestinal and genitourinary systems, labelled image databases for normal and pathological anatomy* 4. **Neuroanatomy in Cross Section:** *MRI/CT brain atlases, neuroimaging navigation tools, axial/coronal/sagittal scan plane overlays, cranial nerve imaging references* 5. **Spine and Neck Imaging Tools:** *Cross-sectional spinal imaging software, vertebral segmentation tools, neck vasculature 3D models* 6. **Clinical Application:** *PACS (Picture Archiving and Communication System), Radiology Information Systems (RIS), radiological case archives for comparison and diagnosis training*
Project Work:	1. **Sectional Anatomy Orientation Chart** *Type: Individual/Diagrammatic Assignment* 2. **Spine and Neck Cross-Sectional Model** *Type: Individual/Model-Based Assignment*
Text Book(s) / Reference Book(s):	1. Cross Sectional Anatomy CT & MR – G Bhavin Jhankaria, Jaypee Brothers Medical Publishers 2. Step by Step Cross-sectional Anatomy – D Karthikeyan, Jaypee Brothers 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
Online Learning Resources	

1. https://www.imaios.com/en/e-Anatomy 2. https://radiopaedia.org/playlists/25785 3. https://www.visiblebody.com/anatomy-and-physiology-apps/atlas-of-human-anatomy 4. https://headneckbrainspine.com/ 5. https://www.ctisus.com/
Topics Relevant to "Skill Development" 1. Visual-spatial reasoning using cross-sectional views 2. CT/MRI anatomical interpretation skills 3. Pattern recognition for normal vs pathological findings 4. Multiplanar anatomical correlation 5. Structured anatomical labelling and reporting

Course Code: BMRIT-020	**Course Title:** Modern Radiological Imaging Equipment and Physics **Type of Course:** Core Course	**L-T-P-C**	3	0	2	4
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the fundamentals and advancements in modern radiological imaging equipment. Emphasis is laid on the operational principles and components of digital imaging technologies, including computed radiography, digital radiography, dental imaging systems, and hospital information systems like PACS. The course also provides essential knowledge of their applications, advantages, and limitations in medical practice.					
Course Objectives	1. To understand the design and function of special radiological imaging equipment. 2. To explain the principles behind digital and computed radiographic techniques. 3. To describe innovations in dental radiology including cone-beam CT. 4. To familiarise students with PACS, RIS, HIS and their importance in radiology workflow. 5. To highlight the clinical applications and safety considerations of digital radiological systems.					
Course Outcomes	CO1: Describe the special radiological equipments CO2: Describe the digital and computed radiography					
Course Content						

Module 1	**Modern Radiographic Systems**			**14 Sessions**
Modern x-ray tube. Digital Mammography and Tomosynthesis, Stitch radiography, Dual energy x-ray absorptionometry (DEXA) scan.				
Module 2	**Computed and Digital Radiography Systems**			**14 Sessions**
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.				
Module 3	**Dental Imaging Systems**			**9 Sessions**
Modern dental equipments. Cone beam dental CT				
Module 4	**Radiological Informatics Systems**			**8 Sessions**
Picture archiving and communication system (PACS), RIS and HIS.				
Basic skill sets required for the laboratory:	1. Operational knowledge of digital and computed radiography systems 2. Ability to handle and maintain specialised radiological imaging equipment 3. Familiarity with dental imaging systems, including cone-beam CT 4. Skills in navigating hospital imaging software like PACS, RIS, and HIS 5. Understanding of workflow in digital radiology departments 6. Ability to assess image quality and troubleshoot equipment issues 7. Awareness of safety protocols and best practices in digital imaging 8. Integration of theoretical physics with equipment functioning 9. Critical thinking in comparing imaging modalities and their clinical applications			
List of Laboratory task:	**Experiment No. 1:** Study of modern X-ray tubes and DEXA scan systems **Experiment No. 2:** Demonstration of Digital Mammography and Tomosynthesis **Experiment No. 3:** Observation of Stitch Radiography techniques **Experiment No. 4:** Understanding Computed Radiography (CR)			

	Experiment No. 5: Hands-on with Digital Radiography (DR) systems **Experiment No. 6:** Study of direct and indirect digital fluoroscopy systems **Experiment No. 7:** Comparison of CR and DR systems **Experiment No. 8:** Demonstration of portable and mobile X-ray units **Experiment No. 9:** Overview of modern dental radiographic equipment **Experiment No. 10:** Introduction to PACS, RIS, and HIS
Targeted application and Tools that can be used:	1. **Modern Radiographic Systems:** *Digital mammography units, tomosynthesis simulators, long-bone stitch imaging software, DEXA scan analysis platforms* 2. **Computed and Digital Radiography Systems:** *CR/DR simulators, flat-panel detector demo tools, portable DR unit trainers, system comparison modules (direct vs. indirect DR)* *3.* **Dental Imaging Systems:** *Cone Beam CT viewers, dental radiography trainers, 3D reconstruction tools for maxillofacial anatomy* 4. **Radiological Informatics Systems:** *PACS viewers and servers, RIS/HIS integration simulators, DICOM workflow training platforms, radiology reporting modules*
Project Work:	*1.* **Digital Imaging Systems Comparison Chart** *Type: Individual/Table-Based Assignment* **2. Infographic on Advanced Mammography Techniques** *Type: Individual/Visual-Conceptual Assignment* *3.* **Interactive Poster: PACS, RIS & HIS Workflow** *Type: Group/Visual-System Integration Assignment*
Text Book(s) / Reference Book(s):	1. *Textbook of Radiology: Physics* – Amol Sasane, Hariqbal Singh, Roshan Lodha; Jaypee Brothers Medical Publishers 2. *The Physics Of Radiology And Imaging* – Thayalan K; Jaypee Brothers Medical Publishers 3. *Christensen's Physics of Diagnostic Radiology* – Thomas S. Curry, James E. Dowdey, Robert E. Murry; Lea & Febiger, U.S. 4. *Textbook Of Radiology For Residents And Technicians* – S. K. Bhargava; CBS Publishers 5. *Concise Text Book on Imaging Modalities & Recent Advances In Diagnostic Radiology* – Lalit Agarwal, Dr. K.B. Gehlot; JBD Publications
Online Learning Resources *1. https://www.youtube.com/watch?v=FMdTtxHbQto* *2. https://www.radiologyinfo.org/en/info/article-digital-radiography*	

3. https://www.sciencedirect.com/topics/medicine-and-dentistry/cone-beam-computed-tomography
Topics Relevant to "Skill Development" *1. Technical proficiency with digital and computed radiography systems* *2. Operation and troubleshooting of flat panel detectors and portable x-ray units* *3. Interpretation of output image quality and equipment calibration* *4. Application of PACS/RIS/HIS in clinical workflow and data handling* *5. Understanding safety protocols for digital imaging environments*

Course Code: BMRIT-021	**Course Title:** Interventional Radiology Techniques **Type of Course:** Core Course	**L-T-P-C**	3	0	4	5
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides students with essential knowledge of interventional radiology procedures, covering their physical principles, equipment, and techniques. It emphasises patient management, positioning, safety protocols, and post-procedural care. Learners gain insights into catheter-based imaging techniques, vascular interventions, and the use of modern angiographic systems, helping them develop the clinical and technical proficiency required in interventional radiology.					
Course Objectives	1. To understand the basic physics and principles of interventional radiology equipment. 2. To become proficient in patient preparation, positioning, and safety during interventional procedures. 3. To learn about the materials, tools, and imaging techniques used in interventional radiology. 4. To identify proper indications, contraindications, and post-procedure care for various interventions. 5. To apply quality assurance protocols and safety guidelines in angiographic environments.					
Course Outcomes	CO1: Know the basic principle and physics of interventional equipment. CO2: Know the management and positioning of patients while performing interventional radiological procedure. CO3: Have 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.			
Course Content				
Module 1	**Basics of Interventional Radiology Equipment**			**10 Sessions**
Introduction to interventional procedures DSA: basic principles and types Equipment: Basics of angiographic equipment, 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				
Module 2	**Interventional Tools and Techniques**			**10 Sessions**
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				
Module 3	**Arteriographic and Venographic Procedures**			**12 Sessions**
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				
Module 4	**Radiation Safety in Angiography**			**6 Sessions**
Safety considerations in angiography room; room design, protective devices, radiation monitoring				
Module 5	**Equipment Maintenance and Quality Assurance**			**7 Sessions**
Care and maintenance tests: General care, functional test Quality assurance program: Acceptable limits of variation, corrective action				
Basic skill sets required for the laboratory:	1. Understanding of the principles and physics of interventional radiology equipment 2. Skills in patient preparation, positioning, and monitoring during interventional procedures 3. Proficiency in handling catheters, contrast media, and angiographic tools 4. Familiarity with indications, contraindications, and radiation safety protocols			

	5. Ability to assist in vascular and non-vascular interventional techniques 6. Competence in post-procedural care and patient safety measures 7. Awareness of aseptic techniques and sterile environment protocols 8. Application of quality control and assurance in angiographic labs 9. Integration of clinical knowledge with real-time imaging techniques
List of Laboratory task:	**Experiment No. 1:** Basics of angiographic equipment and DSA – Using single/biplane angiography units, image intensifiers or flat panel detectors, ECG monitors, and 3D angiography simulation software. **Experiment No. 2:** Handling and classification of catheters and guide wires – Using demonstration kits of various catheter types, guide wires, pressure injectors, and sterile handling tools. **Experiment No. 3:** Arteriographic and venographic procedures – Using angiography procedure videos, anatomical models, contrast injection simulators, and image interpretation stations. **Experiment No. 4:** Radiation safety in the angiography suite – Using radiation monitors (TLDs, dosimeters), lead aprons, room shielding layouts, and signage for controlled areas. **Experiment No. 5:** Equipment care and quality assurance testing – Using QA checklists, maintenance logs, phantom testing for imaging consistency, and inspection of functional components.
Targeted application and Tools that can be used:	*1.* **Interventional Radiology Equipment:** *DSA simulators, flat panel detector interfaces, angiographic table controls, CO_2 angiography viewers, real-time image intensifier systems* 2. **Catheters and Guide Wires:** *Virtual catheter navigation tools, guide wire simulation platforms, injection pressure monitoring systems, percutaneous access training modules* 3. **Arteriographic and Venographic Procedures:** *Vascular imaging atlases, arteriography/venography case banks, 3D angiographic reconstruction tools, interactive vessel mapping software* 4. **Radiation Safety in Angiography:** *Radiation dose monitoring systems, protective shielding simulation tools, angiography suite design planners, personal dosimetry tracking software* *5.* **Equipment Maintenance and QA:** *QA tracking systems, digital checklists for functional tests, equipment calibration tools, quality assurance limit reference guides*
Project Work:	***1.*** **Interventional Equipment Reference Sheet** *Type: Individual/Diagrammatic-Technical Assignment* ***2.*** **Catheter and Guidewire Classification Chart** *Type: Individual/Table-Based Assignment*

	3. **Procedure Flowchart: DSA and Percutaneous Catheterisation** *Type: Individual/Visual-Sequential Assignment* 4. **Annotated Diagrams: Arteriographic and Venographic Routes** *Type: Pair/Clinical-Mapping Assignment* 5. **Radiation Safety Checklist for Angiography Rooms** *Type: Group/Safety-Protocol Assignment*
Text Book(s) / Reference Book(s):	1. *The Practice of Interventional Radiology* – Karim Valji 2. *Interventional Radiology: A Survival Guide* – EBIR Kessel, David; Robertson, Iain – Elsevier Health Sciences 3. *Handbook of Interventional Radiologic Procedures* – Krishna Kandarpa, Lindsay Machan, Janette Durham – Lippincott Williams and Wilkins 4. *Interventional Radiology: A Survival Guide* – David Kessel, Iain Robertson – Elsevier Health Sciences 5. *A Guide on Special Radiographic Investigations & Techniques* – Lalit Agarwal – JBD Publications
Online Learning Resources 1. ***Radiopaedia – Interventional Radiology Overview***- *https://radiopaedia.org/articles/interventional-radiology* 2. ***RSNA (Radiological Society of North America) – Patient Safety & Procedures***- *https://www.radiologyinfo.org/en/submenu.cfm?pg=interventional-radiology* 3. ***NIH – Digital Subtraction Angiography (DSA)***- *https://www.ncbi.nlm.nih.gov/books/NBK539824/* 4. ***YouTube – Interventional Radiology Tools & Techniques (Educational Video)***- *https://www.youtube.com/watch?v=Gspj-KfGdWc* 5. ***Society of Interventional Radiology (SIR)***- *https://www.sirweb.org/patient-center/*	
Topics Relevant to "Skill Development" 1. *Operation and maintenance of angiographic equipment (single/biplane, injectors, monitors)* 2. *Safe and sterile catheterisation techniques including asepsis* 3. *Patient preparation, positioning, and real-time monitoring during IR procedures* 4. *Radiation protection and room design safety protocols in interventional suites* 5. *Performing and interpreting functional equipment tests and applying QA protocols*	

Course Code: BMRIT022	**Course Title:** Patient Care in Radiology **Type of Course:** Core Course	**L-T-P-C**	2	0	4	4
Version no.	1.0					

Course Pre-requisites	None			
Anti-requisites	None			
Course Description	This course provides students with essential knowledge and skills related to patient care in a radiological setting. It focuses on the responsibilities of imaging technologists, patient handling and safety, consent procedures, infection control, radiation safety, and ethical practices. Emphasis is placed on effective communication, emergency care, and maintaining hygiene and asepsis during radiological investigations.			
Course Objectives	1. To introduce students to the foundational principles of patient care in radiology. 2. To train students in patient handling, communication, consent, and emergency procedures. 3. To develop awareness about infection prevention, sterilisation techniques, and universal precautions. 4. To familiarise students with hospital organisation, medico-legal considerations, and ethics in radiology. 5. To prepare students for safe, effective, and ethical conduct during radiological procedures.			
Course Outcomes	CO1: Understand the responsibility of the imaging technologist and other health care facility. CO2: Understand the management and care of patient during different procedures and emergency situations. CO3: Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination. CO4: Differentiate the types of consent forms. CO5: Know about infection control, infection source and isolation techniques. CO6: Describe sterilization techniques. CO7: Understand the radiation safety and protection.			
Course Content				
Module 1	**Introduction to Patient Care and Communication**			**4 Sessions**
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 behaviour				
Module 2	**Hospital Procedures and Organisation**			**4 Sessions**

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; out-patient and follow-up clinics; stock-taking and stock keeping.				
Module 3	**Patient Management and Hygiene**			**4 Sessions**
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.				
Module 4	**Nursing Procedures and First Aid**			**4 Sessions**
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.				
Module 5	**Infection Control and Sterilisation**			**4 Sessions**
Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc. Principles of asepsis: Sterilization - 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)				
Module 6	**Patient Care in Radiological Investigations**			**6 Sessions**
Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control Departmental procedures: Department staffing and organizations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department; appointments; organisations; minimizing waiting time; out-patient and follow-up clinics; stock taking and stock keeping.				
Module 7	**Drug Handling and Medical Records**			**4 Sessions**
Drugs in the department and Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, and 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				

Basic skill sets required for the laboratory:	1. Skills in safe and ethical patient handling during radiological procedures 2. Effective communication techniques with patients and healthcare teams 3. Competence in managing emergency situations within radiology settings 4. Knowledge of various patient transfer and restraint methods 5. Understanding of consent procedures and medico-legal responsibilities 6. Application of infection control and isolation protocols 7. Proficiency in sterilisation techniques and maintaining asepsis 8. Awareness of radiation safety principles and protective measures 9. Familiarity with the roles and responsibilities of healthcare professionals in imaging departments
List of Laboratory task:	**Experiment No. 1:** Introduction to Patient Care and Communication – Using role-play, patient history forms, vital signs measurement tools, and communication scenarios. **Experiment No. 2:** Hospital staffing, organization, records, and medico-legal aspects – Using hospital administrative records, patient appointment registers, and case study discussions on medico-legal issues. **Experiment No. 3:** Care of the patient – Practical demonstrations of patient transfer, restraining techniques, stretcher/chair management, and ergonomics. **Experiment No. 4:** Nursing procedures and First Aid – Practice of injection methods, rectal enema administration, wound dressing, bandaging, and use of first aid equipment. **Experiment No. 5:** Infection control and principles of asepsis – Using sterilization equipment demonstrations, aseptic techniques, and universal precaution protocols. **Experiment No. 6:** Patient care in radiological investigations – Observation and practice in handling patients during GIT, respiratory, cardiovascular, CNS imaging; sterilization and infection control measures. **Experiment No. 7:** Drug handling, storage, and medical ethics – Use of drug classification charts, storage regulations, crash cart components, and discussion on consent and medico-legal documentation.
Targeted application and Tools that can be used:	1. **Patient Care and Communication:** *Electronic patient consent systems, digital vital sign monitors, patient communication skill simulators, ergonomics training modules* 2. **Hospital Procedures and Organisation:** *Hospital management software, patient appointment and record management systems, medico-legal documentation platforms*

	3. **Patient Management and Hygiene:** *Hygiene compliance tracking tools, patient transfer simulation software, personal protective equipment (PPE) usage apps* 4. **Nursing Procedures and First Aid:** *Digital nursing procedure guides, first aid simulation apps, emergency response training platforms, drug administration trackers* 5. **Infection Control and Sterilisation:** *Infection surveillance software, sterilisation process monitoring tools, hospital-acquired infection databases, universal precaution e-learning modules* 6. **Patient Care in Radiological Investigations:** *Procedure-specific patient care checklists, departmental workflow management tools, infection control audit software* 7. **Drug Handling and Medical Records:** *Electronic drug inventory and tracking systems, crash cart management apps, medico-legal case management software, digital medical record keeping systems*
Project Work:	***1.*** **Patient Communication Role-Play Scenarios** *Type: Pair/Practical-Simulation Assignment* ***2.*** **Hospital Procedure and Organization Flowchart** *Type: Individual/Diagrammatic Assignment* ***3.*** **Infection Control Protocol Poster** *Type: Group/Visual-Safety Assignmen* ***4.*** **First Aid Procedures Illustrated Guide** *Type: Individual/Diagrammatic Assignment* ***5.*** **Drug Handling and Medical Records Checklist** *Type: Individual/Administrative-Procedure Assignment*
Text Book(s) / Reference Book(s):	1. *Patient Care in Radiography* – Ruth Ann Ehrlich, Dawn M Coakes – Mosby 2. *Concise Textbook on Hospital Management & Patient Care in Diagnostic Radiology* – N.K. Kardam, Lalit Agarwal – JBD Publications 3. *Patient Care in Radiography: With an Introduction to Medical Imaging* – Ruth Ann Ehrlich, Joan A. Daly – Mosby Elsevier 4. *Introduction to Radiologic and Imaging Sciences and Patient Care* – Adler A.M. – Elsevier 5. *Concise Textbook on Hospital Management & Patient Care in Diagnostic Radiology* – Lalit Agarwal, Dr. N.K. Kardam – JBD Publications

Online Learning Resources

1. *https://radiopaedia.org/articles/radiography-patient-care*
2. *https://www.ncbi.nlm.nih.gov/books/NBK537066/*
3. *https://www.cdc.gov/infectioncontrol/index.html*
4. *https://www.rsna.org/education/patient-safety*
5. *https://presiuniv.knimbus.com/user#/home*

opics Relevant to "Skill Development"

Safe patient handling, transfer, and restraint during radiological procedures

Effective communication and obtaining informed consent in clinical settings

Infection prevention and aseptic technique in imaging departments

Emergency response skills, including vital signs monitoring and first aid

Radiation safety protocols and ethics in medical imaging environments

SEMESTER V

Course Code: BMRIT023	**Course Title:** Basic Techniques in CT Technology **Type of Course:** Core Course	**L-T-P-C**	5	0	8	9
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the fundamental principles and techniques of Computed Tomography (CT). It covers the physics of CT imaging, instrumentation, scan protocols for various anatomical regions, and patient handling. The course also includes image reconstruction, post-processing, safety considerations, and quality control measures. Emphasis is given to the role of technologists in ensuring optimal image quality and patient care during CT procedures.					
Course Objectives	1. To understand the basic physics and instrumentation involved in CT imaging. 2. To learn CT protocols and patient positioning techniques for different anatomical regions. 3. To apply image reconstruction and post-processing techniques. 4. To identify artifacts and improve image quality. 5. To understand radiation safety, documentation, and the role of the imaging technologist in CT procedures.					
Course Outcomes	CO1: Define basic principle and physics of Computed Tomography scan CO2: Recognize protocols needed for Computed Tomography examination CO3: Prepare and positioning for Computed Tomography examination					

	CO4: Interpret post processing of raw Computed Tomography images CO5: Prepare and position the patients for Computed Tomography examination CO6: Categorize knowledge of improving image quality in Computed Tomography images CO7: Plan of scanning with various Computed Tomography protocols for better representation of images CO8: Systematize post processing for Computed Tomography scan CO9: Management of patient for any post contrast reactions			
Course Content				
Module 1	**Introduction to CT and System Components**			**15 Sessions**
Introduction and history, CT principle, CT generations, CT Instrumentation, CT detectors, Axial & Helical CT – Slip ring technology				
Module 2	**Image Acquisition and Reconstruction**			**15 Sessions**
Data acquisition, Image pre-processing/reconstruction techniques, Algorithms for image reconstruction, Image display, Image post-processing techniques, CT artefacts, Image quality				
Module 3	**CT Protocols and Contrast Applications**			**15 Sessions**
CT Protocols for different body parts & Dental scan, CT Protocols for Angiography & Perfusion, CT contrast media and administration, CT guided interventional procedures.				
Module 4	**Advanced CT Technologies**			**15 Sessions**
Multi-detector CT Isotropic imaging, Cardiac CT, Flash CT, Advanced CT scanners, Dual energy & Dual Source Scanners, CT-fluoroscopy				
Module 5	**Safety and Quality Assurance in CT**			**15 Sessions**
Safety consideration, Documentation in CT, Role of Medical Imaging technologist in CT scan procedures, Quality assurance in CT				
Basic skill sets required for the laboratory:	1. Understanding of basic CT physics and scanner components 2. Proficiency in CT scan protocols and patient positioning techniques			

	3. Skill in preparing patients and managing contrast administration 4. Ability to perform CT image reconstruction and post-processing 5. Competence in identifying and correcting common CT image artefacts 6. Knowledge of radiation safety measures and dose optimisation 7. Familiarity with quality control practices in CT imaging 8. Ability to handle post-contrast reactions and ensure patient safety 9. Application of documentation protocols and ethical practices in CT procedures
List of Experiments	**Experiment No. 1:** Introduction to CT Equipment and System Components Demonstration and identification of CT scanner components including detectors, gantry, couch, and slip ring technology across different CT generations (Axial & Helical). **Experiment No. 2:** Image Acquisition and Reconstruction Hands-on with image data acquisition, demonstration of reconstruction techniques and algorithms, image display interfaces, and identification of CT image artifacts. **Experiment No. 3:** CT Protocols and Contrast Applications Preparation and execution of protocols for brain, chest, abdomen, and dental scans. Observation of angiography and perfusion protocols. Use of contrast media and simulated interventional procedures. **Experiment No. 4:** Advanced CT Technologies Demonstration of Multi-detector CT, Isotropic imaging, Dual energy and Dual source scanning, Cardiac CT simulation, and overview of Flash CT. **Experiment No. 5:** CT Safety and Quality Assurance Practical session on safety practices in CT room, documentation procedures, radiation safety, patient preparation, and performing quality assurance tests
Targeted application and Tools that can be used:	1. **CT System Components and Acquisition:** *CT simulator software, slip ring technology models, virtual axial/helical scanning modules, detector configuration visualisers* 2. **Image Reconstruction and Processing:** *Image reconstruction algorithm simulators, DICOM image viewers, CT artefact simulation tools, image quality assessment platforms* 3. **CT Protocols and Contrast Applications:** *Protocol planning software for body/dental/angiography scans, contrast media administration trainers, CT-guided procedure simulation modules*

	4. **Advanced CT Technologies:** *Multi-detector CT interpretation platforms, isotropic imaging tools, cardiac CT analysis software, dual energy and dual source scanner emulators, CT-fluoroscopy training simulators* 5. **Safety and Quality Assurance in CT:** *CT radiation dose calculators, quality control checklists, technologist workflow simulators, safety and documentation compliance software*
Project Work:	1. **Timeline of CT Technology Development** *Type: Individual/Visual-History Assignment* 2. **Image Reconstruction Techniques Flowchart** *Type: Individual/Diagrammatic Assignment* 3. **Checklist for Quality Assurance in CT** *Type: Individual/Administrative-Procedure Assignment*
Text Book(s) / Reference Book(s):	1. *Computed Tomography: Physical Principles, Clinical Applications, and Quality Control – Euclid Seeram – 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. Szczykutowicz – Medical Physics Publishing Corporation* 5. *CT Protocols – Manjot Kaur, Maajid Mohi Ud Din Malik – JBD Publications*

Online Learning Resources

1. *EBook Access (University Resource) – https://presiuniv.knimbus.com/user#/home*
2. *Radiopaedia – CT Physics & Protocols – https://radiopaedia.org/articles/computed-tomography-physics*
3. *CTisus – CT Education & Resources – https://www.ctisus.com*
4. *NIH – CT Dose and Safety – https://www.ncbi.nlm.nih.gov/books/NBK535416/*
5. *YouTube – CT Physics Lectures by Dr. Refeeque – https://www.youtube.com/watch?v=0CDcKLnJz1s*

Topics Relevant to "Skill Development"

1. *Identification, operation, and troubleshooting of CT scanner components—gantry, slip-ring, detectors*
2. *Mastery of CT scan protocols and precise patient positioning for different anatomical regions*
3. *Safe administration of CT contrast and management of post-contrast reactions*
4. *Hands-on experience with CT image reconstruction, post-processing, and artifact correction*
5. *Application of radiation safety practices and quality assurance procedures in CT imaging*

Course Code: BMRIT024	**Course Title:** Radiation Safety in Diagnostic Radiology (incl. AERB Competencies) **Type of Course:** Core Course	**L-T-P-C**	3	0	4	5
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the essential principles of radiation protection in diagnostic radiology. It covers fundamental radiation units, biological effects, detection methods, dose measurement, and protective techniques. The course also emphasises departmental layout planning, use of signage and shielding, and compliance with safety protocols to protect patients, healthcare workers, and the public from harmful radiation exposure.					
Course Objectives	1. To understand the principles and objectives of radiation protection in diagnostic radiology. 2. To familiarise students with radiation quantities, units, and exposure limits. 3. To learn about radiation effects on biological tissues and human health. 4. To explore various radiation detection and measurement devices. 5. To apply safety guidelines for radiation protection of patients, staff, and the public. 6. To study departmental layout and shielding calculations for effective protection. 7. To introduce technical advancements like AI in radiation safety.					
Course Outcomes	CO1: 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 CO5: Layout of Radiology department CO6: Use of protective devices and awareness of radiation with radiation signages CO7: Dose reduction measures with technical protective considerations during radiology CO8: Different radiation measuring devices CO9: Effects of radiation on biological tissue					
Course Content						

Module 1	**Radiation Quantities and Units**			**8 Sessions**
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.				
Module 2	**Biological Effects of Radiation**			**10 Sessions**
Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell - Chromosomal aberration and its application for 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 effects - stochastic and deterministic effects - Acute exposure and chronic exposure - LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.				
Module 3	**Radiation Detection and Dosimetry**			**12 Sessions**
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 types 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.				
Module 4	**Principles and Practices of Radiation Protection**			**8 Sessions**
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.				
Module 5	**Radiation Hazard Evaluation and Control**			**7 Sessions**
Philosophy of Radiation protection, effects of time, distance & shielding. Calculation of workload, 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 materials.				
Basic skill sets required for the laboratory:	1. Understanding of radiation units, quantities, and exposure limits 2. Ability to identify and interpret radiation safety signages 3. Skill in using radiation detection and dose measurement devices			

	4. Knowledge of biological effects of radiation and dose-response relationships 5. Competence in applying radiation protection techniques for patients and staff 6. Awareness of shielding requirements and radiology department layout 7. Familiarity with radiation protection regulations and dose limits 8. Understanding of technical methods for radiation dose reduction 9. Awareness of modern safety practices including AI applications in radiology
List of Laboratory task:	**Experiment No. 1:** Radiation Quantities and Units Identification and calculation of radiation units including exposure, absorbed dose, equivalent dose, and effective dose. Use of conversion factors and occupational dose limits in simulated cases. **Experiment No. 2:** Biological Effects of Radiation Demonstration of radiation effects on cellular structures using simulation tools. Case-based learning on somatic vs hereditary effects, deterministic vs stochastic outcomes, and dose-response relationships. **Experiment No. 3:** Radiation Detection and Measurements Hands-on with survey meters, ionisation chambers, scintillation detectors, TLDs, film badges, and pocket dosimeters. Demonstration of phantom measurements, CTDI, MSAD, DLP, and AGD in different imaging protocols. Role of AI in radiation dose management. **Experiment No. 4:** Principles of Radiation Protection Practical application of ALARA principle through simulated exposure scenarios. Use of shielding, time-distance management, and dose monitoring for both patient and personnel. **Experiment No. 5:** Radiation Hazard Evaluation and Control Calculation of shielding requirements, workload, use and occupancy factors in diagnostic radiology setup. Evaluation of weekly radiation doses and demonstration of safe working practices.
Targeted application and Tools that can be used:	1. **Radiation Quantities and Units:** *Dose conversion calculators, ICRP reference dose tables, simulation tools for effective and equivalent dose estimation, occupational exposure tracking software* 2. **Biological Effects of Radiation:** *Interactive radiation biology simulators, chromosomal aberration visual tools, dose–response relationship models, fetal exposure risk calculators* *3.* **Radiation Detection and Dosimetry:** *Survey meter trainers, TLD/film badge simulators, phantom-based dose*

	measurement tools (CTDI, DLP, AGD), dosimetry software with AI dose optimisation modules 4. **Radiation Protection Principles:** *ALARA implementation tools, shielding simulation platforms, exposure scenario builders, real-time personal dosimeter readers and dashboards* 5. **Hazard Evaluation and Control:** *Radiation facility design planners (including workload/use/occupancy factors), shielding material simulation apps, weekly dose calculation tools, diagnostic radiology safety audit checklists*
Project Work:	***1.*** **Radiation Units and Dose Conversion Chart** *Type: Individual/Reference-Calculation Assignment* ***2.*** **Poster on Biological Effects of Radiation** *Type: Group/Visual-Conceptual Assignment* ***3.*** **Comparison Table of Radiation Detectors** *Type: Individual/Tabular-Technical Assignment*
Text Book(s) / Reference Book(s):	1. *Radiation Protection In Diagnostic X-Ray Imaging – Euclid Seeram, Patrick C. Brennan – Jones and Bartlett Publishers* 2. *Development of Radiation Protection in Diagnostic Radiology – Stewart C. Bushong – CRC Press Inc., U.S.* 3. *Textbook of Radiological Safety – Thayalan K – Jaypee Brothers Medical Publishers* 4. *Radiation Protection in Medical Radiography – Statkiewicz Sherer – Elsevier Health* 5. *Basics of Radiation, Hazards and Prevention In Diagnostic Radiology – Prashant Kumar Jha – JBD Publications*
Online Learning Resources 1. *EBook Access (University Resource) – https://presiuniv.knimbus.com/user#/home* 2. *IAEA Radiation Protection of Patients (RPOP) – https://www.iaea.org/resources/rpop* 3. *RSNA: Radiation Safety Resources – https://www.rsna.org/en/practice-tools/radiology-safety/radiation-safety* 4. *Radiopaedia – Radiation Dose and Protection – https://radiopaedia.org/articles/radiation-dose* 5. *CDC Radiation Emergencies – https://www.cdc.gov/nceh/radiation/emergencies/*	
Topics Relevant to "Skill Development" 1. *Use and calibration of radiation detection instruments (e.g., TLDs, survey meters, dosimeters)* 2. *Estimating and optimising dose indices (CTDI, DLP, MSAD) for diagnostic procedures* 3. *Designing and evaluating shielding plans for radiology departments* 4. *Applying ALARA principles and performing radiation safety audits*	

5. Identifying radiation signage, safety protocols, and applying safety regulations in clinical setups

Course Code: BMRIT025	**Course Title:** Quality Assurance in Diagnostic Radiology and Regulatory Requirements **Type of Course:** Core Course	**L-T-P-C**	2	0	2	3
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides a comprehensive understanding of quality assurance practices and regulatory frameworks in diagnostic radiology. It covers the principles, procedures, and responsibilities involved in maintaining optimal image quality, patient safety, and equipment performance. Students will gain knowledge about national regulatory bodies, QA programmes, routine maintenance, and practical compliance with radiation safety regulations.					
Course Objectives	1. To understand the importance and aim of quality assurance in diagnostic radiology. 2. To familiarise students with regulatory requirements and national standards for radiation protection. 3. To equip students with knowledge of QA procedures in different imaging modalities. 4. To develop skills for care, maintenance, and routine checks of radiological equipment. 5. To prepare students to perform their professional responsibilities effectively and ethically in a radiology department.					
Course Outcomes	CO1: Aim and need of radiation protection CO2: Introduction to quality assurance CO3: Understanding of regulatory requirements CO4: Follow radiation protection regulations and apply practically					
Course Content						
Module 1	**Principles and Objectives of Quality Assurance**			**06 Sessions**		
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.				
Module 2	**QA Procedures in Radiology**			**06 Sessions**
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.				
Module 3	**Regulatory Requirements and Responsibilities**			**06 Sessions**
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.				
Module 4	**Role of Technologists and Regulatory Compliance**			**06 Sessions**
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 and screen maintenance, maintenance of automatic processor and manual processing units, record keeping and log book maintenance, reject analysis and objectives of reject analysis programme.				
Module 5	**Preventive Maintenance and Equipment Care**			**06 Sessions**
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.				
Basic skill sets required for the laboratory:	1. Understanding of the principles and goals of quality assurance in radiology 2. Familiarity with national and international radiation safety regulations 3. Ability to perform routine QA checks across imaging modalities 4. Skills in care, calibration, and maintenance of radiological equipment 5. Competence in documentation and record-keeping for QA audits			

	6. Awareness of regulatory bodies like AERB and their compliance guidelines 7. Practical application of radiation protection standards in clinical settings 8. Ethical and professional conduct in quality control and patient safety
List of Experiments	**Experiment No. 1:** Quality Assurance Programme at the Radiological Faculty Level Hands-on practice with quality assurance procedures across imaging systems including X-ray, fluoroscopy, mammography, CT, tomography, and film processing. Includes testing accuracy of imaging systems, fault tracing, film/chemical storage assessment, and LASER printer calibration. **Experiment No. 2:** QA in Diagnostic Radiology Practical measurement and verification of parameters such as filtration, contrast, optical-radiation field congruence, focal spot size, mA linearity, HVT, resolution, and grid alignment. Includes dedicated QA checks in mammography, CT, and digital radiography systems. **Experiment No. 3:** Regulatory Requirements in Diagnostic Radiology Understanding national regulatory body roles, safety standards, codes, and guides. Includes documentation and reporting protocols for diagnostic radiology practices. **Experiment No. 4:** Technologist Responsibilities and Regulatory Compliance Demonstration of technologist duties in equipment care, cleaning, cassette/screen maintenance, processing unit upkeep, and record keeping. Includes reject analysis practice and implementation of reject analysis objectives. **Experiment No. 5:** Preventive Maintenance and Equipment Care Routine preventive maintenance of diagnostic equipment: daily, weekly, monthly, quarterly, and annual checklists. Includes care protocols for stationary and mobile diagnostic units.
Targeted application and Tools that can be used:	1. **Quality Assurance Programme Implementation:** *QA checklists and audit software, diagnostic imaging performance evaluators, test phantoms for calibration, digital image distortion assessment tools* 2. **Radiology Equipment QA Procedures:** *Beam alignment and congruence testers, focal spot size measuring tools, contrast and resolution test patterns, automatic processor QA kits, digital mammography and CT QA toolkits* 3. **Regulatory Compliance and Documentation:** *National regulatory codes and safety guideline databases, radiology documentation templates, incident reporting software, equipment registration and compliance tracking systems* 4. **Technologist Workflow Management:** *Preventive maintenance scheduling software, reject analysis tools, logbook and calibration record apps, cassette and screen care protocols*

	5. **Preventive Maintenance Tools:** *Routine maintenance guides, mobile equipment handling apps, service history trackers, checklist-based maintenance planning platforms for diagnostic units*
Project Work:	*1.* **QA Flowchart for Diagnostic Imaging Units** *Type: Individual/Visual-Process Assignment* **Practical Checklist: QA in Radiographic Equipment** *Type: Individual/Applied-Checklist Assignment* *2.* **Comparative Report on QA Procedures in CT, Mammography and Digital Radiography** *Type: Pair/Analytical-Comparison Assignment* 3. **Fault Analysis and Troubleshooting Guide** *Type: Individual/Technical-Writing Assignment*
Text Book(s) / Reference Book(s):	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 – Imprint Unknown 4. *An Introduction to Quality Assurance in Radiology* – Zafar Neyaz – JBD Publications

Online Learning Resources

1. *IAEA Quality Assurance Audit for Diagnostic Radiology – https://www.iaea.org/publications/8647*
2. *AERB – Quality Assurance Guidelines for Diagnostic Radiology – https://www.aerb.gov.in*
3. *WHO: Diagnostic Imaging Quality Assurance Programme – https://www.who.int/publications-detail-redirect/a-quality-assurance-programme-for-diagnostic-imaging*
4. *European Commission Radiation Protection Series – https://health.ec.europa.eu/radiation-protection_en*
5. *RSNA Physics Modules – QA & Regulation – https://www.rsna.org/education/physics-modules*

Topics Relevant to "Skill Development"

1. *Performing routine QA tests in radiographic, fluoroscopic, CT, and mammographic systems*
2. *Evaluating image quality parameters and calibrating imaging systems (e.g., laser printers, focal spot, beam alignment)*
3. *Interpreting compliance documentation and maintaining QA logs and reject analysis reports*
4. *Executing preventive maintenance routines across equipment types (daily to yearly protocols)*
5. *Applying regulatory knowledge for safe equipment operation and ensuring documentation for inspections*

SEMESTER VI

Course Code: BMRIT026	**Course Title:** Basics Techniques in MRI Technology **Type of Course:** Core Course	**L-T-P-C**	4	0	8	8
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the fundamental principles, instrumentation, protocols, and safety considerations involved in Magnetic Resonance Imaging (MRI). It equips learners with practical knowledge of MRI techniques, image acquisition, processing, patient handling, and quality assurance necessary for clinical diagnostic imaging.					
Course Objectives	1. To explain the basic physics and instrumentation behind MRI systems. 2. To familiarise students with various MRI pulse sequences and image formation principles. 3. To introduce protocols for MRI of different anatomical regions and vascular structures. 4. To train students in handling patients, safety measures, and post-processing of MRI images. 5. To promote quality assurance and documentation practices within MRI departments.					
Course Outcomes	CO1: Define basic principle and physics of Magnetic Resonance Imaging. CO2: Recognize protocols needed for Magnetic Resonance Imaging examination. CO3: Prepare and positioning for Magnetic Resonance Imaging examination. CO4: Interpret post processing of Magnetic Resonance Imaging images. CO5: Prepare and position the patients for Magnetic Resonance Imaging examination. CO6: Categorize knowledge of improving image quality in Magnetic Resonance Imaging. CO7: Scanning of patient with various Magnetic Resonance Imaging protocols for better representation of images. CO8: Plan of post processing for Magnetic Resonance Imaging data. CO9: Management of patient for any post contrast reactions.					
Course Content						

Module 1	**Fundamentals and Instrumentation of MRI**			**12 Sessions**
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				
Module 2	**Image Encoding and Pulse Sequences**			**12 Sessions**
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				
Module 3	**Vascular Imaging and Flow Phenomena**			**12 Sessions**
Flow phenomena; Flow phenomena compensation; Vascular Imaging—Digital Subtraction MRA, TOF-MRA, PC-MRA, Velocity Encoding, MR-Angiogram, MR-Venogram				
Module 4	**Body Imaging, Artifacts, and Contrast Agents**			**12 Sessions**
Cardiac Imaging; Whole body MRI Protocols; MRI Artifacts and their compensation; MRI contrast agents—T1 contrast agent, T2 contrast agent				
Module 5	**MRI Safety and Quality Assurance**			**12 Sessions**
MRI safety—Implants and pace-makers, Electrical safety, Metallic safety, Instrumental safety, Bio-effects of MRI; Documentation; Quality assurance in MRI				
Basic skill sets required for the laboratory:	1. Understanding of the basic physics and functioning of MRI systems 2. Familiarity with MRI protocols and pulse sequences for different anatomical regions 3. Skills in patient preparation, positioning, and communication for MRI scans 4. Ability to perform MRI procedures with attention to safety and contraindications 5. Competence in handling contrast agents and recognising adverse reactions 6. Proficiency in MRI image post-processing and quality assessment 7. Knowledge of equipment care and quality assurance protocols 8. Awareness of artefacts, their causes, and correction techniques			
List of Experiments	**Experiment No. 1:** Instrumentation of MRI Hands-on demonstration of MRI hardware: magnet types and classification, gradient coils, RF and shim coils, ramping procedures, cryogen handling, and RF shielding evaluation. **Experiment No. 2:** MRI Pulse Sequences Practical simulation and interpretation of Spin Echo, Gradient			

	Echo, and Fast Imaging sequences. Includes adjusting parameters to observe trade-offs and image contrast effects. **Experiment No. 3:** Flow Phenomena and Compensation Experimentation with flow effects in MRI and application of flow compensation techniques. Includes assessment of artefacts due to motion and flow. **Experiment No. 4:** Whole Body MRI Protocols and Artefacts Demonstration of whole-body MRI protocol planning and execution. Identification and compensation of common MRI artefacts using various sequence modifications. **Experiment No. 5:** MRI Safety and Quality Assurance Safety drills and checks related to MRI environment including implant screening, cryogen safety, and bio-effect precautions. Includes practical quality assurance procedures and documentation standards.
Targeted application and Tools that can be used:	*1.* **MRI Fundamentals and Instrumentation:** *Virtual MRI system simulators, interactive coil configuration models, magnetic field visualisation tools, cryogen safety handling modules, RF shielding layout software* *2.* **Image Encoding and Pulse Sequences:** *K-space simulation tools, pulse sequence design software (e.g. Spin Echo vs Gradient Echo), parameter trade-off visualisers, image weighting analysis apps* *3.* **Vascular Imaging and Flow Phenomena:** *MRA simulation platforms (TOF, PC, Subtraction MRA), flow compensation training modules, velocity encoding visualisation tools, MR angiogram/venogram viewers* 4. **Body Imaging, Artefacts, and Contrast Agents:** *Whole-body MRI protocol planners, artefact identification and correction simulators, contrast agent selection apps, pharmacokinetics visualisation tools* *5.* **MRI Safety and QA Tools:** *Implant safety screening checklists, MRI zone management software, bio-effect risk analysis tools, QA audit platforms for MRI systems, equipment documentation and compliance trackers*
Project Work:	*1.* **MRI Instrumentation Infographic** *Type: Individual/Visual-Diagram Assignment* *2.* **Pulse Sequence Comparison Chart** *Type: Individual/Analytical-Tabular Assignment* *3.* **MRI Safety Simulation Poster** *Type: Group/Visual-Simulation Assignment* 4. **MRI Contrast Agent Exploration** *Type: Individual/Research-Based Assignment*
Text Book(s) / Reference Book(s):	1. *Tomography and Magnetic Resonance Imaging of the Whole Body (Vol. I & II)* – 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
Online Learning Resources *1. Radiopaedia – https://radiopaedia.org/* *2. MRIquestions.com – https://mriquestions.com/* *3. Siemens Healthineers MRI Education – https://www.siemens-healthineers.com/magnetic-resonance-imaging/education* *4. ISMRM (International Society for Magnetic Resonance in Medicine) – https://www.ismrm.org/* *5. Coursera - MRI Fundamentals (varied providers) – https://www.coursera.org/*	
Topics Relevant to "Skill Development" *1. MRI image acquisition and sequence optimisation* *2. Patient preparation and positioning for MRI* *3. Identification and correction of MRI artefacts* *4. Safety screening and handling of implants in MRI* *5. Quality assurance and documentation protocols in MRI departments*	

Course Code: BMRIT027	**Course Title:** Introduction to Nuclear Medicine Techniques **Type of Course:** Core Course	**L-T-P-C**	2	0	2	3
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the basic concepts and instrumentation of nuclear medicine and molecular imaging. It covers the principles of radionuclide production, radiopharmaceuticals, and advanced nuclear imaging techniques such as SPECT, PET, and their hybrid modalities. Emphasis is placed on safety, radiation dose considerations, and the layout of nuclear medicine facilities.					
Course Objectives	1. To understand the fundamental principles of nuclear medicine and radioactivity. 2. To gain knowledge of radionuclides, their production, and transportation. 3. To study the instrumentation used in nuclear imaging including SPECT and PET systems. 4. To explore advanced hybrid imaging techniques like PET-CT and PET-MRI. 5. To develop awareness of safety protocols, radiation dose management, and room layout in nuclear medicine.					

Course Outcomes	CO1: Understand the history and basic principles of nuclear medicine. CO2: Explain the production, transport, and activity of radionuclides. CO3: Describe preparation and safe handling of radiopharmaceuticals. CO4: Understand the instrumentation of gamma cameras, SPECT, and PET systems. CO5: Explore advanced hybrid imaging techniques such as PET-CT, SPECT-CT, and PET-MRI. CO6: Recognize safety considerations and manage radiation dose effectively in nuclear medicine. CO7: Understand facility layout requirements for nuclear medicine departments.			
Course Content				
Module 1	**Fundamentals of Nuclear Medicine**			**10 Sessions**
History; Isotopes and Radionuclides—Production of Radionuclides, Transport of Radionuclides; Radioactivity—Radioactive transformations, Specific Activity; Radiopharmaceuticals—Preparation, Precautions while handling				
Module 2	**Imaging Techniques and Instrumentation**			**10 Sessions**
Gamma Camera instrumentation—Collimator: classification and types; Single Photon Emission Computed Tomography (SPECT); Positron Emission Tomography (PET); Advanced techniques in Nuclear Medicine—SPECT-CT, PET-CT, PET-MRI				
Module 3	**Radiation Safety and Facility Design**			**10 Sessions**
Safety Considerations and Radiation Dose in Nuclear Medicine; Room layout in nuclear medicine				
Basic skill sets required for the laboratory:	1. Understanding of the fundamental principles of nuclear medicine and radioactivity 2. Familiarity with radionuclide production, transport, and safe handling of radiopharmaceuticals 3. Skills in preparing and measuring radiopharmaceutical doses accurately 4. Ability to operate gamma cameras, SPECT, PET, and hybrid imaging systems 5. Competence in patient preparation, positioning, and communication for nuclear medicine procedures			

	6. Knowledge of radiation safety protocols, use of protective equipment, and dose management 7. Proficiency in acquiring and processing nuclear medicine images with attention to quality control 8. Awareness of emergency procedures related to radiation spills and adverse patient reactions 9. Understanding of facility layout requirements for radiation protection and equipment maintenance 10. Ability to maintain accurate documentation and comply with regulatory standards
List of Experiments	**Experiment No. 1:** History; Isotopes and Radionuclides – Production of Radionuclides, Transport of Radionuclides; Radioactivity – Radioactive Transformations, Specific Activity; Radiopharmaceuticals – Preparation and Precautions while Handling **Experiment No. 2:** Gamma Camera Instrumentation – Collimator: Classification and Types; Single Photon Emission Computed Tomography (SPECT); Positron Emission Tomography (PET); Advanced Techniques in Nuclear Medicine – SPECT-CT, PET-CT, PET-MRI **Experiment No. 3:** Safety Considerations & Radiation Dose in Nuclear Medicine; Room Layout in Nuclear Medicine
Targeted application and Tools that can be used:	*1.* **Fundamentals of Nuclear Medicine:** *Radionuclide production simulators, radioactivity decay visualisation tools, radiopharmaceutical preparation safety modules, isotope identification charts* *2.* **Imaging Techniques and Instrumentation:** *Gamma camera simulation software, SPECT/PET imaging platforms, hybrid imaging viewers (SPECT-CT, PET-CT, PET-MRI), collimator type comparison tools* *3.* **Radiation Safety and Facility Design:** *Radiation dose calculators, nuclear medicine room layout planners, virtual walkthroughs for radiation shielding design, safety compliance checklists for nuclear facilities*
Project Work:	***1.*** **Radionuclide Production and Transport Report** *Type: Pair/Research Report* ***2.*** **Gamma Camera and Collimator Types Comparison Chart** *Type: Individual/Analytical Assignment* ***3.*** **SPECT and PET Imaging Techniques Presentation** *Type: Group/Presentation Assignment*
Text Book(s) / Reference Book(s):	1. *Nuclear Medicine Textbook: Methodology and Clinical Applications* – Duccio Volterrani, Paola Anna Erba, Ignasi Carrió, H. William Strauss – Springer 2. *Nuclear Medicine Instrumentation* – Jennifer Prekeges – 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 – LWW 5. *A Concise Guide on Basic Radiation Physics, Radiotherapy Physics & Nuclear Medicine* – Lalit Agarwal, Dr. Arvind Shukla – JBD Publications
Online Learning Resources *1. IAEA Human Health Campus – Nuclear Medicine – https://humanhealth.iaea.org/HHResources/NuclearMedicine/index.html* *2. SNMMI (Society of Nuclear Medicine and Molecular Imaging) – https://www.snmmi.org/* *3. Radiopaedia – Nuclear Medicine – https://radiopaedia.org/articles/nuclear-medicine* *4. eScan Academy – Nuclear Medicine Courses – https://www.escanacademy.com/* *5. EBook Access (University Resource) – https://presiuniv.knimbus.com/user#/home*	
Topics Relevant to "Skill Development" *1. Safe handling and preparation of radiopharmaceuticals* *2. Operation of SPECT and PET imaging systems* *3. Interpretation of hybrid imaging outputs (e.g., PET-CT, PET-MRI)* *4. Radiation dose monitoring and minimisation* *5. Facility layout planning for nuclear medicine environments*	

Course Code: BMRIT028	**Course Title:** Ultrasound Techniques **Type of Course:** Core Course	**L-T-P-C**	3	0	0	3
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course introduces students to the fundamental principles and applications of ultrasound technology in medical imaging. It covers the physical properties of ultrasound, interaction with matter, various types of transducers, image display techniques, Doppler imaging modalities, and ultrasound contrast agents. The course also discusses image artefacts, advanced ultrasound imaging techniques such as 3D and 4D imaging, as well as bio-effects, safety considerations, and quality assurance protocols in ultrasound practice.					
Course Objectives	1. To understand the physical properties of ultrasound and its interaction with biological tissues. 2. To gain knowledge about different types of ultrasound transducers and advances in their design. 3. To study image display technologies, including instrumentation and image processing techniques. 4. To explore Doppler imaging methods and the use of ultrasound contrast agents.					

	5. To recognise image characteristics, artefacts, and the role of artificial intelligence in ultrasound. 6. To learn about bio-effects, safety protocols, and quality assurance procedures in ultrasound systems.			
Course Outcomes	CO1: Describe the Ultrasound properties, interaction of ultrasound with matter CO2: Describe the transducer and types CO3: Explain the concepts of image display CO4: Describe Doppler imaging and ultrasound contrast agents CO5: Describe the image characteristics and artefacts CO6: Explain the safety considerations in ultrasound and protocols			
Course Content				
Module 1	**Fundamentals of Ultrasound and Its Interaction with Matter**			**7 Sessions**
Ultrasound: Properties of ultrasound, interaction of ultrasound with matter				
Module 2	**Ultrasound Transducers and Advances**			**8 Sessions**
Transducers: Types of transducers, advances in the design of modern ultrasound transducers				
Module 3	**Image Display and Ultrasound Instrumentation**			**7 Sessions**
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				
Module 4	**Doppler Imaging and Contrast Agents**			**9 Sessions**
Doppler 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.				
Module 5	**Image Characteristics, Artefacts and Advanced Ultrasound Techniques**			**9 Sessions**
Image characteristics and artefacts: vascular, interventional, intraoperative and ophthalmic ultrasonography, 3D and 4D ultrasound imaging Artificial Intelligence in Ultrasound				
Module 6	**Bio-effects, Safety Considerations and Quality Assurance**			**5 Sessions**
Bio-effects and safety considerations in ultrasound, ultrasound system performance measurements, ultrasound equipments quality assurance – conventional Doppler system testing and documentation				

Targeted application and Tools that can be used:	1. **Fundamentals and Transducers:** *Ultrasound property simulators, tissue interaction models, transducer type visualisation tools, transducer design comparison modules* 2. **Image Display and Instrumentation:** *Ultrasound machine interface simulators, scan converter and storage device emulators, image pre/post-processing demo tools, ultrasound display mode training aids* 3. **Doppler and Contrast Imaging:** *Doppler waveform simulators, colour and power Doppler tools, harmonic imaging demonstrators, contrast-enhanced ultrasound (CEUS) case-based viewers* 4. **Advanced Imaging and AI:** *Artefact identification modules, 3D/4D ultrasound simulators, interventional ultrasound practice tools, AI-based ultrasound interpretation systems* 5. **Safety and QA:** *Bio-effect risk calculators, system performance test kits, Doppler QA checklists, documentation templates for ultrasound quality assurance*
Project Work:	1. **Ultrasound and Matter Interaction Concept Map** *Type: Individual/Visual Assignment* 2. **Transducer Types and Technological Advances Chart** *Type: Pair/Research Poster* 3. **Instrumentation and Display System Manual** *Type: Group/Instructional Assignment* 4. **Ultrasound Safety and QA Audit Report** *Type: Individual/Simulation-Based Assignment*
Text Book(s) / Reference Book(s):	1. Ultrasound physics and technology – Vivien Gibbs, David Cole, Antonio Sassano – Churchill Livingstone 2. Manual of Diagnostic Ultrasound – Philip E. S. Palmer – World Health Organization 3. Physics and Technical Aspects Diagnostic Ultrasound – Dinesh K Baghel – AITBS Publishers 4. Diagnostic Ultrasound – Carol M. Rumack, Deborah Levine – Elsevier 5. Ultrasound Imaging (1000 Multiple Choice Questions) – Yadav – JBD Publications
Online Learning Resources 1. Radiopaedia – Ultrasound – https://radiopaedia.org/articles/ultrasound 2. AIUM (American Institute of Ultrasound in Medicine) – https://www.aium.org/ 3. SonoWorld – Free Ultrasound Education – https://www.sonoworld.com/ 4. ISUOG (International Society of Ultrasound in Obstetrics and Gynecology) – https://www.isuog.org/ 5. EBook Access (University Resource) – https://presiuniv.knimbus.com/user#/home	
Topics Relevant to "Skill Development" 1. Operation and handling of various types of ultrasound transducers 2. Real-time Doppler imaging techniques and interpretation	

Identification and correction of image artefacts Use of 3D and 4D ultrasound imaging in clinical settings Implementation of safety protocols and quality assurance in ultrasound equipment

Course Code: BMRIT029	**Course Title:** Biostatistics and Research Methodology **Type of Course:** Programme Course	**L-T-P-C**	2	0	0	2
Version no.	1.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	This course provides an introduction to the fundamental concepts of biostatistics and research methodology relevant to medical and health sciences. It covers basic statistical terms, data tabulation and graphical representation, measures of central tendency and variability, probability and standard distributions, and sampling techniques. The course equips students with essential skills to analyse and interpret statistical data, enhancing their ability to conduct and evaluate research studies.					
Course Objectives	1. To understand the importance and scope of statistics in the curriculum and health sciences. 2. To learn and apply fundamental statistical terms and concepts. 3. To gain knowledge on data tabulation and graphical representation techniques. 4. To comprehend measures of central tendency and variability and their applications. 5. To understand probability distributions and their relevance in statistics. 6. To explore different sampling techniques and their significance in research.					
Course Outcomes	CO1: Understand the Importance of statistics course in the curriculum CO2: Understands Statistical Terms					
Course Content						
Module 1	**Introduction to Statistics and Types of Data**			**5 Sessions**		
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.						
Module 2	**Data Tabulation and Graphical Representation**			**5 Sessions**		
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, Ogive; Normal Probability Curve.				
Module 3	**Measures of Central Tendency**			**5 Sessions**
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 and Calculation of Mode; Comparison of the Mean, and Mode; Guidelines for the Use of Various Measures of Central Tendency.				
Module 4	**Measures of Variability**			**5 Sessions**
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.				
Module 5	**Probability and Standard Distributions**			**5 Sessions**
Probability and Standard Distributions: Meaning of Probability of Standard Distribution, The Binomial Distribution. The Normal Distribution; Divergence from Normality - Skewness, Kurtosis.				
Module 6	**Sampling Techniques**			**5 Sessions**
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.				
Targeted application and Tools that can be used:	1. **Introduction to Statistics and Data Types:** Interactive tutorials on variable types and measurement scales; data classification exercises 2. **Data Tabulation and Graphical Representation:** Software tools for creating frequency tables and diverse graphs (histograms, polygons, ogives); normal curve plotting simulators 3. **Measures of Central Tendency:** Calculation worksheets and statistical software demos for mean, median, mode on grouped and ungrouped data; comparative analysis tools 4. **Measures of Variability:** Step-by-step variance and standard deviation calculators; visual tools illustrating data dispersion and range 5. **Probability and Standard Distributions:** Simulation platforms for binomial and normal distributions; skewness and kurtosis visualisation tools 6. **Sampling Techniques:** Virtual sampling design simulators; case studies on sampling errors and test of significance calculators			

Project Work:	**1. Types of Data and Variables Presentation** *Type: Individual/Visual-Research Assignment* 2. **Sampling Techniques Case Study** *Type: Group/Research and Presentation*
Text Book(s) / Reference Book(s):	1. *Elements of Health Statistics* – Rao N.S 2. *An Introduction to Biostatistics* – Sunder Rao 3. *Methods in Biostatistics* – B.K. Mahajan 4. *Elementary Statistics in Medical Workers* – Inderbir Singh 5. *An Introduction to Statistical Methods* – Ram Prasad & Sons, Gupta C.B

Online Learning Resources

1. *Coursera – Biostatistics for Public Health – https://www.coursera.org/learn/biostatistics-public-health*
2. *Khan Academy – Statistics and Probability – https://www.khanacademy.org/math/statistics-probability*
3. *NCBI Bookshelf – Statistical Methods in Medical Research – https://www.ncbi.nlm.nih.gov/books*
4. *EdX – Essentials of Biostatistics in Public Health – https://www.edx.org*
5. *WHO Health Research Tools – https://www.who.int/tools*

Topics Relevant to "Skill Development"

1. *Organising and tabulating raw data into frequency distributions and graphs*
2. *Applying statistical measures (mean, median, mode, SD) in real datasets*
3. *Interpreting probability distributions in health research scenarios*
4. *Selecting appropriate sampling methods for health studies*
5. *Conducting basic statistical analysis and interpreting results for research papers*

B.MRIT Radiology Clinical Education

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:

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

Teaching and Examination Scheme
Course Name: Bachelor in Medical Radiology and Imaging Technology
Duration of Program: Four Years (8 Semesters) Pattern: Full Time Rotatory Internship Semester: **Seventh & Eighth (4th year)**
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:

Postings	Duration
1. Conventional Radiography, Mammography, CR, DR and PACS	4 months
2. Radiological Imaging & Special Procedures and Advanced Equipment	2 months
3. Ultrasonography & Doppler Imaging	1 month
4. Interventional Radiology	1 month
5. Computed Tomography	2 months
6. Magnetic Resonance Imaging	2 months

Total	**12 months**

Assessment of Internship

The intern shall maintain a record of work which is to be verified and certified by the faculty under whom he/she works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training. Based on the record of work and date of evaluation, the Head of the Institution/hospital will issue a certificate of satisfactory completion of training, following which the University will award the B.MRIT degree or declare him eligible for it.

Guideline for Internship

RATIONALE

The Clinical Education, is designed for the students to familiarize them with the applications of radiography, mammography, radiological special procedures, CT, MRI and advanced imaging techniques etc. Student should be able to reliably perform all non-contrast plain radiography as well as contrast radiological and imaging procedures along with Radiologist.

COMPETENCY

Identify the Anatomy to be imaged, properly position the patient for Imaging, Correctly select appropriate projection/projections to demonstrate the area of interest Use appropriate radiographic/radiological and imaging parameters.

COURSE OUTCOMES

On completion of this subject, the student should be able to:

- Correctly Identify the Anatomy to be imaged
- To properly position the patient for radiography/Radiological and Imaging procedures
- Correctly select appropriate projection/projections to demonstrate the area of interest
- Use appropriate radiographic parameters to produce a radiographic image with satisfactory results
- Should be able to differentiate a properly positioned and exposed radiographic image from a wrongly positioned and over or underexposed radiographic image

- Should be able to correctly identify anatomical features displayed in radiographic image obtained.

TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	CIE		ESE		Total		CIE		ESE*		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
--	--	--	20	--	--	--	--	--	--	--	100	50	100	50	**200**	100

Note: ESE* will be conducted immediate after end of the 7th & 8th semester at the institutional level.

Legends: L*-Lecture,* ***T*** *– Tutorial/Teacher Guided Theory Practice,* ***P*** *–Practical,* ***ESE*** *-End Semester Examination,*

CIE*- Continuous Internal Evaluation*

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.

EXPECTATIONS FROM Skill Knowledge Partner (SKP)

Helping institute in developing the following competencies among students Soft Skills i.e. Communication, Presentation and others.

- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Patient Safety, Radiography/Radiological and Imaging and Quality Assurance aspects.

ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

- Identify Hospitals/Diagnostic Centers available for training along with capacity.
- Institutions have to enter in to MOU with number of SKPs (Institutes/Hospitals/Diagnostic Centers) for accommodating all the enrolled students for the mandatory internship
- Student and mentor allocation as per the slots available for Hands on training (Desirable mentor-student ratio is 1:10).
- Communication with Institutes/Hospitals/Diagnostic Centers available for training along with capacity and its confirmation.
- Student enrollment for training.
- Issuing letter to the Institutes/Hospitals/Diagnostic Centers for the training along with details of students and mentors.
- Principal/ HOD/ Faculty should address students about safety norms, rules and discipline to be maintained in the Institutes/Hospitals/Diagnostic Centers during the training before relieving students for training.
- The designated faculty member would visit the Institutes/Hospitals/Diagnostic Centers periodically to check the progress of the student in the training, his/ her attendance, discipline, log book preparation &project report preparation
- Mentors to carry out progressive assessment of the students during the training through Continuous Internal Evaluation (CIE), End Semester Examination (ESE) assessment by mentor along with Institutes/Hospitals/Diagnostic Centers expert as external examiner

ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training; an undertaking for this should also be taken from them

- Students would interact with the mentor to suggest choices for suitable Institutes/Hospitals/Diagnostic Centers. If students have any contact in Institutes/Hospitals/Diagnostic Centers (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.
- Students have to fill the forms duly signed by authorities along with training letter and suBMRIT it to training officer in the Institutes/Hospitals/Diagnostic Centers on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.

- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Institutes/Hospitals/Diagnostic Centers and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.
- Students should know that if they break any rule of Institutes/Hospitals/Diagnostic Centers or do not follow the discipline then Institutes/Hospitals/Diagnostic Centers can terminate the training and send back the student.
- It is the responsibility of the student to collect information from Institutes/Hospitals/Diagnostic Centers about Radiography/Radiological & Imaging procedures/ Patient Safety /work ethics/professional practices/organizational structure etc.
- During the training period students have to keep daily record of all the useful information in Log book along with the time and date and type of Radiography/Radiological & Imaging procedures, how it was performed with patient's history any difficulty encountered.
- Maintain the Diary/Logbook and get it signed from mentor as well as Institutes/Hospitals/Diagnostic Centers Training in-charge.
- In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.
- Prepare final report about the training for suBMRITting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Institutes/Hospitals/Diagnostic Centers training in-charge.

FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report; actual format may differ slightly depending upon the nature of Institutes/Hospitals/Diagnostic Centers. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page with date and time start and end

Chapter 1. Organizational structure of Institutes/Hospitals/Diagnostic Centers and General Lay Out

Chapter 2. Introduction of Institutes/Hospitals/Diagnostic Centers (History, Facilities available.
Specialization and number of employees etc.)

Chapter 3. Types of major equipment/instruments/ machines used in Radiology with their specification, approximate cost and specific use and their routine maintenance.

Chapter 4. Standard Operating procedures.

Chapter 5. Quality assurance and radiation safety procedures.

Chapter 6. Equipment handling and procedures.

Chapter 7. Safety procedures followed

Chapter 8. Particulars of Practical Experiences in Radiology and Imaging

Chapter 9. Short report/description of the project (if any done during the training)

Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

References /Bibliography

SUGGESTED LEARNING STRATEGIES

Students should visit the website of the Institutes/Hospitals/Diagnostic Centers where they are undergoing training to collect information about Facilities, Specialization, capacity, number of employees, etc. They should also refer the operating manuals of the major machines and operation, testing, quality control and standard operating procedures and practices used in the Radiology. Students may also visit websites related to other similar industries as their learning resource. The training activity may vary according to nature and size of Institutes/Hospitals/Diagnostic Centers. The details of activities to be completed during 6 months should be planned appropriately. The evaluation of Clinical Education (Internship)will be done on the basis of skills acquired by the student during this 6 months period.

ASSESSMENT SCHEME FOR CLINICAL EDUCATION (INTERNSHIP)

Training duration	**CONTINUOUS INTERNAL EVALUATION (Weekly report of all 6 months and attendance)**		**END SEMESTER ASSESSMENT (Practical and Oral)**		**Total marks**	
6 months	**Max. marks**	**Min. marks**	**Max. marks**	**Min. marks**	**Max. marks**	**Min. marks**
	100	**50**	**100**	**50**	**200**	**100**

EVALUATION SHEET FOR CONTINUOUS INTERNAL EVALUATION

Sr. No.	**Enrollment Number**	**Name of Student**	**Seminar/presentation in workshop or conference**	**Marks by Supervisor**	**Marks by Mentor Faculty**	**Total Marks**
			Out of 40 (A)	**Out of 30 (B)**	**Out of 30 (C)**	**Out of 100 (A+B+C)**

Marking criteria for seminar/presentation at workshop/conference and marking criteria for supervisor/mentor faculty mentioned in the log book template.

DISTRIBUTION OF END-SEMESTER-EXAMINATION (ESE*) MARKS

Marks for Training Report	Marks for Practical's	Marks for Oral/Viva-voce	Total ESE marls
25	**25**	**50**	**100**

Practical (25 marks) must include minimum two practical related demonstration infront of the internal examiners.

Board of examiners for 7th & 8th semester:

- HOD of Radiology: Chairperson
- Programme Co-ordinator/Course Co-ordinator/Chief of MRIT/Incharge of MRIT: Co-chairperson
- Subject Experts: Internal examiners (two) members.

Logo Book Template:

Name of the Student:

Name of the Under Graduate degree:

USN:

Batch:

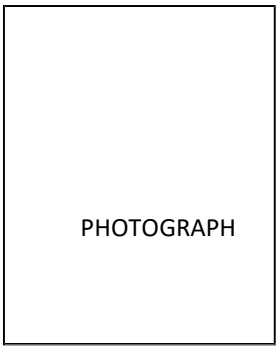
Institute/University Logo

Bachelor in Medical Radiology and Imaging Technology (B.MRIT)

Log Boo k

Cover Page

PARTICULARS OF STUDENT



Name of the student: Reg no:
Sessions:

Year of admission: Year of completion:
Address:

Contact details:
Email id:
Signature of the student:

CERTIFICATE

This is to certify that Mr/Ms…….. has satisfactorily completed the training requirements for the programme of Bachelor in Medical Radiology and Imaging Technology (B.MRIT) from (name of the Institute/University & address). She/He has completed all the clinical responsibilities during her/his Under-graduation training from…….to…….....

Signature
Head/Programme Co-ordinator

Signature
Principal/ Dean

Index

SECTION I: CLINICAL POSTINGS

Date	Department/ Modalities	Posting Brief Description	Name & Signature of the Staff/ Mentor/Supervisor

Date	Department/ Modalities	Posting Brief Description	Name & Signature of the Staff/ Mentor/Supervisor

SECTION II. SEMINARS PRESENTED/ATTENDED

Date	Department/ Modalities	Posting Brief Description	Name & Signature of the Staff/ Mentor/Supervisor

Date	Department/ Modalities	Posting Brief Description	Name & Signature of the Staff/ Mentor/Supervisor

SEMINAR EVALUATION FORM

Evaluation of Seminar

Sl. No	**Criteria**	**5 Excellent**	**4 Good**	**3 Average**	**2 Below Average**	**1 Poor**
1.	Content of the Presentation					
2.	Aesthetic of slides preparation					
3.	Oratory & Presentation Skills					
4.	Audio- visual aids used					
5.	Clarity of presentation					
6.	Critical Analysis					
7.	Ability to respond to questions on the subject					
8.	Ability to defend the topic					
9.	Referencing					
10.	Implementation recent advancement on the topic					
Total Marks**: 50**						

SEMINAR SCORE SHEET

Sl. No.	Date	Topic	Total Marks (Max.50)	Evaluations Signature	Co-ordinator Signature

Supervisor/mentor shall be determined the marks basis of the following:

S.No.	Parameter	Score
1.	Proficiency of knowledge required for each radiological imaging procedures	0-5
2.	The competency in skills expected to manage each radiological imaging procedures	0-5
3.	Responsibility, punctuality, work up of case, involvement in follow-up reports	0-5
4.	Capacity to work in a team (Behaviour with colleagues, technologist and relationship with other healthcare workers)	0-5
5.	Initiative, participation in discussions, research aptitude	0-5

SCORING SCALE:

8. Poor
9. Below Average
10. Average
11. Good
12. Excellent

Note: A score of less than 2 in any of above items will represent unsatisfactory completion of internship.

SECTION III. EXTENSION/EXTRA CURRICULAR ACTIVITIES

(CONFERENCES/CME/WORKSHOP/TRAININGS)

Sl. No.	Date	Event (Institution/Place)	Achievements	Signature of the Faculty

DETAILS OF ABSENCE

Sl. No.	Date of Absence		Reason	Signature of the Faculty
	From	To		

Sl. No.	Date of Absence		Reason	Signature of the Faculty
	From	To		

Sl. No.	Date of Absence		Reason	Signature of the Faculty
	From	To		

EVALUATION OF THE LOGBOOK

Sl. No.	Items of observation during presentation	I	II	III	IV	V	VI	Internship
1	Organization of the log book							
2	Adequacy of Content/ Information in the log book							
3	Punctuality							
4	Relevance of Content/ Information in the log book							
5	Shows professional conduct during the Teaching Learning session							
6	Timely submissions of Projects/Synopsis/Seminar effectively							
7	Work Relationship & Frequency of consulting faculty							
8	Overall quality of department work							
	Total Score							
	Signature of the Co-ordinator							

Scoring:

4. Poor
5. Below Average
6. Average
7. Good
8. Excellent

IMMUNIZATION FORM

SL.NO.	Vaccination	Date of vaccination	Dose (Attach Bar code Slip)