



**National Commission for Allied and Healthcare Professions
(NCAHP)**

Competency Based Curriculum
for
Diploma
in
MEDICAL RADIOLOGY AND IMAGING
TECHNOLOGY



As per NCAHP Act 2021

Background of the profession

Why this profession holds so much importance

Medical Radiology and Imaging Technology is a healthcare profession concerned with the direct administration of radiation, primarily X-rays, for disease diagnosis, injury assessment and treatment.

From the humble beginnings of plain film techniques, the field has evolved into a wide range of imaging methods using conventional and digital X-rays, ultrasound, computed tomography (CT), magnetic resonance imaging (MRI) and radionuclide imaging. Modern diagnostic radiography and medical imaging form an integral part of medical practice, both in diagnosis and treatment.

The term diagnostic radiography is used to describe a variety of radiographic or X-ray examinations. These procedures, including those requiring contrast agents, make it possible to study organs and structures that otherwise cannot be visualized. These professionals are at the heart of modern medicine.

Diagnostic radiographers employ a range of imaging techniques and sophisticated equipment to produce high-quality images of injuries and diseases. They use techniques including X-rays, mammography, fluoroscopy, CT (Computed Tomography), MRI (Magnetic Resonance Imaging), nuclear medicine and angiography. Medical imaging studies have been a cornerstone of medical diagnosis for decades; however, technological advances and the introduction of new imaging modalities have made medical imaging one of the most dynamic, rapidly expanding and high-demand fields in clinical medicine.

About Medical Radiology and Imaging Technology

Radiology is a branch of medicine that uses radiation and imaging technology to diagnose and treat diseases. It enables radiologic technologists to produce images of various internal body structures to aid in the detection of injury or disease using radiation.

Radiology is central to clinical medical practice across a wide range of specialties. It is one of the most practical and effective ways to diagnose diseases, monitor treatment and detect disease progression or relapse in a minimally invasive and anatomically precise manner. Consequently, due to increasing sophistication and accuracy in clinical imaging, the utilization and importance of radiology have increased dramatically over the last two decades.

In recent years, the increasing complexity of radiologic procedures has made Medical Radiology and Imaging Technology a highly specialized and sophisticated field requiring competently trained personnel to maintain a high gradation of accuracy in radiographic positioning and exposure techniques. A qualified Medical Imaging Technologist is skilled in both diagnostic and interventional radiology.

Education of these professionals

When developing any educational program, it is essential that program planning be outcome-based, meeting local and national workforce requirements, professional satisfaction and career development opportunities for healthcare professionals.

One of the major shifts in education is the transition from traditional knowledge-based learning to competency-based education and training. Optimal education and training require students to integrate knowledge, skills and attitudes to perform professional responsibilities effectively in real-life situations.

Accordingly, this curriculum adopts a competency-based learning approach and is designed to standardize educational content across the country.

The NCAHP has developed curricula for the Bachelor of Medical Radiology Imaging and Technology (BMRIT) and Master of Medical Radiology and Imaging Technology (MMRIT) in three broad specializations:

- CT Technology
- MRI Technology
- Breast Imaging Technology

The BMRIT and MMRIT task force committee has recommended that all existing diploma courses in Radiography and Imaging Technology be phased out within five years and that the minimum qualification for Medical Radiology and Imaging Technologists should be the four-year BMRIT program. Therefore, no diploma curriculum was initially prepared.

Diploma in Medical Radiology and Imaging Technology

Introduction

The Commission has received representations from various sectors requesting continuation of the Diploma course in MRIT, particularly considering the needs of primary healthcare services in rural areas. Requests were also received to continue the Diploma in Medical Radiology and Imaging Technology (DMRIT) program until the academic year 2029-2030.

Accordingly, the task force committee developed the Diploma in Medical Radiology and Imaging Technology curriculum, keeping in view the requirements of the primary healthcare sector and rural healthcare services.

Candidates who successfully complete the Diploma course shall be designated as **Medical Radiology and Imaging Assistant** and will be permitted to practice:

- Fixed X-ray imaging
- Mobile X-ray/Bedside radiography
- Basic radiological procedures
- Computed Radiography (CR)/Digital Radiography (DR)
- C-Arm procedures
- Dental radiography
- Fluoroscopy procedures

However, they can't practice in the following modalities:

- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Mammography
- Interventional Radiology
- DEXA
- Other advanced imaging modalities

This course aims to provide the technical and interpersonal skills necessary to work under the supervision of qualified Radiographers or Medical Radiology and Imaging Technologists.

Learning Objectives: At the completion of this course, the student should -

At the completion of this course, the student should be able to:

1. Understand the basics of Human Anatomy, Physiology, Radiation Physics, Darkroom Techniques, Radiographic Equipment, Radiation Protection and safety measures.
2. Understand the basic procedures related to radiography modalities and imaging procedures.
3. Learn proper positioning and exposure factors for radiographic procedures, including contrast, non-contrast and fluoroscopic procedures.
4. Understand radiation protection and preventive measures.
5. Acquire knowledge and skills related to the routine care and maintenance of radiographic cassettes, imaging plates and equipment.
6. Demonstrate knowledge and skills related to biomedical waste disposal.
7. Maintain records and stock related to radiographic films, equipment and emergency drugs.

Expectations from Future Diploma Holders

1. The student shall be skilled in-patient preparation, assisting the radiology team during procedures and ensuring patient support and safety.
2. Employment opportunities are available in hospitals in both private and public sectors, as well as independent trauma centers, primary healthcare centers and rural healthcare facilities.
3. Diploma holders are encouraged to pursue higher qualifications in BMRIT/MMRIT. To remain updated with advancements and emerging technologies, professionals should participate in continuing professional education programs as per NCAHP guidelines.

Scope of practice for Diploma holders

Medical Radiology and Imaging Assistant possess, utilize and maintain knowledge of radiation protection and safety. They have a thorough understanding of human anatomy, the effects of injuries and diseases on the body and the principles involved in producing diagnostic X-ray images.

Their work involves a wide range of radiographic imaging radiology modalities. Medical Radiology and Imaging Assistants serve as the primary liaison between patients, radiologists and other healthcare team members. They remain sensitive to patient needs through effective communication, patient assessment, patient monitoring and patient care skills.

As members of the healthcare team, Medical Radiology and Imaging Assistants participate in quality improvement processes and continuously assess their professional performance. They engage in continuing education to enhance patient care, public education, professional knowledge and technical competence.

Medical Radiology and Imaging Assistants use a variety of radiological modalities, including:

- Fixed X-ray imaging
- Mobile X-ray/Bedside radiography
- Basic radiological procedures
- Computed Radiography (CR)/Digital Radiography (DR)
- C-Arm procedures
- Dental radiography
- Fluoroscopy procedures

The task force committee has developed the Diploma in Medical Radiology and Imaging Technology curriculum keeping in view the requirements of the primary healthcare sector and rural healthcare services.

Curriculum of Diploma in Medical Radiology and Imaging Technology shall be implemented from the academic year 2026-27 onwards.

Career Progression:

The table below illustrates the various channels of indicative career progression in two distinct sectors, namely the clinical setting and the industry/technical sector. The level of responsibility increases progressively with advancement in the career pathway. The table also specifies the required qualifications and experience necessary for professionals to fulfil the responsibilities associated with each category.

Considering the extent of patient interaction and the advanced technical skills required to meet the present-day demands of healthcare services, the committee has recommended phasing out the Diploma program within the next 3-5 years (by year 2030) in order to promote Bachelor's and Master's degree programs in Medical Radiology and Imaging Technology.

The Committee recommends the following indicative career progression scheme for Diploma in Medical Radiology and Imaging Technology professions.

Nomenclature based on indicative career progression for Diploma in Medical Radiology and Imaging Technology:

Category	Nomenclature in various sectors		Minimum Qualification and Experience
	Clinical	Industry/Technical	
01	Medical Radiology and Imaging Assistant (MRIA) - Grade III	Technical Associate (TA) - Grade III	Pass in Higher Secondary (10 Plus 2) with Physics, Chemistry and Biology and Diploma in Medical Radiology and Imaging Technology (DMRIT) or its equivalent.
02	Medical Radiology and Imaging Assistant (MRIA) - Grade II	Technical Associate Gr-II	Promotion from Category 1. with an experience of 3 years as RA - Gr III
03	Medical Radiology and Imaging Assistant (MRIA) - Grade I	Technical Associate Gr-I	Promotion from Category 2 With an experience of 3 years as RA - Gr II.

Lateral Entry for Diploma Holders:

There is a provision for lateral entry into the 3rd semester (2nd year) of the Bachelor in Medical Radiology and Imaging Technology (BMRIT) program for candidates who have successfully completed a Diploma in Medical Radiology and Imaging Technology. This provision enables diploma holders to upgrade their qualifications and advance their careers in the field of Medical Radiology and Imaging Technology.

Recognition of Title and qualification

The practice of medical radiography is performed by healthcare professionals responsible for the administration of ionizing radiation for diagnostic purposes. After successful completion of the diploma course, the candidate shall be designated as a **Medical Radiology and Imaging Assistant**.

Definition of Diploma in Medical Radiology and Imaging Technology

A Medical Radiology and Imaging Assistant is a trained health professional who performs medical imaging by producing high quality X-ray pictures or images used to diagnose and treat injury or disease.

It is an important part of medicine and a patient's diagnosis and treatment are often dependent on the X-ray images produced. They are responsible for producing high quality medical images that assist medical specialists and doctors to diagnose or monitor a patient's injury or illness treatment. They operate CR, DR, fluoroscopy and mobile X-ray machines.

As the curriculum defined for Diploma in Medical Radiology and Imaging Technology is restricted to certain areas in the Diagnostic Radiology in view of required knowledge, skills and patient care in the modern medicine. The introduction of Diploma is allowed for few years keeping in view of primary healthcare and rural requirements. The Candidates who successfully complete the Diploma course shall be designated as **Medical Radiology and Imaging Assistant** and will be permitted to practice:

- Fixed X-ray imaging
- Mobile X-ray/Bedside radiography
- Basic radiological procedures
- Computed Radiography (CR)/Digital Radiography (DR)
- C-Arm procedures
- Dental radiography
- Fluoroscopy procedures

Eligibility for admission

Selection procedure:

- He/she has passed the Higher Secondary (10+2) or equivalent examination recognized by any Indian University or a duly constituted Board with Physics, Chemistry, Biology
- Reservation as per Govt. of India/respective to State Govt. rules.
- He/she has attained the age of 17 years of age at the time of admission or will complete that age on or before 31st December of the year of admission of the first year of the Diploma program.

Selection of eligible candidates:

Selection to the Diploma in Medical Radiology and Imaging Technology course shall be made based on 10+2 merit.

Provision of Lateral Entry:

No lateral entry at Diploma level as this is the basic entry level for the professionals.

Duration of the course:

Duration of the course is 2.5 years or 5 semesters (inclusive of six months of internship) with per semester 540 hours of Theory & Practical Classes and 1080 hours dedicated for six months of internship.

Total number of hours of the programme: 3240 hours.

Medium of instruction:

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

Maximum period for completion of the course:

- The maximum period for completion of Diploma in Medical Radiology and Imaging Technology is 5 years.
- If a candidate does not complete within the 5 years, he/she should re-register.

Attendance and Monitoring progress of studies:

- A candidate shall study in concerned department of the Institute for the entire period as a full-time student.
- A candidate who has a minimum of 75% attendance in theory and practical separately and who has fulfilled other requirements of the course shall be permitted to appear for examination.
- A candidate having shortage of attendance shall repeat the exam when it is offered next.

Assessment and Evaluation

Scheme of Evaluation

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

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

Continuous Internal Evaluation (CIE)

- 30% of the total marks is allotted for CIE in each course. (Ex: 30 out of 100 Marks)
- Distribution of 30% CIE:
- CIE 1: 50% of CIE-1 (Sessional test(s)) shall be based on the average of marks obtained in two notified formative written tests. Absence without prior permission for a formative test shall result in scoring of the test as zero.
- CIE 2: The remaining 50% of CIE-2 (Continuous assessment) will be based on internal assessments in the form of evaluation seminars, journal club presentations, case presentations, completion of assignments etc. which will be specified in the individual course curricula). Check the table at the end of each course.

- CIE will be conducted for theory and practical for each course wherever applicable.
- A Candidate must secure at least 40% of total marks fixed for CIE in the particular course in order to be eligible to appear for the End Semester Examination (ESE) for that course.

End semester examination (ESE)

- There shall be a University Examination at the end of each semester.
- To be eligible to appear for university examination a candidate should fulfil all the following conditions:
 - Undergone satisfactorily the approved program of study in the course/courses for the prescribed duration.
 - Shall have the minimum attendance requirement in all courses of that semester for the first appearance
 - Secure at least 40% of total marks fixed for CIE in a particular course; and
 - Fulfill any other requirement that may be prescribed by the University from time to time.
- The End semester examination will consist of Theory examination for all courses and in addition, Practical examination for specified courses.

Theory examination:

Written tests with question types, pattern, duration and weightage as specified in the Course-wise curricula

Practical examination:

Broad outline would be in the form of Spotters, Demonstration of equipment handling, Case based discussions.

Criteria for pass:

- A candidate must secure a minimum of 40% marks in the Continuous Internal Evaluation (CIE) and 40% marks in the End Semester Examination (ESE) separately in each theory and practical course, wherever applicable, in order to pass the course.
- In case of failure, the candidate shall subsequently appear for both the theory and practical examinations of the University in that particular course, wherever applicable.
- A candidate who has successfully passed all the prescribed courses shall be declared to have passed the programme.
- Class/distinction shall be awarded only to those candidates who pass the entire programme in the first attempt, based on the aggregate marks obtained in the individual semesters.

An attempt means the appearance of a candidate for one or more courses either in part or full in a particular examination. If a candidate submits application for appearing for the examination but does not appear for any of the courses either in full or part in the university examination, he can appear for supplementary examination provided other conditions such as attendance requirement, internal assessment marks, etc. are fulfilled and his appearing in the supplementary examination shall be considered as the first attempt.

Grading system

Marks Range (%)	Grade Point	Letter Grade	Description	Classification	CGPA
90 & above	10	O	Outstanding	First Class with distinction	7.00 and above
80-89	9	A+	Excellent		
70-79	8	A	Very Good		
60-69	7	B+	Good	First Class	6.00-6.99
55-59	6	B	Above Average	Second Class	5.50-5.99
50-54	5	C	Average	Second Class	5.00-5.49
40-49	4	P	Pass	Pass Class	4.00-4.99
Below 40	0	F	Fails	Fail	Less than 4.0
Absent	0	I	Absent	--	--

The following procedure shall be adopted for the computation of the **Semester Grade Point Average (SGPA)** and **Cumulative Grade Point Average (CGPA)**:

- The Semester Grade Point Average (SGPA) is the ratio of the sum of the products of the number of credits and the grade points obtained by a student in all course components taken during a semester to the total number of credits earned in that semester, i.e.,

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where:

- C_i = Number of credits assigned to the i th course component
- G_i = Grade point secured by the student in the i th course component
- The Cumulative Grade Point Average (CGPA) shall be calculated in a similar manner, taking into account the performance in all semesters of the programme, i.e.,

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

where:

- S_i = SGPA of the i th semester
- C_i = Total number of credits in the i th semester

Ref: UGC guidelines for more information.

Carry over benefit:

A candidate shall appear for all the courses of that particular semester in the University examinations but failed in that semester can avail this benefit, provided:

- A candidate shall be permitted to progress to the II Semester irrespective of backlog courses in the I Semester.
- A candidate with backlog courses in the I Semester shall appear for those backlog courses along with the II Semester examinations. A candidate with not more than three backlog courses (I and II Semesters put together) shall be permitted to progress to the III Semester, provided that all I Semester courses are cleared before appearing for the III Semester University examination.
- A candidate with not more than two backlog courses in the III Semester shall be permitted to progress to the IV Semester, provided that all II Semester courses are cleared before appearing for the IV Semester University examination. The candidate shall appear for the III Semester backlog courses along with the IV Semester examinations.
- A candidate shall be permitted to proceed to the Internship (V Semester) only after successfully clearing all courses of the I, II, III and IV Semesters.

Re-totalling:

Re-totalling of marks is permitted only for theory papers. The University/board, on application within the stipulated time and remittance of a prescribed fee, shall permit a re-totalling of marks for the course/s applied. The marks obtained after re-totalling shall be the final marks awarded. There is no facility provided for repeat paper valuation of any courses.

Supplementary Examinations:

Supplementary examination 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 lack of attendance will be barred from appearing in any one or all course/s for the supplementary examination.
- A candidate permitted to appear for the supplementary examination can improve his internal assessment marks before he takes the supplementary examination by courseing himself to internal assessment.

Completion requirements:

Candidate shall be declared eligible for the award of the Diploma if he or she has:

- Fulfilled all Diploma requirements.

- No dues to the University, Institution, departments, hostels, library etc.
- No disciplinary action pending against him.
- The award of Diploma must be recommended by the Board of Management.

Award of Diploma:

The Diploma will be awarded in person to all eligible students who have qualified during preceding academic year.

Board of examiners for each semester (except internship):

The Examination Committee shall recommend in such manner as may be determined by the State Board, names of suitable experts as the chairman of panels of Board of examiner for setting and moderating the question papers and arrange the panels of moderators, senior examiners and examiners prepared in such manner as per the guidelines of the State council.

HOD of Radiology: Chairperson

Programme Co-ordinator/Course Co-ordinator/Chief of MRIT/In-charge of MRIT: Co-chairperson

Course Experts:

External examiner (one):

- The examiner must be MMRIT or equivalent.
 - Internal examiner (one):
 - The examiner must be MMRIT or equivalent.

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

- Standalone institutions must have an MoU with either a medical college or hospital with minimum of 100 beds or healthcare facility with carrying minimum of 100 investigation per day includes of x-rays and Radiological procedures as per the guidelines (desired number of Radiology equipment/beds/OPD etc.) defined in the curriculum to ensure practical exposure to the students.
- The distance between the institute and the practicing facility or hospital shall be a maximum of 20 km if the college is in an urban area, and 30 km if it is in a rural area.
- MoU to also define the radiology clinical supervision of the students -institutional staff or clinical preceptors can be considered.
- For the institutes to be capable of providing high quality training to the student and exposure to all the related modalities, it should have the following:
- Fixed X-ray unit

- Mobile X-ray/Bedside unit
- Computed Radiography (CR)/Digital Radiography (DR) unit
- C-Arm unit
- Dental radiography unit
- Fluoroscopy unit

Method of teaching and learning:

- Lecture
- Tutorial
- Problem based learning
- Small group teaching and learning
- Continuous interactive learning
- Case-based
- Seminars
- Clinical conferences
- E-learning
- Skills laboratory

Structure of the Diploma in Medical Radiology and Imaging Technology programme:

Overview

Foundation courses (12 credits)	Human Anatomy Physiology Basics of Microbiology Basics of Biochemistry
Core courses (58 credits)	Basics of Radiation Physics Conventional Radiography Equipment Clinical Radiography Positioning (Part-I) Clinical Radiography Positioning (Part-II) X-ray Image Processing Radiological Procedures Hospital Practice and Patient care Radiation safety and Quality Assurance in Radiography Introduction to CT and MRI
Auxiliary Courses (10 Credits)	Introduction to Healthcare & Medical Terminology and Record Keeping Basic Computers and Information Science Medical Law and Ethics & Professionalism and Values Principles of Management English and Communication Skills

Internship (20 credits)	Internship
Total credits	100

Distribution of Credits:

Teaching Scheme	Credit	Hours
L - Lectures	1 credit	15 hours
T - Tutorial	1 credit	15 hours
P - Practical	1 credit	30 hours
C- Clinical (Studentship)	1 credit	75 hours

Curriculum Outline

Teaching and Examination Scheme																
Course Name: Diploma in Medical Radiology and Imaging Technology																
Pattern: Full Time				Duration: 15 Weeks				Semester: First								
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
			L	T	C/P	Credits (L+T+P)	Theory				Practical				Grand Total	
							Exam Duration in Hrs.	CIE	ESE	Total		CIE	ESE	Total		
								Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks		Min Marks
1.	Human Anatomy	DMRIT01	3	--	--	3	2.5	30	70	100	40	--	--	--	--	100
2.	Physiology	DMRIT02	3	--	--	3	2.5	30	70	100	40	--	--	--	--	100
3.	Basics of Radiation Physics	DMRIT03	5	1	--	6	2.5	30	70	100	40	--	--	--	--	100
4.	Introduction to Healthcare & Medical Terminology and Record Keeping*	DMRIT04	2	--	--	2	1.5	15	35	50	20	--	--	--	--	50

Teaching and Examination Scheme																
Course Name: Diploma in Medical Radiology and Imaging Technology																
Pattern: Full Time				Duration: 15 Weeks				Semester: First								
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
			L	T	C/P	Credits (L+T+P)	Theory				Practical				Grand Total	
							Exam Duration in Hrs.	CIE	ESE	Total		CIE	ESE	Total		
						Max Marks		Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
5.	English and Communication Skills*	DMRIT05	2	--	--	2	1.5	15	35	50	20	--	--	--	--	50
6.	Radiography Clinical Education - part I (studentship)*	DMRIT06	--	--	20	4	--	--	--	--	--	15	35	50	25	50
	Total		15	1	20	20	--	--	--	400	--	--	--	50	--	450
Student Contact Hours Per Week: 36 Hrs. Theory and practical periods of 60 minutes each. Medium of Instruction: English Total Marks: 450																
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical																
*Institutional Level Examination																
(Institutional Level examination) marks are not to be counted for the grade at the end of the semester. However, the marks obtained in each individual course shall be reflected in the marks card.																

Teaching and Examination Scheme																
Course Name: Diploma in Medical Radiology and Imaging Technology																
Pattern: Full Time			Duration: 15 Weeks				Semester: Second									
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
			L	T	C/P	Credits (L+T+P)	Theory					Practical				
							Exam Duration in	CIE Max Marks	ESE Max Marks	Total		CIE Max Marks	ESE Max Marks	Total		Grand Total
										Max Marks	Min Marks			Max Marks	Min Marks	
1.	Basics of Biochemistry	DMRIT07	3	--	--	3	2.5	30	70	100	40	--	--	--	--	100
2.	Conventional Radiography Equipment	DMRIT08	4	--	2	5	2.5	30	70	100	40	--	--	--	--	100
3.	Clinical Radiography Positioning (Part-I)	DMRIT09	4	--	6	7	2.5	30	70	100	40	15	35	50	20	150
4.	Basic Computers and Information Science*	DMRIT10	2	--	--	2	1.5	15	35	50	20	--	--	--	--	50
5.	Radiography Clinical Education - part II (studentship)*	DMRIT11	--	--	15	3	--	--	--	--	--	15	35	50	20	50
	Total		13	--	23	20	--	--	--	350	--	--	--	100	--	450

Competency Based Curriculum for "DIPLOMA IN MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY"
(Intellectual property of National Commission for Allied and Healthcare Professions, Ministry of Health and Family Welfare)

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

Medium of Instruction: English Total Marks: 450

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

*Institutional Level Examination

(Institutional Level examination) marks are not to be counted for the grade at the end of the semester. However, the marks obtained in each individual course shall be reflected in the marks card.

Teaching and Examination Scheme																
Course Name: Diploma in Medical Radiology and Imaging Technology																
Pattern: Full Time			Duration: 15 Weeks				Semester: Third									
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
			L	T	C/P	Credits (L+T+P)	Exam Duration in Hrs.	Theory				Practical				Grand Total
								CIE	ESE	Total		CIE	ESE	Total		
								Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks	
1.	Basics of Microbiology	DMRIT12	3	--	--	3	2.5	30	70	100	40	--	--	--	--	100
2.	Clinical Radiography Positioning (Part-II)	DMRIT13	4	1	6	8	2.5	30	70	100	40	15	35	50	20	150
3.	X-ray Image Processing	DMRIT14	3	--	2	4	2.5	30	70	100	40	15	35	50	20	150
4.	Principles of Management*	DMRIT15	2	--	--	2	1.5	15	35	50	20	--	--	--	--	50
5.	Radiography Clinical Education - part III (studentship)*	DMRIT16	--	--	15	3	--	--	--	--	--	15	35	50	20	50
Total			12	1	23	20	--	--	--	350	--	--	--	150	--	500

Competency Based Curriculum for "DIPLOMA IN MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY"
(Intellectual property of National Commission for Allied and Healthcare Professions, Ministry of Health and Family Welfare)

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

Medium of Instruction: English Total Marks: 500

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

*Institutional Level Examination

(Institutional Level examination) marks are not to be counted for the grade at the end of the semester. However, the marks obtained in each individual course shall be reflected in the marks card.

Teaching and Examination Scheme																
Course Name: Diploma in Medical Radiology and Imaging Technology																
Pattern: Full Time			Duration: 15 Weeks				Semester: Fourth									
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
			L	T	C/P	Credits (L+T+P)	Theory				Practical				Grand Total	
							Exam Duration in Hrs.	CIE	ESE	Total		CIE	ESE	Total		
Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks		Min Marks								
1.	Hospital Practice and Patient Care	DMRIT17	2	--	2	3	1.5	15	35	50	20	15	35	50	20	100
2.	Radiological Procedures	DMRIT18	3	--	4	5	2.5	30	70	100	40	15	35	50	20	150
3.	Radiation safety and Quality Assurance in Radiography	DMRIT19	3	--	2	4	2.5	30	70	100	40	15	35	50	20	150
4.	Introduction to USG, CT and MRI	DMRIT20	3	--	--	3	2.5	30	70	100	40	--	--	--	--	100
5.	Medical Law and Ethics & Professionalism and Values*	DMRIT21	2	--	--	2	1.5	15	35	50	20	--	--	--	--	50

Teaching and Examination Scheme																
Course Name: Diploma in Medical Radiology and Imaging Technology																
Pattern: Full Time				Duration: 15 Weeks				Semester: Fourth								
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme									
			L	T	C/P	Credits (L+T+P)	Theory				Practical				Grand Total	
							Exam Duration in Hrs.	CIE	ESE	Total		CIE	ESE	Total		
								Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks		Min Marks
6.	Radiography Clinical Education - part IV (studentship)*	DMRIT22	--	--	15	3	--	--	--	--	--	15	35	50	20	50
	Total		13	--	23	20	--	--	--	400	--	--	--	200	--	600
Student Contact Hours Per Week: 36 Hrs. Theory and practical periods of 60 minutes each.																
Medium of Instruction: English Total Marks: 600																
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical																
*Institutional Level Examination																
(Institutional Level examination) marks are not to be counted for the grade at the end of the semester. However, the marks obtained in each individual course shall be reflected in the marks card.																

Teaching and Examination Scheme																				
Course Name: Diploma in Medical Radiology and Imaging Technology																				
Pattern: Full Time				Duration: 1200 Hours				Semester: Fifth												
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme													
			L	T	C/P	Credits (L+T+P)	Theory						Practical				Grand Total			
							Exam Duration in Hrs.	CIE		ESE		Total		CIE		ESE		Total		
								Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks		Min Marks		
.	Internship	DMRIT23	:	:	:	20	:	:	:	:	:	:	:	:	:	:				

Total Marks of the program:

Semester	Marks
First	450
Second	450
Third	500
Fourth	600
Total	2000

Programme Outcomes:

PO No.	Attribute	Competency
PO1	Knowledge	Apply fundamental knowledge of radiation physics, radiographic procedures, anatomy, physiology, patient care and radiation protection required for routine radiography practice.
PO2	Ethics and Professionalism	Demonstrate ethical values, professional conduct, integrity and responsibility while working in healthcare settings.
PO3	Lifelong Learning	Update knowledge and technical skills continuously to adapt to advancements in radiography and healthcare practices.
PO4	Communication	Communicate effectively with patients, caregivers, radiologists and healthcare team members with empathy and professionalism.
PO5	Leadership and Responsibility	Demonstrate responsibility, discipline and the ability to work efficiently under supervision in radiology departments and healthcare institutions.
PO6	Critical Thinking	Apply critical thinking skills in patient positioning, exposure parameter selection, image evaluation and basic problem-solving during radiographic procedures.
PO7	Safety and Radiation Protection	Ensure patient, staff and public safety by following radiation protection principles, infection control practices and departmental safety protocols.
PO8	Problem Analysis	Identify and respond appropriately to routine technical issues, patient-related challenges and emergencies encountered during radiographic procedures.
PO9	Radiographic Equipment Handling	Operate and assist in handling routine radiographic equipment such as fixed X-ray, mobile X-ray, CR/DR systems, fluoroscopy, C-arm and dental radiography equipment under supervision.
PO10	Departmental Management	Assist in maintaining workflow, patient records, stock maintenance, equipment care and quality assurance activities in radiology departments.
PO11	Professional Development	Participate in continuing education activities and professional organizations to improve competency and maintain professional standards.
PO12	Teamwork	Work collaboratively with radiologists, technologists, nurses and other healthcare professionals to provide effective patient care and radiographic services.

FIRST SEMESTER

Course: Human Anatomy

Course Code: DMRIT01

RATIONALE

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

COURSE OUTCOMES

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

C01: Describe the general anatomy of human body

C02: Explain normal disposition of various structures and organs in the body and its clinical correlation

C03: Describe the microscopic structure of various tissues

C04: Determine the topography of various structures on the surface of the body

C05: Identify and locate structures of the body

C06: Identify organs and tissues under microscope

C07: Point out various features of appearance of normal body in skiagrams

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

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Introduction: Human Body as a Whole Definition of anatomy and its subdivisions, Terms of location, positions and planes, Cell and its organelles, Epithelium - definition, classification, describe with examples, functions, Glands - classification, describe serous and mucous glands with examples, Basic tissues - classification with examples	05
II	Locomotion and Support Cartilage - types, examples and histology Bone - classification, examples and histology. Parts of long bone, names of all bones, vertebral column and intervertebral disc. Fontanel's of fetal skull. Joints - classification of joints with examples, typical synovial joint (in detail). Muscular system - classification of muscular tissue and histology Important muscles of the body- Sternocleidomastoid, Trapezius, Muscles of tongue, Deltoid, Biceps brachii, Intercostal muscles, Thoracic diaphragm, Rectus abdominis, External oblique, Internal oblique, Transversus abdominis, Pelvic diaphragm, Gluteus maximus, Gluteus medius, Gluteus Minimus, Quadriceps femoris, Soleus.	07
III	Cardiovascular System Heart - size, location, chambers, exterior and interior, Blood supply of heart, Pericardium, Systemic and pulmonary circulation, Branches of aorta - common carotid artery, subclavian artery, Axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery, dorsalis pedis artery., Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, median cubital vein, Dural venous sinuses, Lymphatic system - cisterna chyli and thoracic duct, Lymphatic tissues and its histology, Regional lymph nodes - cervical, axillary and inguinal lymph nodes. Respiratory System Parts of RS - nose, nasal cavity, paranasal air sinuses, larynx, trachea, lungs, pleura, bronchopulmonary segments, Histology of trachea and lungs.	07

Unit	Topic and contents	Hours
IV	Gastro-Intestinal System Theory Parts of GIT- oral cavity (lip, cheek, tongue, salivary glands, palate, dentition) pharynx (Waldeyer's ring) oesophagus, stomach, small and large intestine and appendix, Liver, gall bladder, pancreas and spleen, Histology of oesophagus, stomach, small and large intestine, liver, gall bladder and pancreas. Peritoneum Description of reflection, folds and pouches in brief.	07
V	Urinary System Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder. Reproductive System Parts of male reproductive system- testis, vas deferens, epididymis, prostate, Parts of female reproductive system- uterus, fallopian tubes, ovary, mammary gland, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary. Endocrine Glands 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.	07
VI	Nervous System Neuron, Classification of nervous system, Cerebrum, cerebellum, brain stem, spinal cord & spinal nerve, Meninges, ventricles and cerebrospinal fluid, Blood supply of the brain, Cranial nerves (in brief), Nerve plexus (Brachial & lumbar) Sensory Organs Skin and its appendages, Eye - parts of eye ball and lacrimal apparatus, Extra- ocular muscles, Histology of cornea and retina, Ear - parts of ear- external, middle and inner ear and contents Embryology Spermatogenesis and oogenesis, Ovulation, fertilization, Placenta	06
Total		39

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No	Topic and contents	Hours
1.	Demonstration of Histology of types of epithelium, Histology of serous, mucous and mixed salivary gland, Surface marking of the body region wise.	1
2.	Demonstration of Histology of hyaline, elastic and fibrocartilage, Demonstration of all bones showing parts, radiographs of normal bones and joints, Histology of compact bone (TS and LS), Demonstration of all muscles of the body, Histology of skeletal, smooth and cardiac muscle.	1
3.	Demonstration of heart, pericardium and vessels of the body, Histology of large artery, medium sized artery and large vein, Histology of lymph node, spleen, tonsil and thymus, Normal chest radiograph showing heart shadows, Normal angiograms. Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea.	1
4.	Demonstration of parts of GIT, liver, gall bladder, pancreas and spleen, Histology of tongue, salivary glands, oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas and spleen, Radiographs of abdomen plain and contrast. Demonstrations of reflections, folds and pouches.	1
5.	Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen - IVP, retrograde cystogram. Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary, Radiographs of pelvis - Hysterosalpingogram. Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands.	1
6.	Demonstration of Histology of peripheral nerve and optic nerve, Demonstration of major nerves in the body, Demonstration of cranial cavity and parts of brain, Histology of cerebrum, cerebellum, spinal cord. Demonstration of Histology of thin and thick skin, Demonstration of histology of cornea and retina.	1
Total		6
Demonstration will be part of theory/tutorial classes. There is in separate credit for the Practicals/demonstrations.		

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Topic	Marks (± 5%)
I.	Introduction Human Body as a Whole	14
II.	Locomotion and Support	14
III.	Cardiovascular System, Respiratory System	20
IV.	Gastro-Intestinal System, Peritoneum	14
V.	Urinary System, Reproductive System, Endocrine Glands	20
VI.	Nervous System, Sensory Organs, Embryology	14
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Human Anatomy, Vol.1, 2 & 3, 5th edition, 2010,	B.D. Chaurasia	CBS publishers & distributors Pvt. Ltd.
2	Physiology & Anatomy with Practical Considerations	Ester. M. Grishcimer	J. P. Lippincott. Philadelphia
3	Manipal Manual of Anatomy, 2nd edition, 2012	Sampath Madhyastha	CBS publishers & distributors Pvt. Ltd
4	Text Book of General Anatomy, 2nd edition, 2013	Shobha Rawlani and Shivalal Rawlani	Jaypee brothers
5	Langman's Medical Embryology, 11th edition, 2009	T.W Sadler	Wolters Kluwer

Course: PHYSIOLOGY

Course Code: DMRIT02

RATIONALE

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

COURSE OUTCOMES

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

CO1: Explain the normal functioning of organs and systems.

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

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

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

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

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

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

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	General physiology Introduction to Physiology, Concept of Homeostasis, cell - Morphology - Functions of organelles and Cell membrane, Transport mechanisms, Body fluid compartments. Muscle nerve physiology Neurons: Morphology, Action Potential, Neuroglia: Types & functions, Muscles: Types, structure of sarcomere. Neuromuscular junction, sliding filament mechanism of contraction. Blood Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis - stages, essential factors, regulation of Erythropoiesis, Haemoglobin: Functions, concentration, physiological variations. Fate of Haemoglobin - Jaundice, types, Color index, MCH, MCV, MCHC, PCV - normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood grouping. Landsteiner's laws, ABO system, determination of blood groups, blood transfusion, complications of incompatible blood transfusion, Rh group, erythroblastosis foetalis, prevention and treatment, Blood bank. Haemostasis: Mechanisms. Clotting mechanism: factors, intrinsic and extrinsic pathways. Disorders of clotting - haemophilia, vitamin K deficiency. Anticoagulants - mechanism of action and their uses, Anaemia: Classification - Morphological and Etiological, Blood volume: normal values.	7

Unit	Topic and contents	Hours
II	Cardiovascular system Organization of cardiovascular system, greater and lesser circulation, Physiological anatomy of the heart, nerve supply, Junctional tissues of heart (pacemaker), Cardiac cycle: Mechanical events, Heart sounds, causes, characteristics and significance, Normal ECG, clinical significance of ECG, Heart rate - Physiological variations, Cardiac output: Definitions, normal values, physiological variations, Arterial blood pressure: Definitions, normal values, physiological variations, factors maintaining blood pressure. Role of baroreceptors in regulation of blood pressure.	5
III	Respiratory system Respiratory and non-respiratory function of respiratory system. Physiological anatomy of respiratory system Functions of respiratory tract. Respiratory membrane. Respiratory muscles. Surfactant: functions, respiratory distress syndrome. Definitions of terms used in respiratory physiology: Eupnea, Hyperpnoea, Tachypnea, Apnea, Dyspnea. Mechanics of breathing - intrapulmonary and Intrapleural pressure changes during a respiratory cycle. Spirometry - Lung volumes and capacities. Vital capacity. Oxygen transport: Role of haemoglobin, factors affecting, oxygen carrying capacity. Carbon dioxide transport: forms, chloride shift (Hamburger's 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 O ₂ therapy, Artificial respiration and Ventilators.	7
IV	Excretory system Functions of kidneys. Nephrons - Juxta glomerular apparatus - functions, Steps in Urine formation - Ultrafiltration, Tubular Reabsorption, Tubular Secretion, GFR. Definition, normal values, factors affecting GFR, measurement of GFR, Renal threshold for glucose, tubular load for glucose, Role of aldosterone and ADH in urine formation, Micturition, Innervation of bladder. Diuresis, Renal functions tests - Based on analysis of urine and analysis of blood, Skin: Functions of skin. Sweat glands.	3

Unit	Topic and contents	Hours
V	Digestive system Introduction, structure of alimentary canal, Saliva: Composition, functions, Stomach: Functions. Gastric Juice: composition, functions, Pancreatic Juice: Composition and functions, Liver: Functions, Bile: composition, functions, Gall bladder: functions, Succus entericus: Composition, functions. Functions of large intestine, Movements of small intestines, Deglutition.	4
VI	Endocrine system Major endocrine glands- Hormone: Definition, Anterior pituitary: hormones and their functions, disorders - Gigantism, 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.	7

Unit	Topic and contents	Hours
VII	Special senses Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & inner ear, cochlea, Deafness - types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell Reproductive system Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system: Ovarian hormones functions - Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.	6
Total		39

SUGGESTED PRACTICALS/DEMONSTRATION

SUGGESTED PRACTICALS/DEMONSTRATION	Hours
Study of Microscope and its uses Collection of blood and study of haemocytometer Haemoglobinometry Determination of RBC count Determination of WBC count Determination of blood groups Determination of bleeding time Determination of clotting time Recording of Arterial Blood Pressure, Clinical examination of Radial pulse Recording of spirogram and determination of vital capacity Artificial respiration, CPR Demonstration of ECG recording	6
Total	6
Demonstration will be part of theory/tutorial classes. There is in separate credit for the practicals/demonstrations.	

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Topics and content	Marks (± 5%)
I.	General physiology, Muscle nerve physiology, Blood	18
II.	Cardiovascular system	14
III.	Respiratory system	14
IV.	Excretory system	9
V.	Digestive system	9
VI.	Endocrine system, Nervous system	18
VII.	Special senses, Reproductive system	14
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Foundation of Anatomy and Physiology	Ross Wilson	Churchill Livingstone.
2	Physiology & Anatomy with Practical Considerations	Ester. M. Grishcimer	J.P. Lippincott. Philadelphia
3	Text Book of Physiology	A. P. Krishna	Suman Publication
4	Text Book of Physiology	A.K. Jain	Avichal Publishing Company;

Course: Basics of Radiation Physics

Course Code: DMRIT03

RATIONALE

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

COURSE OUTCOMES

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

CO1: Describe general physics related to imaging

CO2: Differentiate between within general radiation

CO3: Identify construction of radiology equipment's

CO4: Interpret quality of control of radiology equipment's

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

CO6: Describe production of x-rays

CO7: Describe circuit system of radiology equipment's

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	
5	1	--	6	30	70	--	--	100

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

TUTORIAL ASSIGNMENTS

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Basic concepts: Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron volt-Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence-Fluorescence-electromagnetic spectrum.	5
II	Electricity and magnetism: Electric charges, Coulomb's law-Unit of charge-Electric potential, unit of potential-Electric induction, capacitance and Capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR-Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current. Electromagnetic waves: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.	6
III	Electronics Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers. Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply. Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback-negative feedback in amplifiers.	5
IV	Discovery of x-rays-X-ray production and properties: Bremsstrahlung Radiations-Characteristics X-Rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets.	5

Unit	Topic and contents	Hours
V	Heat Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation in both stationary and rotating X-ray tubes).	4
VI	Interaction of ionizing radiation with matter -Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation. Interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer and linear attenuation coefficient-coherent scattering-photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance.	5
VII	Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number. Radiation intensity and exposure, photon flux and energy flux density. LET, range of energy relationship for alpha, beta particles with X-Rays. Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit.	6
Total		36

SUGGESTED TUTORIAL WORKSHEET

Sr. No	Radiation Physics Tutorial Worksheets	Hours
1.	Tutorial 1: Units and Measurements 1. Define force, work, power and energy. 2. Write SI units of force, work, power and temperature. 3. Differentiate heat and temperature. 4. Calculate work done when force = 10 N and displacement = 5 m.	1
2.	Tutorial 2: Atomic Structure 1. Define atom, nucleus and isotope. 2. Explain ionization and excitation. 3. Define binding energy. 4. Explain electromagnetic radiation.	1
3.	Tutorial 3: Quantum Physics 1. Define electron volt. 2. State mass-energy equivalence. 3. Explain quantum nature of radiation.	1
4.	Tutorial 4: Electricity Basics 1. State Coulomb's law. 2. Define electric potential. 3. Explain capacitance. 4. Define resistance.	1
5.	Tutorial 5: Circuits 1. State Ohm's law. 2. Define EMF. 3. Differentiate series and parallel circuits.	1
6.	Tutorial 6: Alternating Current 1. Define RMS value. 2. Explain power factor. 3. Describe LCR circuit.	1
7.	Tutorial 7: Electromagnetic Waves 1. Define electromagnetic waves. 2. Explain energy density. 3. List electromagnetic spectrum.	1
8.	Tutorial 8: Semiconductors 1. Define intrinsic semiconductor. 2. Differentiate n-type and p-type semiconductors. 3. Define majority carriers.	1

Sr. No	Radiation Physics Tutorial Worksheets	Hours
9.	Tutorial 9: Diodes 1. Define p-n junction. 2. Explain forward and reverse bias. 3. What is rectification?	1
10.	Tutorial 10: Transistors 1. Define transistor. 2. Explain amplification. 3. Define feedback in amplifiers.	1
11.	Tutorial 11: X-ray Production 1. Define Bremsstrahlung radiation. 2. Define characteristic radiation. 3. Explain Half Value Layer (HVL).	1
12.	Tutorial 12: Heat 1. Define heat capacity. 2. Explain modes of heat transfer. 3. Define thermal conductivity.	1
13.	Tutorial 13: Radiation Interaction 1. Define photoelectric effect. 2. Explain Compton scattering. 3. Define pair production.	1
14.	Tutorial 14: Attenuation 1. Define attenuation. 2. Explain Half Value Thickness (HVT) and Tenth Value Thickness (TVT). 3. Define linear attenuation coefficient.	1
15.	Tutorial 15: Radiation Quantities 1. Define photon flux. 2. Explain Linear Energy Transfer (LET). 3. Write units of kVp, mA, mAs.	1
Total		15

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Marks (± 5%)
Basic concepts	10
Electricity and magnetism, Electromagnetic waves	10
Electronics	06
Discovery of x-rays-X-ray production and properties	25
Heat	06
Interaction of ionizing radiation with matter-	25
Exponential attenuation, Physical quantity, its unit and measurement	14
Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Basic radiological physics	K. Thayalan	Jaypee Brothers Medical Publishers (P) Limited, 2003
2	Christensen's physics of diagnostic radiology	Curry and Dowdey	Wolters Kluwer
3	X-Ray Equipment for Student	D.N. And M.O. Chesney	Blackwell Science Ltd
4	A Textbook of Radiation Physics for Radiologic Technology	Surendra Maharjan, Suraj Sah	Samiksha Publications

Course: Introduction to Healthcare and Medical Terminology and Record Keeping

Course Code: DMRIT04

RATIONALE

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

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
2	--	--	2	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

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

Topic and contents	Hours
Introduction to Health: Definition of Health, Determinants of Health, Health indicators of India, Health team concept National Health Policy National Health Programs (Brief objectives and scope) Family welfare programs in India Introduction to Nursing: Nursing and Nursing principles, Interpersonal relationships, Bandaging basic turns, Bandaging extremities, Triangular bandages and their applications Nursing position, bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's position, comfort measures, Aids, rest and sleep Lifting and transporting patients, transferring patients to wheel chair, transferring from bed to stretcher Bedside Management: Proper usage of bedpan, Observation of stools, urine, sputum. Understand the use and care of catheters. Enema procedures Method of giving nourishment: Feeding, tube feeding, drips, transfusion Monitoring and recording of vitals Simple aseptic techniques, sterilization and disinfection Observation of surgical dressings Concepts of First Aid	15

Medical Terminologies and Record Keeping

THEORY COMPONENTS

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

Topic and contents	Hours
Topics include: origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests. Topics to be covered under the course are as follows: Derivation of medical terms. Define word roots, prefixes and suffixes. Conventions for combined morphemes and the formation of plurals. Basic medical terms. Form medical terms utilizing roots, suffixes, prefixes and combining roots. Interpret basic medical abbreviations/symbols. Utilize diagnostic, surgical and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system and endocrine system. Interpret medical orders/reports. Data entry and management on electronic health record system.	15

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Principles and Practice of Nursing Management and Administration	Jogindra Vati	Jaypee Brothers Ltd
2	Textbook of Preventive and Social Medicine	K Park	Banarsidas Bhanot Publishers
3	Introduction to Healthcare	Dakota Mitchell and Lee Haroun	Delmar
4	Introduction to Healthcare and Careers	Roxann Delaet	Joanes and Bartlett Learning
5	Medical Terminology, Documentation and Coding	Anne P. Stich	Routledge Publisher
6	Medical Terminology for Health Professions	Ann Ehrlich, Carol L. Schroeder	Cengage Learning
7	Medical Terminology	M. Mastenbjörk M.D. S. Meloni M.D. Medical Creation David Andersson	Medical Creations
8	Medical Records: Organization and Management	GD Mogli (Author)	Jaypee Brothers Medical Publishers

Course: English and Communication Skills

Course Code: DMRIT05

RATIONALE

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

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
2	--	--	2	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

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

Topic and contents	Hours
Language-Basic Content: Review of grammar, Remedial study of grammar, building vocabulary Introduction Parts of speech Exercise on use of grammar Tense, Number, Gender Assessment methods: Objective type, Fill in the blanks. Content: Read and comprehend prescribed course books Reading, Summarizing, Comprehension Assessment methods: Fill in the blanks and one-mark questions Content: Various Forms of Composition Letter writing Note taking Precise writings Diary writing Reports on health problem etc. Official correspondence: Outgoing correspondence, replying incoming correspondence, writing circulars, notices, charge memos, note taking, writing summaries, observation reports. Teaching learning activities: Exercise on writing: Letter writing, resume/CV Essay writing. Assessment methods: Applications, short reports to be written. Content: English- Spoken mode, Debates, Telephonic conversion, formal & informal conversation: Agreeing emphasizing, interrupting, politely, opinions, interviews, visual presentation. Teaching learning activities: Participating in seminar, Telephonic conversion, conversation in different situations, practice in public speaking Assessment methods: Assessment of the skills based on the checklist. Content: Listening to comprehension media, audio, video, speeches, definition of listening, types of listening, purposes of listening, obstacles for listening, contexts of listening, to be a good listener, listening to a lecture etc. Teaching learning activities: Listening to audio, video tapes and identify the key points. Assessment methods: Practical test of listening and filling out the blanks, essay type.	30

SUGGESTED LEARNING RESOURCES

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

Course: Radiography Clinical Education - part I (studentship)

Course Code: DMRIT06

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.

Total Hours: 300 (20 hrs/week × 15 weeks)

Nature: Clinical / Skill-based/ Stimulation based Training

COURSE OUTCOMES (COs)

At the end of 300 hours of studentship, the learner will be able to:

CO1: Apply the principles of radiation physics (interaction, attenuation, inverse square law, exposure factors) during routine X-ray procedures.

CO2: Correlate anatomy and physiology with radiographic imaging to identify normal structures and optimize imaging parameters.

CO3: Demonstrate understanding of X-ray equipment operation and exposure parameter selection (kVp, mAs, distance) in clinical settings.

CO4: Implement radiation protection principles (ALARA, shielding, collimation, dose optimization) during observational clinical practice.

CO5: Exhibit effective patient communication and basic patient care skills during radiographic procedures, ensuring patient safety and comfort.

CO6: Evaluate image quality and identify common errors/artifacts, relating them to underlying physical principles and suggesting corrective measures.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	50
--	--	20	4	--	--	15	35	

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

Integrated Studentship Plan (300 hours):

SL. No.	Observation	Integrated Learning (Radiation Physics + Anatomy + Physiology + Communication)
1	Hand Radiography	Interaction of X-rays with bone (photoelectric effect), hand anatomy, positioning communication
2	Wrist Radiography	Beam attenuation, joint anatomy, exposure factors, patient instruction
3	Forearm Radiography	Radiation intensity variation, long bone anatomy, positioning explanation
4	Elbow Radiography	Scatter radiation, joint physiology, communication during movement
5	Shoulder Radiography	X-ray penetration, muscle anatomy, patient handling
6	Chest Radiography	High kVp technique, Compton scattering, lung physiology, breathing instructions
7	Abdomen Radiography	Soft tissue attenuation, exposure selection, patient preparation
8	Pelvis Radiography	Radiation absorption in dense bone, gonadal protection, consent
9	Spine Radiography	Beam alignment, vertebral anatomy, radiation dose considerations
10	Skull Radiography	X-ray attenuation in skull, beam angulation, patient communication
11	Sinus Radiography	Air vs bone contrast, sinus anatomy, positioning explanation
12	Mobile Radiography	Inverse square law, radiation protection, bedside communication
13	Radiation Protection	ALARA, shielding, filtration, practical exposure control
14	Quality Assurance	Image quality, artifacts, exposure errors, correction techniques
15	Integration & Revision	Case-based learning integrating physics, anatomy, physiology and communication

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Weightage (%)	IA marks
1	Logbook (procedures & skills)	20	3
2	Clinical performance (skill assessment)	20	3
3	Case presentation / Seminar	20	3
4	Professional behaviour & attendance	20	3
5	Viva / Internal practical test	20	3
TOTAL		100	15

End Semester Evaluation (ESE)

Sl. No.	Component	IA marks
1	Practical exam (procedure performance)	20
2	Viva voce	5
3	Logbook verification	5
4	Case discussion	5
TOTAL		35

Second Semester

Course: Basics of Biochemistry

Course Code: DMRIT07

RATIONALE

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

COURSE OUTCOMES

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

CO1: Understand the responsibility of health care personals and hazards faced in the clinical laboratory

CO2: Explain the different types, use, care and maintenance of laboratory apparatus and instruments.

CO3: Understand the fundamental chemistry and knowledge of different solutions

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

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

CO6: Describe assimilation of nutrients and consequences of malnutrition

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

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

CO9: Describe the applications of radioisotopes

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

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Nutrition Calorific value Nitrogen Balance Respiratory quotient BMR Nutritional importance of carbohydrate, lipids, proteins, vitamins and minerals Emphasis on parenteral nutrition.	11
II	Acid-Base Balance Henderson Hassel Bach equation Buffers of the body fluids, Ph regulation , Disturbance in acid base balance Anion gap Basic principles & estimation of blood gases and ph. Water & Electrolyte balance Overview of water and electrolyte balance Basic principles in estimation of Electrolyte. Normal values and interpretation	11
III	Clinical chemistry-Brief overview of normal values and interpretation of results Renal function tests Liver function tests Tumour markers Cardiac markers Diagnostic Enzymology Lipid profile Blood sugar and GTT Normal & Abnormal urine analysis	11
IV	Radioisotopes: Definition, Application & Hazards, Radioimmunoassay (RIA), Normal and abnormal urine analysis Clinical charts on LFT, RFT and diagnostic enzymology	12
TOTAL		45

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Casepresentations/ Logbook/Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE) Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Topics and content	Marks (± 5%)
I.	Nutrition	24
II.	Acid-Base Balance Water & Electrolyte balance	24
III.	Clinical chemistry-Brief overview of normal values and interpretation of results	24
IV.	Radioisotopes: Definition, Application & Hazards	24
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

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

Course: Conventional Radiography Equipment

Course Code: DMRIT08

RATIONALE

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

COURSE OUTCOMES

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

C0001: Describe the structure and working of x-ray tube, production of x-rays

C0002: Describe the types of x-ray tube and heat dissipation methods

C0003: Explain the x-ray generator circuits

C0004: Describe the different circuit types

C0005: Describe the meters and exposure timers

C0006: List the control of scattered radiation

C0007: Describes about the fluoroscopy

C0008: Explains about the care and maintenance of x-ray equipment's

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

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	X-ray tube: Historical aspects, construction of X-ray tubes- Crookes tube, Coolidge tube, gas filled x-ray tube . Stationary anode X-Ray tube- Construction and working, Thermionic Emission. Anode angle, heel effect, space charge, off focus radiation, tube insert and housing Production of x-rays: Characteristic X-Rays, Bremsstrahlung radiation. Continuous and characteristics spectrum of x - rays, Rating chart, Cooling chart, Factors affecting quality and quantity of X-Rays	8
II	Rotating anode x - ray tube: construction and working, Speed of rotating anode, Dual focus, Practical consideration in choice of focus, focal spot size, anode heel effect, inherent filter and added filter, their effect on quality of the spectrum. Grid controlled and high-speed tubes: Construction and working, Ceramic tubes. Heat dissipation methods: Heat units-calculation and Overload protection. Heat dissipation methods.	6
III	X-Ray circuit: Diode, Triode, Semiconductors, Transistors, Forward and reverse bias. Rectification- Half wave and full wave. Transformers- Construction and types . Filament circuit, kV circuit. X-Ray primary and secondary circuits. Simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.	8
IV	X-ray generator and interlocking 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, Capacitors discharge and grid control systems. Fuses, switches-Mechanical, toggle and relay switch. Circuit breaker (locker) -Exposure switching -HT cables-earthing.	8
V	Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimetre, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimetre, digital panel meters. Clockwork timers, mAs timer, Pulse counting timer, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer.	8

Unit	Topic and contents	Hours
	Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; Filters- inherent filters, added filters, heavy metal filters, grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.	
VI	Mammography: Historical aspects, construction of X-ray tubes, construction and working, Speed of rotating anode, Practical consideration in choice of focus, focal spot size, anode heel effect, inherent filter and added filter, their effect on quality of the spectrum.	10
VII	Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed-circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid-controlled x-ray tube.	8
VIII	Care and Maintenance of X-ray equipment; General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.	4
Total		60

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No	Topic	Hours
1.	X-ray tube; Production of x-rays	4
2.	Rotating anode x - ray tube; Grid controlled and high speed tubes; Heat dissipation methods	4
3.	X-ray circuits	4
4.	X-Ray generators and Interlocking circuits; Relays	4
5.	Meters and exposure timers	4
6.	Control of scattered radiation: Beam limiting devices	4
7.	Fluoroscopy	3
8.	Care and Maintenance of X-ray equipment	3
Total		30

Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Casepresentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	TOPICS	Marks (± 5%)
I	X-ray tube; Production of x-rays	16
II	Rotating anode x - ray tube; Grid controlled and high-speed tubes; Heat dissipation methods	15
III	X-ray circuits	10
IV	X-Ray generators and Interlocking circuits; Relays	10
V	Meters and exposure timers	9
VI	Control of scattered radiation: Beam limiting devices	16
VII	Fluoroscopy	10
VIII	Care and Maintenance of X-ray equipment	10
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Radiographic Imaging (Cbs) I.C.R.P.	D.N. Chesney & M.O Chesney	CBS Publishers & Distributors
2	An Introduction of Physics to Diagnostic Radiography	Christensen, Curry & Dowdey	Lea & Febiger
3	Radiological Science for technologists	Stewart C Bushong	Mosby
4	Equipment for Diagnostic Radiography	E. Forster	Springer Dordrecht
5	The Physics of Radiology And Imaging	K Thayalan	Jaypee
6	Concise Text Book on Imaging modalities & Recent Advances In Diagnostic Radiology	Dr. K.B. Gehlot, Lalit Agarwal	JBD Publications

Course: Clinical Radiography Positioning (Part-I)

Course Code: DMRIT09

RATIONALE

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

COURSE OUTCOMES

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

CO1: Understand the basic patient positioning during radiographic investigation.

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

CO3: Application of equipment while working in radiology departments.

CO4: Choose proper position during radiography.

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

CO6: Explain the use of accessories.

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

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

Teaching Scheme (In Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	150
4	--	6	7	30	70	15	35	

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Principles of Radiography: Preparation of the Room, Apparatus and Instruments Positions of the Patient: Erect, Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc. Relative position of X-Ray tube and patient, relevant exposure factors. Use of accessories such as radiographic cones, grid and positioning aids. Anatomic and Physiological basis of the procedure, Association with theory with practical work. Radiographic appearances, both normal and common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and types of course. Radiation protection, use of gonad shield, practical methods of reducing radiation dose to the patient.	7
II	Upper limb: Routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus. Supplementary projections for Scaphoid, Carpal tunnel, Ball Catchers projections, Head of the Radius, Supracondylar fracture and Olecranon process	10
III	Lower limb: Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, knee-joint, patella and femurs. Supplementary projections for Talo-Calcaneal joint, Forced projections for torn ligaments, Flat Feet, Club Feet, Intercondylar projections for loose bodies in the knee, Axial projection for Patella.	10
IV	Shoulder Girdle and Thorax: Routine projections for the shoulder joint, Scapula, Acromio-Clavicular joint, Clavicle, Sternoclavicular joint, Sternum and Ribs. Supplementary projections for the axial projection of Clavicle, Bicipital groove, Coracoid process.	10

Unit	Topic and contents	Hours
V	Lung and Mediastinum: Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions. Abdominal viscera- Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus. Supplementary techniques. Upper respiratory system Technique for postnasal airways, larynx, trachea, thoracic inlet and Valsalva manoeuvre. - Phonation.	11
VI	Pelvic girdle and hip region: Routine projections for the whole pelvis, Sacro-Ileac joints, hip joint and Neck of Femur. Supplementary projections for the greater and lesser trochanters of Femur. Frog leg projection, Ischium, Symphysis Pubis, Ileum, Acetabulum and Congenital Dislocation of Hip, Arthrodesis. Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.	12
Total		60

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No	Topic and contents	Hours
1.	Principles of Radiography	13
2.	Upper limb	18
3.	Lower limb	18
4.	Shoulder Girdle and Thorax	12
5.	Chest	16
6.	Pelvic girdle and hip region, Skeletal survey	13
Total		90

Evaluation System

Continuous Internal Evaluation (CIE) (Theory)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Continuous Internal Evaluation (CIE) (Practical)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

End Semester Evaluation (ESE) Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

End Semester Evaluation (ESE)

There shall be practical examination for 35 marks in the course. Distribution of marks for ESE practical exams:

ESE		CIE		Grand total
Practical	Viva		Sub Total	
20	15	15	50	50

Question Paper Blueprint

Unit	TOPICS	Marks (± 5%)
I	Principles of Radiography	13
II	Upper limb	20
III	Lower limb	20
IV	Shoulder Girdle and Thorax	13
V	Chest	19
VI	Pelvic girdle and hip region, Skeletal survey	13
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Atlas of Radiographic Positioning and Radiological Procedures	Philip W Ballinger, Eugene D. Frank	Mosby
2	Clarks Positioning in Radiography	Ra 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 and Leslie E Kendrick	Elsevier Science
5	Radiology of Positioning and Applied Anatomy for Students and Practitioners	Garkal Gs	Jaypee Brothers Medical Publishers
6	Manual of Radiographic Positioning	S. Tamijeselman	JBD Publications

Course: Basic Computers and Information Science

Course Code: DMRIT10

RATIONALE

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

Teaching scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P		Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six
2	--	--	2	

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.	2
II	Input output devices: Input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices (monitors, pointers, plotters, screen image projector, voice response systems).	2
III	Processor and memory: The Central Processing Unit (CPU), main memory.	2
IV	Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.	2
V	Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).	2

Unit	Topic and contents	Hours
VI	Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.	3
VII	Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.	3
VIII	Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.	3
IX	Introduction of Operating System: introduction, operating system concepts, types of operating system.	3
X	Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.	2
X1	Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.	2
X11	Application of Computers in clinical settings. Practical on fundamentals of computers - Learning to use MS office: MS word, MS PowerPoint, MS Excel. To install different software. Data entry efficiency	4
	TOTAL	30

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Basic of Computer and Information Technology	Ashok Arora	Vikas
2	Computer and Information Science	Roger Lee (editor)	Springer
3	Information science and computer basics: An introduction	Mitchell, Ruth K	Clive Bingley

Radiology Clinical Education - Part II (studentship)

Course code: DMRIT11

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.

Total Hours: 225 (15 hrs/week × 15 weeks)

Nature: Clinical / Skill-based Training

COURSE OUTCOMES (COs)

At the end of 225 hours of studentship, the learner will be able to:

CO1: Demonstrate professional behaviour, communication skills and ethical practices in radiology departments.

CO2: Prepare patients, equipment and examination rooms for routine radiographic procedures.

CO3: Perform basic radiographic positioning techniques under supervision.

CO4: Operate radiographic equipment with understanding of exposure parameters.

CO5: Assist in special radiographic and fluoroscopic procedures.

CO6: Maintain records, logbooks and adhere to quality assurance protocols.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	50
--	--	15	3	--	--	15	35	

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

Unit	Topic and contents	Hours
I	Orientation to Radiology Department Structure and workflow of radiology department Roles of radiographic assistance and healthcare team Professional ethics and patient confidentiality Communication skills (patient handling, consent) Introduction to radiology records and documentation	15
II	Patient Care & Preparation Patient identification and verification protocols Patient preparation for radiographic procedures Handling special patients: Trauma patients Pediatric patients Geriatric patients Critically ill patients Infection control and universal precautions Contrast media basics (observation only)	30
III	Radiographic Equipment Handling Familiarization with X-ray equipment Positioning of X-ray tube and patient Exposure parameter selection (kVp, mAs, SID) Use of accessories: Grids Cassettes/DR systems Immobilization devices Equipment safety checks	30
IV	Perform routine and Supplementary projections positioning techniques: (These studentships must be done under supervision of faculty/senior staff) Upper Limb Hand, wrist, forearm, elbow, humerus Lower Limb Foot, ankle, leg, knee, femur Chest & Abdomen Chest PA/AP Abdomen erect/supine Pevis	150
	TOTAL	225

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Weightage (%)	IA marks
1	Logbook (procedures & skills)	20	3
2	Clinical performance (skill assessment)	20	3
3	Case presentation / Seminar	20	3
4	Professional behavior & attendance	20	3
5	Viva / Internal practical test	20	3
	TOTAL	100	15

End Semester Evaluation (ESE)

Sl. No.	Component	IA marks
1	Practical exam (procedure performance)	20
2	Viva voce	5
3	Logbook verification	5
4	Case discussion	5
	TOTAL	35

Third Semester

Course: Basics of Microbiology

Course Code: DMRIT12

RATIONALE

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

COURSE OUTCOMES

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

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

CO002: Describe the methods of sterilisation and disinfection and their applications

CO003: Explain the concepts of immunity, hypersensitivity and immunisation

CO004: Describe Nosocomial infections and methods for the prevention of hospital-acquired infections

CO005: Describe the management of biomedical waste

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

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

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Morphology of Bacteria: (Structure, size, shape, arrangement cell wall, flagella, spore, capsule, fimbria), Physiology of Bacteria: (Bacterial growth curve, Temp, O ₂ , CO ₂ , 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	12
II	Infection: Classification, Sources of infection, Modes of transmission: Nosocomial infection including biomedical waste management: Definition, Classification, Significance, Prevention and control, Biomedical waste management	10
III	Immunology: Immunity, Antigen, Antibody, Hypersensitivity	6
IV	General Properties of fungi. (General characters, classification, Morphology, Reproduction) General Properties of Viruses. (General character, classification based on Genome, Capsid, Envelope & replication and cultivation of virus).	9
V	Applied Microbiology: Pyrexia of unknown origin, Meningitis, Zoonotic infections, Hepatitis, HIV infection and AIDS, Food poisoning, Diarrhea, Urinary tract infections, Pulmonary Tuberculosis	8
Total		45

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/Logbook/Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE) Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

S. No	Units	Marks (± 5%)
1.	UNIT I	26
2.	UNIT II	20
3.	UNIT III	13
4.	UNIT IV	12
5.	UNIT V	15
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

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

Course: Clinical Radiography Positioning (Part- II)

Course Code: DMRIT13

RATIONALE

Clinical Radiography Positioning provides the students with knowledge of x-ray imaging, positioning and all the care that should be taken. To improve skills and knowledge on patient positioning for students' MRIT and to identify radiological pathologies and to gain knowledge on radiographic anatomy. They also gain knowledge of image quality in radiological images and management of patients in emergency situations.

COURSE OUTCOMES

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

C01: Prepare management and positioning of patients

C02: Correlate of indications, contraindications of the patient

C03: Understand the patient preparations needed before any radiological examination.

C04: Generalize knowledge of post procedural care.

C05: Students will be able position the patients for radiological procedures.

C06: Knowledge of image quality in radiological images.

C07: Management of patients in radiology department for various procedures.

C08: Ability to handle emergency situations in radiology department.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	150
4	1	6	8	30	70	15	35	

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Skull: Routine projections for cranium and facial bones; Supplementary projections for trauma, Towne's method, Sella turcica, Optic foramina, Jugular foramina, Temporal bones, Mastoids, Petrous bone, Zygomatic arches, Orbits, Maxillae, Nasal bones, Mandible, Temporomandibular joints. Nasal Sinuses: Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, erect and horizontal projections for fluid levels.	15
II	Dental Radiography Technique for intraoral full mouth. - Occlusal projections. Extraoral projections, including orthopantomography.	10
III	Vertebral Column: Routine projections for Atlanto-Occipital joint, cervical spine, Cervico-thoracic Junction, thoracic Spine, lumbar Spine, Lumbo-Sacral Region, Sacrum and Coccyx. Supplementary projections for the intervertebral foramina, posterior arch of Atlas, Flexion and Extension of Cervical Spine, Scoliosis and Kyphosis, Sacro Iliac Joint.	15
IV	Radiography using mobile X-ray equipment: Radiography in the ward: Radiography in the specialised unit, such as: Intensive care unit, Coronary care, Neonatal unit and Radiography in the operating theatre. Mammography: Basic views, special views, wire localization. Localisation of foreign bodies. Various techniques	5
V	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	5
VI	Neonatal and Paediatric Radiography, Forensic Radiography Microradiography: General principles, Requirement, Equipment, Technique.	5

Unit	Topic and contents	Hours
VII	Soft Tissue Radiography: High and low kilo voltage technique; differential filtration. Non - screen technique - simultaneous screen and non -screen technique. Multiple radiography, Uses of soft tissue radiography. High kV Radiography: General principles. Relation to patient dose, Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement. Radiographic factor: application and uses.	5
VIII	Localisation of foreign bodies: General location principles. Ingested, inhaled, inserted, embedded foreign bodies. Foreign bodies in the eye. Preparation of the area to be investigated. Appropriate projection for all Techniques to locate non-opaque foreign body.	5
	TOTAL	60

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No	Topics	Hours
1.	Skull radiography	20
2.	Dental Radiography; Upper respiratory system	10
3.	Vertebral Column	20
4.	Radiography in the ward; Mammography	15
5.	Ward /mobile radiography	5
6.	Neonatal and Pediatric Radiography; Forensic Radiography Microradiography	5
7.	Soft Tissue Radiography Multiple Radiography High kV Radiography Scatter elimination; beam collimation; grid ratio, speed and type of grid movement, Radiographic factor; application and uses.	10
8.	Localization of foreign bodies	5
	Total	90

Evaluation System

Continuous Internal Evaluation (CIE) (Theory)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/Logbook/Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Continuous Internal Evaluation (CIE) (Practical)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests • Same pattern as Summative test • Average of two to be considered • Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

End-of-Semester Evaluation (ESE) Written Paper

Type of question	No. of questions	Marks per question	Total
Long Essay	3 (to answer 2)	10	20
Short Essay	9 (to answer 7)	5	35
Short Answer	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

End Semester Evaluation (ESE)

There shall be practical examination for 35 marks in the course.

Distribution of marks for ESE practical exams:

ESE		CIE		Grand total
Practical	Viva		Sub Total	
20	15	15	50	50

Unit	Topic	Marks (± 5%)
1.	Skull radiography	14
2.	Dental Radiography; Upper respiratory system	14
3.	Vertebral Column	14
4.	Radiography in the ward; Mammography	14
5.	Ward / mobile radiography	14
6.	Neonatal and Pediatric Radiography; Forensic Radiography Microradiography	14
7.	Soft Tissue Radiography Multiple Radiography High kV Radiography Scatter elimination; beam collimation; grid ratio, speed and type of grid movement, Radiographic factor; application and uses.	6
8.	Localization of foreign bodies	6
	Total Marks (including optional questions)	96

Question Paper Blueprint

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Radiological positioning	Merlis	Mosby
2	A guide to Radiological positioning	Clarks	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

Course: X-ray Image Processing

Course Code: DMRIT14

RATIONALE

Radiography and Image processing techniques provide the construction and operation of the film, intensifying screen, cassette, darkroom and automatic processor.

COURSE OUTCOMES

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

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

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	150
3	--	2	4	30	70	15	35	

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

THEORY COMPONENTS

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

Unit	Topic and contents	Hours
I	Photographic Principles: Radiographic film- construction and types; Photographic effect and latent image formation; Film density and log relative exposure; Characteristic curve - its formation and features; Spectral response; Film faults and Artefacts 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	11
II	Dark Room - Planning & Construction: Planning for a small & large Hospital; Location of Dark Room; Construction of Dark Room; Ventilation; Wall Protection; Entrance to Dark Room - Single Door, Double Door, Labyrinth Dark Room Accessories: Dry bench; Hopper, Drawer, Cupboard; Loading and unloading cassettes; Hangers, types of hangers and storage of hangers; Wet bench; Cleanliness, control of dust, dark room sinks; Hatches; Drier; Safe Lights-types and uses, factors affecting safelight performance, safelight Tests; Viewing room, Film dispensing	8
III	Film Processing: 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	7
IV	Computed Radiography and Digital Radiography	10

Unit	Topic and contents	Hours
V	The Radiographic Image: The emergent beam related to densities on film contrast - objective and courseive Radiation contrast, film contrast and Radiographic contrast- Density, Sharpness, Unsharpness Resolution: Factors affecting resolution, choice of Kilovolt age and Mill amperage, Choice of Short Focus and Broad Focus, selection of Focus to Film Distance and Object to Film Distance selection of cassettes, Avoiding scatter radiation, magnification, distortion, penumbra Reproduction of Radiographs: Copying Radiographs, Magnification and Minification Radiography Imaging Communication: Hospital Information System, Radiology Information System, PACS, DICOM	6
	Total	45

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No	Topics	Hours
1.	Radiographic film; Intensifying Screens; X-ray Cassette	10
2.	Dark Room - Planning & Construction	5
3.	Film Processing; Photochemistry	3
4.	Computed Radiography and Digital Radiography	10
5.	The emergent beam related to densities on film contrast - objective and courseive Radiation contrast, film contrast and Radiographic Contrast-Density, Sharpness, Unsharpness; Factors affecting resolution; Reproduction of Radiographs	2
	Total	30

Evaluation System

Continuous Internal Evaluation (CIE) (Theory)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Continuous Internal Evaluation (CIE) (Practical)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests • Same pattern as Summative test • Average of two to be considered • Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

End Semester Evaluation (ESE) Written Paper

Type of question	No. of questions	Marks per question	Total
Long Essay	3 (to answer 2)	10	20
Short Essay	9 (to answer 7)	5	35
Short Answer	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Topics	Marks (± 5%)
1.	Radiographic film; Intensifying Screens; X-ray Cassette	30
2.	Dark Room - Planning & Construction	20
3.	Film Processing; Photochemistry;	6
4.	Computed Radiography and Digital Radiography	30
5.	The emergent beam related to densities on film contrast - objective and coarse Radiation contrast, film contrast and Radiographic contrast- Density, Sharpness, Unsharpness; Factors affecting resolution; Reproduction of Radiographs	10
	Total Marks (including optional questions)	96

End Semester Evaluation (ESE)

There shall be practical examination for 35 marks in the course.

Distribution of marks for ESE practical exams:

ESE		CIE	Grand total	
Practical	Viva		Sub Total	
20	15	15	50	50

Suggested Learning Resources

S.No.	Title of Book	Author	Publication
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

Course: Principles of Management

Course Code: DMRIT15

Rationale

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

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	Institute-level exam only: The Institute-level examination will be held before the University examinations commence. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory to be eligible for the award of a Diploma. These marks will not be considered for the class award. Supplementary examinations shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.
2	--	--	2	

L, lecture; T, Tutorial; P, Practical

Theory Components

Topic and contents	Hours
Introduction to management Strategic Management Foundations of Planning Planning Tools and Techniques Decision Making, conflict and stress management Managing Change and Innovation Understanding Groups and Teams Leadership Time Management Cost and efficiency	30

Suggested Learning Resources

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

Course: Radiography Clinical Education - Part III (studentship)*

Course code: DMRIT16

Rationale:

Student will gain additional skills in radiographic positioning, image processing techniques, interaction with patients, professional personnel and management. Students apply knowledge from previous clinical learning experiences under the supervision of senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Total Hours: 225 (15hrs/week x 15 weeks)

Nature: Clinical/skill- based Training

Course Outcome (COs)

At the end of 225 hours of studentship, the learner will be able to:

CO1: Demonstrate professional behaviour, communication skills, ethical practices and management in radiology department.

CO2: Prepare patients, equipment, positioning and examination rooms for routine radiographic procedures.

CO3: Perform basic radiographic positioning techniques under supervision.

CO4: Operate radiographic equipment with understanding of machine and exposure parameters.

CO5: Assist in radiographic positioning and fluoroscopic procedures.

CO6: Maintain records, logbooks and adhere to quality assurance protocols.

Teaching Scheme (In Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	50
--	--	15	3	--	--	15	35	

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

*: Institutional Level examination.

PRACTICAL COMPONENTS

Unit	Topic and contents	Hours
I	Skull and Nasal Sinuses Routine projections and Supplementary projections.	60
II	Dental Radiography Technique for intraoral full mouth. - Occlusal projections. Extraoral projections, including orthopantomography.	30
III	Vertebral Column: Routine projections and Supplementary projections.	60
IV	Radiography using mobile X-ray equipment: Radiography in the ward: Radiography in the specialised unit, such as: Intensive care unit, Coronary care, Neonatal unit and Radiography in the operating theatre. Mammography: Basic views, special views,	30
V	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	25
VI	Neonatal and Paediatric Radiography, Forensic Radiography and Microradiography. Soft Tissue Radiography. Non - screen technique. Localisation of foreign bodies.	20
	TOTAL	225

Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Weightage (%)	IA marks
1	Logbook (procedures & skills)	20	3
2	Clinical performance (skill assessment)	20	3
3	Case presentation / Seminar	20	3
4	Professional behaviour & attendance	20	3
5	Viva / Internal practical test	20	3
	TOTAL	100	15

End Semester Evaluation (ESE)

Sl. No.	Component	IA marks
1	Practical exam (procedure performance)	20
2	Viva voce	5
3	Logbook verification	5
4	Case discussion	5
	TOTAL	35

Fourth Semester

Course: Hospital Practice and Patient Care

Course Code: DMRIT17

Rationale

Patient management is based on team work, it is essential that the student should appreciate the technologist's role and that the importance of co-operation with wards and other departments. The students should be attached to wards or the accident and emergency department for a definite training period.

Course Outcomes

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

C01: Understand the responsibility of the imaging technologist and other health care facility.

C02: Understand the management and care of patient during different procedures and emergency situations.

C03: Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination

C04: Differentiate the types of consent forms

C05: Know about infection control, infection source and isolation techniques

C06: Describe sterilization techniques

C07: Understand the radiation safety and protection

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	100
2	--	2	3	15	35	15	35	

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

Theory Components

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

Unit	Topic and contents	Hours
I	Introduction to Patient Care: Responsibilities of Medical Imaging Technologist, Obtaining Consents and history for different radiological examinations, Patient transfer and Restraining techniques, Obtaining vital signs, Ergonomics and body mechanism Communication: Patient education, Communication with the patient, Professional role and behavior	3
II	Hospital procedure: Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.	4
III	Care of the patient: FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients.	3
IV	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.	5

Unit	Topic and contents	Hours
V	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)	5
VI	Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control Departmental procedures: Department staffing and organisations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department; appointments; organisations; minimizing waiting time; out-patient and follow-up clinics; stock taking and stock keeping.	5
VII	Drugs in the department and Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti-hypertensive etc. crash cart. Medical ethics and records: Medico legal implication of MLC cases, Importance of consent, Consent in detail, Precaution while dealing with female patient, Medical records	5
Total		30

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests - Same pattern as Summative test - Average of two to be considered - Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

Continuous Internal Evaluation (CIE) (Practical)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests - Same pattern as Summative test - Average of two to be considered - Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Long Essay	2 (to answer 1)	10	10
Short Essay	4 (to answer 3)	5	15
Short Answer	7 (to answer 5)	2	10
			35
Duration (minutes)			90

Question Paper Blueprint

Unit	Topic and contents	Marks (± 5%)
1.	Introduction to Patient Care and Communication	5
2.	Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.	10
3.	Care of the patient	12
4.	Nursing procedures in Radiology and first aid	5
5.	Infection and Principles of asepsis	7
6.	Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control.	10
7.	Drugs in the department and Storage and medical ethics and records	5
	Total Marks (including optional questions)	54

Suggested Learning Resources

S.No.	Title of Book	Author	Publication
1	Patient care in radiography	Ruth Ann Ehrlich, Dawn M Coakes	Mosby
2	Patient care in radiography: with an introduction to medical imaging	Ruth Ann Ehrlich and Joan A. daly	St. Louis, Mo.: Mosby Elsevier
3	Care of the Patient in Diagnostic Radiography	D. Noreen Chesney and Muriel O. Chesney	

Course: Radiological Procedures

Course Code: DMRIT18

Rationale

Contrast & Special Radiological Procedures are diagnostic procedures usually performed by giving contrast through oral or intravenous to diagnose the disease. These imaging procedures are done under the guided of fluoroscopy or c-ran equipment.

Course Outcomes

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

CO1: Prepare management and positioning of patients while performing radiological procedures.

CO2: Correlate of indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for different radiological procedures.

CO3: Understand the patient preparations needed before any radiological examination.

CO4: Generalize knowledge of post procedural care.

CO5: Students will be able position the patients for radiological procedures.

CO6: Knowledge of image quality in radiological images.

CO7: Management of patients in radiology department for various procedures.

CO8: Ability to handle emergency situations in radiology department.

CO9: Precautions and care required in interventional suits.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	150
3	--	4	5	30	70	15	35	

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

Tutorial Assignments

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

Theory Components

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

Unit	Topic and contents	Hours
I	Introduction: General approach to Special Radiographic procedures, Responsibility of Radiology Technologist during radiological procedures, Preparation of patient for different procedures, Room layout in interventional radiology and fluoroscopy. Contrast Media: Positive and Negative, Ionic & Non Ionic, Adverse Reactions to contrast media and patient management. Emergency Equipment in the Radiology Department	10
II	Gastro Intestinal Tract: Barium Swallow; Barium Meal - Single and Double Contrast; Barium Meal Follow Through; Small Bowel Enema (Enteroclysis); Barium Enema - Gastrograffin Enema; Loopogram Biliary Tract: Oral & Intravenous Cholecystography; Percutaneous Transhepatic Cholangiography; Percutaneous Transhepatic Biliary Drainage; Endoscopic Retrograde Cholangiopancreatography	15
III	Urinary System: IVU (Intravenous Urography), Retrograde Pyeloureterography (RGU), Micturating Cysto-Urethrography, Ascending Urethrography Reproductive System: Hysterosalpingogram, FTR (Fallopian Tube Recanalization)	10
IV	Central Nervous System: Cervical Myelography - Cisternal Puncture and Lateral Cervical Puncture, Lumbar Myelography, Myelography with water soluble and oily contrast media Respiratory System: Bronchography, Percutaneous Lung Biopsy Other procedures in radiology: Arthrography, Sialography, Lymphography, Sinography & Fistulography, Dacrocystography, Embolization & embolic agents	10
Total		45

Suggested Practicals/Demonstration

Sr. No	Topic and contents	Hours
1.	General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures Contrast media and their adverse reactions to contrast media and patient management	20
2.	Procedures for gastrointestinal tract including barium studies Procedures for biliary tract	20
3.	Procedures for urinary system and reproductive system	20
4.	Procedures for central nervous system and respiratory system	20
Total		60

Evaluation System

Continuous Internal Evaluation (CIE) (Theory)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Continuous Internal Evaluation (CIE) (Practical)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests - Same pattern as Summative test - Average of two to be considered - Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Long Essay	3 (to answer 2)	10	20
Short Essay	8 (to answer 6)	5	30
Short Answer	12 (to answer 10)	3	30
			80
Duration (minutes)			150

Question Paper Blueprint

Unit	Marks (± 5%)
General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures Contrast media and their adverse reactions to contrast media and patient management	15
Procedures for gastrointestinal tract including barium studies Procedures for biliary tract	27
Procedures for urinary system and reproductive system	27
Procedures for central nervous system and respiratory system	27
Total Marks (including optional questions)	96

S. No.	Title of Book	Author	Publication
1	Radiographic Imaging	Bhushan and Lakkhar	Arya Publications
2	A guide to radiological procedures	Chapman	Elsevier
3	Fundamentals of Special Radiographic Procedures	Albert M. Snopek	

Course: Radiation Safety and Quality Assurance in Radiography

Course Code: DMRIT19

Rationale

Radiation protection aims to reduce unnecessary radiation exposure with a goal to minimize the harmful effects of ionizing radiation. In the medical field, ionizing radiation has become an inescapable tool used for the diagnosis and treatment of a variety of medical conditions. To study radiation physics relevant to radiation protection to gain information on radiation types and doses received to study the molecular and cellular effects of radiations and to know the radiation quantities units dose limits and regulatory bodies to know about equipment design for radiation protection and to implement patient and personnel radiation protection practices for radiological procedures.

Quality assurance testing includes the monitoring, evaluation and maintenance of equipment for optimal performance and stability. It is essential that radiological technologists recognize, record and report, according to policy, when a significant increase or underexposure in radiation exposure occurs.

COURSE OUTCOMES

At the end of the course, students will be able to learn:

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

CO10: Aim and need of radiation protection

CO11: Introduction to quality assurance

CO12: Understanding of regulatory requirements

CO13: Follow radiation protection regulations and apply practically

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	
3	--	2	4	30	70	15	35	

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

Theory Components

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

Unit	Topic and contents	Hours
I	Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux-Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.	5
II	Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary 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.	5
III	Radiation detection and Measurements: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers - proportional counters- G.M counters- scintillation detectors - liquid semiconductor detectors - Gamma ray spectrometer. Measuring systems - free air ionization chamber - thimble ion chamber - condenser chamber - Secondary standard dosimeters - film dosimeter - chemical dosimeter- Thermoluminescent Dosimeter. -Pocket dosimeter- Radiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle function and uses.	5
IV	Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey - ALARA- personnel dosimeters (TLD and film batches) - occupational exposure.	5

Unit	Topic and contents	Hours
V	Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors and different shielding material.	5
VI	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; 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	5
VII	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 Digital Radiography	5

Unit	Topic and contents	Hours
VIII	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	5
IX	Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements Role of technologist in radiology department Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme. 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.	5
Total		45

Suggested Practicals/Demonstration

Sr. No	Topic	Hours
1	Radiation Quantities and Units	3
2	Biological Effects of radiation	3
3	Radiation detection and Measurements Survey meter and personal dosimeter	3
4	Radiation protection; Principles of radiation protection; ALARA	3
5	Radiation Hazard evaluation and control	3

Sr. No	Topic	Hours
6.	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; 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	3
7.	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 Digital Radiography	3
8.	Regulatory requirements in Diagnostic Radiology	3
9.	Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements	3
10.	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.	3
Total		30

Evaluation System

Continuous Internal Evaluation (CIE) (Theory)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Continuous Internal Evaluation (CIE) (Practical)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests - Same pattern as Summative test - Average of two to be considered - Absence without prior permission to be marked as 0	25		
	Total	25	0.4	10
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	25	0.2	5
	Total CIE marks			15

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Marks ($\pm 5\%$)
Radiation Quantities and Units	18
Biological Effects of radiation	20
Radiation detection and Measurements Survey meter and personal dosimeter	20
Radiation protection; Principles of radiation protection; ALARA	19
Radiation Hazard evaluation and control	19
Total Marks (including optional questions)	96

Suggested Learning Resources

S. No.	Title of Book	Author	Publication
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 - US;
5	Quality Assurance	Dr. R. Sundhararajan, M.V. Kumudhavalli, Minal T. Harde	Thakur Publications Pvt Ltd
6	AERB Safety Guide & Code		AERB

Subject: Introduction to USG, CT and MRI

Subject Code: DMRIT20

Rationale

Understanding the fundamental principles, instrumentation, image formation processes, and safety aspects of CT and MRI enables students to develop competencies in advanced diagnostic imaging and ensures safe, effective clinical practice.

Course Outcomes

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

CO1: Describe the historical development, basic principles, and clinical applications of Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Ultrasonography (USG) in diagnostic imaging.

CO2: Explain CT image formation, image reconstruction processes, Hounsfield Units (HU), CT windowing techniques, and the basic principles of ultrasound image formation, including pulse-echo, transducer function, and echogenicity.

CO3: Discuss the evolution of CT scanner generations, evaluate radiation safety measures and dose optimization practices in CT imaging, and explain the principles of ultrasound instrumentation, transducers, beam characteristics, and image optimization.

CO4: Explain the atomic structure, magnetic properties of hydrogen nuclei, spin precession, the Larmor equation, and the basic physics of ultrasound, including sound wave propagation, velocity, frequency, wavelength, attenuation, and acoustic impedance.

CO5: Interpret the mechanisms of MR signal generation, resonance, relaxation phenomena, and the formation of T1-weighted, T2-weighted, and Proton Density (PD)-weighted images, while also explaining the interaction of ultrasound with tissues, image formation, and common ultrasound artifacts.

CO6: Differentiate various MRI magnet systems, radiofrequency coils, CT system components, and ultrasound transducers, and apply appropriate CT radiation safety, MRI safety, and ultrasound safety principles in clinical practice.

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

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

Theory Components

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

Unit	Topic and contents	Hours
I.	Ultrasonography: History, Basic principle, Transducer, Interaction and attenuation, Artifacts and Ultrasound safety	10
II.	Computed Tomography: History, Basic principle, Image reconstruction, Hounsfield unit and CT windowing	5
III.	Generation of CT and Radiation safety in CT	12
IV.	Magnetic Resonance Imaging: History, Basic principle, Atomic structure and motion, MR active nuclei Hydrogen, spin precession, Larmor equation, MR signal, Resonance, Relaxation, T1, T2 and PD weighted images	13
V.	Types of magnets and coils, MR safety considerations	5
Total		45

Evaluation System

Continuous Internal Evaluation (CIE) (Theory)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/Case records/Record book/assignment whichever is applicable	50		
	Total	50	0.3	15
	Total CIE marks			30

End-of-Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Marks (± 5%)
Ultrasonography: History, Basic principle, Transducer, Interaction and attenuation, Artifacts and Ultrasound safety	20
Computed Tomography: History, Basic principle, Image reconstruction, Hounsfield unit and CT windowing	18
Generation of CT and Radiation safety in CT	20
Magnetic Resonance Imaging: History, Basic principle, Atomic structure and motion, MR active nuclei Hydrogen, spin precession, Larmor equation, MR signal, Resonance, Relaxation, T1, T2 and PD weighted images	20
Types of magnets and coils, MR safety considerations	18
Total Marks (including optional questions)	96

Suggested Learning Resources

S. No.	Title of Book	Author	Publication
1	Ultrasound physics and technology: how, why and when	Vivien Gibbs	Churchill Livingstone
2	Computed Tomography: Physical Principles, Clinical Applications, and Quality Control	Euclid Seeram RT(R) BSc MSc FCAMRT (Author)	Saunders
3	Computed Tomography for Technologists: A Comprehensive Text	Lois Romans	Lippincott Williams and Wilkins;
4	The CT Handbook: Optimizing Protocols for Today's Feature-Rich Scanners	Timothy P. Szczykutowicz	Medical Physics Publishing Corporation
5	MRI inPractice	Catherine Westbrook & Caralyn Kaut	Wiley-Blackwell
6	Protocols inMRI	Catherine Westbrook	Wiley-Blackwell

Course: Medical Law and Ethics & Professionalism and Values

Course Code: DMRIT21

Rationale

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

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

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	Institute level exam only:
2	--	--	2	The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

Theory Components

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

Topic and contents	Hours
The important and relevant topics that need to focus on are as follows: 1. Medical ethics - Definition - Goal - Scope 2. Introduction to Code of conduct 3. Basic principles of medical ethics - Confidentiality 4. Malpractice and negligence - Rational and irrational drug therapy 5. Autonomy and informed consent - Right of patients 6. Care of the terminally ill- Euthanasia 7. Organ transplantation 8. Medico legal aspects of medical records - Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects. 9. Professional Indemnity insurance policy 10. Development of standardized protocol to avoid near miss or sentinel events 11. Obtaining an informed consent. 12. Medical ethics - Definition - Goal - Scope 13. Introduction to Code of conduct 14. Basic principles of medical ethics - Confidentiality 15. Malpractice and negligence - Rational and irrational drug therapy 16. Autonomy and informed consent - Right of patients 17. Care of the terminally ill- Euthanasia 18. Organ transplantation 19. Medico legal aspects of medical records - Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects. 20. Professional Indemnity insurance policy 21. Development of standardized protocol to avoid near miss or sentinel events 22. Obtaining an informed consent.	20

Topic and contents	Hours
23. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality 24. Personal values- ethical or moral values 25. Attitude and behavior- professional behavior, treating people equally 26. Code of conduct, professional accountability and responsibility, misconduct 27. Differences between professions and importance of team efforts 28. Cultural issues in the healthcare environment	10

SUGGESTED LEARNING RESOURCES

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

Radiology Clinical Education - Part IV (studentship)

Course Code: DMRIT22

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.

Total Hours: 225 (15 hrs/week × 15 weeks)

Nature: Clinical / Skill-based Training

Course Outcomes (COs)

At the end of 225 hours of studentship, the learner will be able to:

CO1: Demonstrate professional behavior, communication skills and ethical practices in radiology departments.

CO2: Prepare patients, equipment and examination rooms for routine radiographic procedures.

CO3: Perform basic radiographic positioning techniques under supervision.

CO4: Operate radiographic equipment with understanding of exposure parameters.

CO5: Assist in special radiographic and fluoroscopic procedures.

CO6: Maintain records, logbooks and adhere to quality assurance protocols.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	50
--	--	15	3	--	--	15	35	

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

Sl. No.	Topic and contents	Hours
I	General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures. Contrast media and their adverse reactions to contrast media and patient management.	15
II	Procedures for gastrointestinal tract including barium studies. Procedures for biliary tract. Procedures for urinary system and reproductive system.	30
III	Procedures for central nervous system and respiratory system Radiation Quantities and Units. Regulatory requirements in Diagnostic Radiology Role of technologist in radiology department Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme. 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.	30
IV	Radiation detection and Measurements. 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. QA in Diagnostic Radiology.	150
	TOTAL	225

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Weightage (%)	IA marks
1	Logbook (procedures & skills)	20	3
2	Clinical performance (skill assessment)	20	3
3	Case presentation / Seminar	20	3
4	Professional behavior & attendance	20	3
5	Viva / Internal practical test	20	3
	TOTAL	100	15

End Semester Evaluation (ESE)

Sl. No.	Component	IA marks
1	Practical exam (procedure performance)	20
2	Viva voce	5
3	Logbook verification	5
4	Case discussion	5
	TOTAL	35

Fifth Semester (Internship)

Teaching and Examination Scheme

Course Name: Diploma in Medical Radiology and Imaging Technology

Pattern: Full Time Rotatory Internship

Semester: Fifth Semester

Course Code: DMRIT23

Internship: minimum 1080 hours (calculated based on 8 hours per day for six months 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 six months as to be eligible for the award of the Diploma. The internship is partial fulfilment of the requirements for the completion and no candidate shall be declared to have completed the program otherwise. The internship shall be completed within 9 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:

S. No.	Postings	Duration
1	Conventional Radiography (Fixed Radiography) Computed Radiography (CR)/Digital Radiography (DR) unit Mobile X-ray/Bedside radiography, Operation theatre radiography, Dental radiography	4 months
2	Fluoroscopy and other radiological procedures	2 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 Diploma or declare him/her eligible for it.

Guideline for Internship

Rationale

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

Course Outcomes

On completion of this course, 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												
L	T	P		(L+T+P)	Theory						Practical					
			Paper Hrs.		CIE		ESE		Total		CIE		ESE		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
:	:	:	20	:	:	:	:	:	:	:	:	:	:	:	:	:

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

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 submit 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.
- Prepare final report about the training for submitting to the department 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
- 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. Types of major equipment/instruments/ machines used in Radiology with their specification and specific use and their routine maintenance.

Chapter 3. Equipment handling and procedures.

Chapter 4. Safety procedures followed

Chapter 5. Particulars of Practical Experiences in Radiology and Imaging

Chapter 6. Short report/description of the project (if any done during the training)

References /Bibliography.

Log Book Template:

Cover Page

Institute/University Logo

Diploma in Medical Radiology and Imaging Technology

Log Book

Name of the Student:

Name of the Diploma:

USN:

Batch:

PARTICULARS OF STUDENT

PHOTOGRAPH

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 Diploma in Medical Radiology and Imaging
 Technology from (name of the Institute/University & address). She/He has completed all
 the clinical responsibilities during her/his training from.....to.....

Signature
Head/Programme Co-ordinator

Signature
Principal/Dean

Competency Based Curriculum for “**DIPLOMA IN MEDICAL RADIOLOGY AND IMAGING TECHNOLOGY**”
(Intellectual property of National Commission for Allied and Healthcare Professions, Ministry of Health and Family Welfare)

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(Intellectual property of National Commission for Allied and Healthcare Professions, Ministry of Health and Family Welfare)

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 course					
8	Ability to defend the topic					
9	Referencing					
10	Implementation recent advancement on the topic					
Total Marks: 50						

[illegible]

**SUPERVISOR/MENTOR SHALL BE DETERMINED
THE MARKS BASIS OF THE FOLLOWING:**

Sl. 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:**

- 1 Poor
- 2 Below Average
- 3 Average
- 4 Good
- 5 Excellent

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

(CONFERENCES/CME/WORKSHOP/TRAININGS)

[illegible]

[illegible]

EVALUATION OF THE LOGBOOK

Sl. No.	Items of observation during presentation	I	II	III	IV	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:

- 1 Poor
- 2 Below Average
- 3 Average
- 4 Good
- 5 Excellent

[illegible]