

**M. Sc. Allied Health Sciences  
(Medical Imaging Technology)  
(w.e.f. 2025-26 admitted batch)**

**Course Structure and Syllabi**



**A DIVISION OF AHERF  
THE APOLLO UNIVERSITY  
MURUKAMBATTU - CHITTOOR (Dt) 517127  
ANDHRA PRADESH**

**M. Sc. MEDICAL IMAGING TECHNOLOGY  
SCHEME AND SYLLABUS**

## **PROGRAM OUTCOMES (PO)**

**PO 1:** Clinical care: Organize and implement the prescribed preventive, investigative and management plans; and will offer care and appropriate follow-up services to patients in a cost-effective way.

**PO 2:** Communication: Communicate effectively and appropriately with patients/clients, caregivers, other health professionals and other members of the community.

**PO 3:** Membership of a multidisciplinary health team: Function effectively as an individual, and as a member in multidisciplinary healthcare teams to accomplish shared goals within and across settings to achieve coordinated, high-quality care.

**PO 4:** Ethics and accountability at all levels: Understand the core concept of clinical ethics and law so that they may apply these to their practice as healthcare service providers.

**PO 5:** Commitment to professional excellence: Execute professionalism and reflect technical competence, appearance, empathy, compassion, honor, and integrity in his/her thought and action to ensure the safe delivery of healthcare.

**PO 6:** Leadership and mentorship: Demonstrate leadership qualities where needed in order to ensure clinical productivity and patient satisfaction in an autonomous and confident manner.

**PO 7:** Social accountability and responsibility: Recognize that allied health professionals need to judiciously manage resources and promote innovation and sustainability to provide optimal patient care in a socially responsible manner.

**PO 8:** Scientific attitude and scholarship: To be engaged in evidence-based practice and need-based research studies and to apply and disseminate research findings and knowledge for improving the quality of care.

**PO 9:** Lifelong learning: Recognize the need and have the ability to engage in independent and continuous lifelong learning and improvement in skills and knowledge while harnessing modern tools and technology for the advancement of self and profession.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEO):**

**PEO1:** Demonstrate technical proficiency, in-depth knowledge, and application of scientific and safety principles in all allied health professional programs and apply clinical skills to one's own work, as a member and leader in a team, and in multidisciplinary clinical settings and to attain high level of proficiency in defined clinical competencies of the allied health technologists

**PEO2:** Recognize that allied and healthcare professionals need to be advocates within the healthcare system, to judiciously manage resources and to acknowledge their social accountability. To serve the community, region and the nation and will hence direct all research and service activities towards addressing their priority health concerns. Have the ability to

engage in independent and lifelong learning and improvement in skills and knowledge while harnessing modern tools and technology.

**PEO3:** Practice with ethics and accountability at all levels (clinical, professional, personal, and social). To exhibit at all times a high level of professionalism and this be reflected in his/her thought and action, as well as in a range of attributes and characteristics that include technical competence, empathy, verbal and non-verbal communication, an anti-discriminatory and non-judgmental attitude. Communicate effectively and appropriately with patients/clients, caregivers, and health professionals.

**PEO4:** Inculcate the skills to function effectively as an individual and as an active member of a multidisciplinary health team. Develop skills to take on a leadership role in order to ensure clinical productivity and patient satisfaction. Must be able to respond in an autonomous and confident manner to planned and uncertain situations and should be able to manage themselves and others effectively.

### **PROGRAM SPECIFIC OUTCOMES (PSO):**

**PSO1** Graduates will develop expertise in operating and optimizing advanced imaging modalities, including **Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound, Nuclear Medicine, and Digital Radiography**. They will be able to apply appropriate imaging techniques, contrast media administration, and radiographic positioning to acquire high-quality diagnostic images while minimizing artifacts and ensuring patient safety.

**PSO2** Graduates will demonstrate a strong understanding of **radiation protection principles, safety protocols, and quality assurance procedures** in medical imaging. They will be proficient in applying **ALARA (As Low As Reasonably Achievable) principles, radiation monitoring, shielding techniques, and regulatory compliance** to ensure safe imaging practices for both patients and healthcare professionals. Additionally, they will develop the ability to conduct **equipment calibration, functional tests, and corrective actions** to maintain optimal system performance.

**PSO3** Graduates will be equipped with **biostatistical research skills, ethical decision-making capabilities, and pedagogical expertise** in medical imaging education and healthcare management. They will be able to design, conduct, and analyze **clinical research studies, evaluate diagnostic test accuracy, and publish scientific manuscripts** adhering to ethical guidelines. Additionally, they will gain the ability to **teach, assess, and mentor** students or junior professionals in the field of radiology and imaging sciences.

## **THE APOLLO UNIVERSITY ACADEMIC REGULATIONS**

### **SCOPE:**

This Academic regulation provide a framework for the regulatory guidelines of all programs offered by The Apollo University. It includes procedures and practices that are to be followed to ensure academic standards in the University. The regulations are approved by the Academic Council. These regulations may be amended from time to time with the approval of the Academic council for the benefit of students or sometimes to reflect the changes suggested by the statutory bodies.

Information regarding amendments (if any) to the regulations will be communicated to the students by publishing in the University website. Students must follow the amended regulations as they might impact the process for the award of degree. The decision of the Vice Chancellor shall be the final in case of any discrepancy. These regulations apply to all students, despite the program of study.

### **1. ADMISSION INTO THE PROGRAM**

The University admits the students in two modes. One through the convenor quota as per the Andhra Pradesh Private Universities Act, for which the admissions will be carried out through the convener quota by the Govt of Andhra Pradesh. The other is through University quota for which the following procedure will be followed:

- A. The applicant shall satisfy the entrance requirements specified by The Apollo University and in accordance with guidelines of statutory councils for various Under-graduation /Post-graduation /Doctor of Philosophy programs.
- B. The Applicant shall be qualified in the qualifying examination for a particular program.
- C. The Applicant secures a rank in national level entrance exam or suitable such test conducted by The Apollo University / professional body.
- D. The Applicant qualifies in the specified state or national level examinations prescribed by The Apollo University.

The Apollo University will widely notify the counselling schedule for admissions into the academic programs in the media. The provisional admission will be given to the eligible students during the counseling scheduled by The Apollo University. The selected candidates will be provisionally admitted into the program of his/her choice if the candidate meets the program specific requirements in addition to academic performance qualifying exam. Admission is purely based on merit and so merely meeting the requirements will not ensure admission. The University does not discriminate based on gender, race, region, religion, disability or nationality. The University reserves the right to make admissions based on various criteria which is specified in the admission brochure.

## **2. ELIGIBILITY CRITERIA**

### **Undergraduate programs**

The qualifying exam eligibility for each program is given Annexure 1. The student should have passed the qualifying exam either in the year the student is seeking admission or the previous year.

**Convener Quota:** The student seeking admission to any program under convener quota shall qualify in the relevant entrance exam conducted by the Government of Andhra Pradesh.

**University Quota:** For getting admission under University quota, percentage of marks obtained in the qualifying exam, the rank obtained in TAU entrance exam or any recognized national level examination in the year of admission will be considered.

### **Counselling**

All the eligible students need to apply for admission and have to attend counselling conducted by TAU as per the schedule for the university quota.

## **3. PROGRAMS**

The Apollo University offers variety of programs which includes certificate, undergraduate, postgraduate, and Research. The list of programs on offer for the academic year 2023-24 are annexed in Annexure 2 and those of 2023-24 are annexed in Annexure 3.

### **Minimum duration of the program**

The minimum duration of each program depends on the type of program, viz., undergraduate, postgraduate, integrated programs, etc., and the faculty which offers the program. The maximum duration of the program is N+2 years, where N stands for the minimum duration of the program as mentioned in Annexure 2 and 3. If the student has not obtained the minimum number of credits within the stipulated time, the Vice-Chancellor may extend the maximum duration in extenuating circumstances upon receiving a request along with reasons from the student for not completing the program on time.

## **4. CHOICE BASED CREDIT SYSTEM**

The choice-based credit system (CBCS) facilitates the education student-centric. It provides the opportunity for the learner to choose the courses from a basket of core, elective, and skill enhanced courses. All programs of study are designed to meet the specified number of credit requirements. The courses taken by the student in each semester as part of program are allotted some credit points based on the number of hours assigned. Upon successful completion of the course, the student secures the number of credits allotted for that course. Once the minimum number of credits of the program is achieved, the degree can be awarded, subject to fulfillment of all other relevant conditions.

## **5. STRUCTURE OF THE PROGRAM**

The Program structure Consists of

- i) University Courses
  - A. University Core
  - B. University Electives

- ii) Faculty Courses
  - A. Faculty Core
  - B. Faculty Electives
- iii) Program Courses
  - A. Program Core
  - B. Program electives

Each course\* is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week. (\*one course means one subject)

Core Courses = 3 Credit / 4 Credits                      Elective =3 Credits

**In general, credits are assigned to the courses as detailed below:**

- **A classroom lecture/ tutorial of 60 min (1 hr) duration per week, spread over the entire semester, shall be considered as one credit.**
- **A laboratory session of a minimum of 120 min (2 hr) per week shall be considered as one credit.**
- **A project work/ Internship session of 60 minutes (1 hr) carried out per week shall be considered as one credit.**

## **6. MEDIUM OF INSTRUCTION**

The medium of instruction (including examinations and project reports) shall be English.

## **7. REGISTRATION**

Any of the following student must register for the courses opted in a particular semester during the scheduled registration period.

- i. a new student who enrolls into any program
- ii. an existing student who is continuing on rolls from the preceding regular semester
- iii. a former student, i.e., who has not enrolled in the preceding regular semester or who has availed academic break or detained and got readmission

Each newly admitted student shall attend an induction/ orientation program prior to commencement of the first semester. During this program academic advisors assist the students in choosing the courses. Existing students may register online by using their registration number and mail ID through the Apollo ERP portal. Class schedules are available approximately two weeks before the beginning of every semester for each program. The concerned head of the department must approve class schedule.

## **8. ATTENDANCE REQUIREMENTS**

- Students should earn a minimum of 80% attendance in the current semester to become eligible to write the Semester End examinations.
- The monthly statement of attendance will be displayed on the Department Notice Board/ Apollo ERP by the respective departments within the first five working days of the following month.
- Candidates who are falling short of 80% attendance will be detained on the recommendation of the HoD and are not eligible to appear for the current semester examinations. The students who are detained in the current semester will not be allowed to register for the next semester

and they have to repeat the same semester by paying the tuition fee prescribed. However, they can write arrear subjects, if any.

## 9. EVALUATION

The assessment of the student's performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks). A student has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination. Practical/ Project Work/ Industrial Training/ Viva voce/ Seminar etc. are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 50% to secure Pass Grade. For courses having both theory and practical components, 60% of the weightage will be given for theory component and 40% weightage for practical component. The student must secure 40% (Theory + Practical) with 24 marks minimum in theory to attain pass grade.

Details of Assessment Procedure are furnished below in Table 1.

**Table 1: Assessment Procedure**

S. No.	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Evaluation
1	Theory	40	Continuous Evaluation	i) Twenty (20) marks for mid examinations. Three mid examinations shall be conducted for 20 marks each; an average of the best two performances shall be taken into consideration. ii) Ten (10) marks for Quizzes, Assignments and Presentations. iii) Ten (10) marks for periodic evaluation ,case studies and projects iv) Sixty (60) marks for Semester-end examinations
		60	Semester-end Examination	
	Total	100		

2	Laboratory	100	Continuous Evaluation	1)80 marks with equal weightage to all experiments subject to conduct of minimum of 10 experiments 2)20marks for the end exam ( with one of our university teacher as external other than course teacher )
3	Project work	100	Continuous Evaluation	i) (80) Marks for periodic evaluation and technical report writing by the Project Supervisor. ii) Twenty (20)marks for final Report presentation and Viva-voce, by a panel of internal examiners
4	Students Seminars	100	Continuous Evaluation	Each student has to give a seminar on any topic in consultation with the faculty member in charge. A detailed report shall be submitted to the in charge. 60 marks for periodic evaluation including report preparation and 40 marks for viva voce by a panel of examiners.

### GRADING SYSTEM

Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

**Table 2: Grades & Grade Points**

Sl. No.	Grade	Grade Points	Absolute Marks
1	O(Outstanding)	10	90 and above
2	A+(Excellent)	9	80 to 89

3	A(Very Good)	8	70 to 79
4	B+(Good)	7	60 to 69
5	B(Above Average)	6	50 to 59
6	C(Average)	5	45 to 49
7	P(Pass)	4	40 to 44
8	F(Fail)	0	Less than 40
9	Ab.(Absent)	0	-

### **SEMESTER GRADEPOINT AVERAGE (SGPA)**

A Semester Grade Point Average (SGPA) for the semester will be calculated according to the formula:

$$\text{SGPA} = \frac{\sum [ C \times G ]}{\sum C}$$

Where

C=number of credits for the course,

G=grade points obtained by the student in the course.

A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course and is deemed to have earned the credits assigned to that course.

## **CUMULATIVE GRADE POINT AVERAGE (CGPA)**

A similar formula is used to arrive at Cumulative Grade Point Average (CGPA), considering the student's performance in all the courses taken in all the semesters up to the particular point of time.

Table 3 shows the CGPA required for the award of class after the successful completion of the program.

**Table3:CGPA required for award of Class**

<b>Class</b>	<b>CGPA Required</b>
First Class with Distinction	$\geq 8.0^*$
First Class	$\geq 6.5$
Second Class	$\geq 5.5$
Pass Class	$\geq 5.0$

\*In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses of every semester in first attempt.

### **11. REAPPEARANCE**

- A student who has secured 'F' grade in a Theory course shall have to reappear at the subsequent Semester end examination held for that course.
- A student who has secured 'F' grade in a Practical course shall have to attend Special Instruction Classes scheduled by the Department for securing pass.
- A student who has secured 'F' Grade in Project work / Industrial Training etc. shall have to reappear for Viva – voce scheduled by the department.
- A student who is declared fail (F) in a course/s can apply for revaluation within one week from the date of publication of results with a fee prescribed by the university. The marks /grade awarded in the revaluation is final.

#### **11.1 Procedure for revaluation**

- The students who have not satisfied with the marks awarded by the examiner Can apply for revaluation of his/her answer script/s
- The students have to apply through proper channel for revaluation and to pay the revaluation fee per paper to the university towards revaluation fee.
- Students have to apply for revaluation within 7 days from the date  
Publication of result.  
The scripts will get valued by second examiner and if the difference is more than 15 marks, they will get valued by the third examiner. The average of the nearest two marks will be declared as the final marks.

#### **11.2 ASSESSMENT MECHANISM**

The Apollo University offers a student the benefits of Choice Based Credit System.

Every paper is allotted a certain number of credits as per the UGC norms. A student is awarded the specified credits on obtaining a pass in the respective paper.

The Choice Based Credit System (CBCS) has been adopted for all UG and PG Courses from the year 2021-22 onwards as per the recommendations of the A.P. State Council for Higher Education (APSCHE). The structure of undergraduate programmes provides a wide range of choice for students to opt for courses based on their eligibility, aptitude and career goals.

### **11.3 Semester End Examination**

The End semester examination will be a comprehensive examination of 3 hours duration. Two End Semester examinations are conducted in a year-

Odd semester examinations in November/ December and

Even semester examination in May/June

Practical examination / Project viva will be held 2 weeks prior to the theory semester end examinations.

### **Under-Graduation Programs**

Course	Continuous Assessment	End semester	Aggregate in End semester Examinations
All UG Courses	No passing minimum	40%	40%

### **11.4 Post Evaluation Programme:**

Under the Post Evaluation Programme there are three menus:

- Provision for improvement
- Re-totaling and Revaluation of answer scripts
- Restrictions to appear for the examinations

### **11.5 Provision for improvement**

A student who passes a paper in the first attempt can reappear for the same paper in the succeeding End-of-Semester examination only, for improving his/her marks. Re-appearance for improvement is allowed for theory and practical subjects of all semesters, except for the final semester subjects. A revised mark statement will be issued after withdrawing the previous one, if the marks obtained in improvement are higher than the marks awarded earlier. When there is no improvement, there shall not be any change in the original marks already awarded. The improved marks shall be considered for classification but not for ranking.

Provision for Re-totaling and Revaluation of valued answer scripts

- UG/PG candidates may apply for re-totaling / revaluation of valued answer scripts, to the Controller of Examinations through the Heads of Departments and Principal / Dean, in the prescribed forms, remitting the prescribed fee within 7 days from the date of publication of results. Revaluation of answer scripts is permissible only for the current semester papers and not for any arrear paper.

- Those who wish to apply for revaluation of final semester papers can do so within five days from the date of publication of results. In re-valuation, the answer papers will be valued by an external examiner and if there is a difference of 15 marks between the two evaluations then the script will be sent for third valuation which is final, and the mark awarded by the third examiner will be taken into the account.
- A revised mark statement will be issued after withdrawing the previous one, if the marks obtained in revaluation / retotaling are higher than the marks obtained earlier. In other cases, the original marks obtained earlier will be retained and the matter will be intimated to the student concerned as 'No change'.
- A candidate who applies for revaluation should not apply for retotaling.

### **Restrictions to appear for the examinations**

Candidates who fail in any of the papers in the UG and PG End semester examinations shall complete the paper concerned within N+2 years from the date of admission to the particular course. If they fail to do so, they shall re-register their names and take the examination in the texts/revised regulations/syllabus of the paper prescribed for the subsequent batch of candidates, in force at the time of their reappearance. In the event of removal of that paper consequent to change of regulation and/or curriculum after N+2 years period, the candidate shall have to take up an equivalent paper in the revised syllabus as suggested by the Chairman, Board of Studies concerned.

### **12. BETTERMENT OF GRADES**

A student who has secured only a Pass or Second class and desires to improve his/her Class can appear for Betterment Examinations only in Theory courses of any Semester of his/her choice, conducted in Summer Vacation along with the Special Examinations. Betterment of Grades is permitted 'only once' immediately after completion of the program of study.

### **13. DETENTION AND RE-ADMISSION**

If a student fails to meet the minimum attendance requirement or minimum standards for academic progression, the concerned academic head will recommend for detention, and it will be notified by the concerned Dean of the School. The students who are detained in the current semester will not be allowed to register for the next semester and they have to repeat the same semester.

The candidates who are detained or availed academic break or suspended in the previous semester/academic year and want to continue their study shall apply for re-admission to the university. The candidates shall request for re-admission to the respective Head of the Department, with details viz., Full Name, Registration Number, Department, School, Fee payment particulars with proofs and reasons for discontinuations. The concerned academic head will forward it to the Registrar with specific comments. The Registrar will notify the decision of re-admission which shall include the prescribed fee particulars, semester/ year into which readmission is granted and additional courses to be completed by the student (if any). The candidates should apply for re-admission in advance that is before the commencement of the semester.

#### **14. GROOMING AND ATTIRE FOR STUDENTS**

Grooming and Etiquette is of great significance in the dynamic of shaping one's Personality. The Apollo University stands by a *Code of Grooming, Attire and Etiquette* that promotes a professional standard: Academic Day; Campus Placements and Non-Academic Hours on Campus.

The Dress Code to be in compliance on academic premises while attending: Formal Functions of the Institution / Lectures / Practicals / Dining Area / Library / Labs / Office Areas.

Students shall follow appropriate attire during Academic and Non-Academic hours on the campus. Students shall wear clean, neat, pressed and presentable clothing, and command respect by dressing in accordance with responsible personal norms. Students shall always wear The Apollo University ID Card with the Lanyard.

##### **Grooming and Formal Wear - Boys:**

Formal Shirts / T-Shirts with a Collar should preferably be tucked in with a Formal pair of Pants Shoes and Socks to complete the Formal Attire. Personal Hygiene should be followed, and Hair should be well groomed.

##### **Smart Casuals for Boys:**

Long Kurtas / Formals / Semi-Formal Shirts with Jeans.

Grooming and Formal Wear - Girls: Sarees / Salwar Suits / Leggings or Jeggings with Long Kurtis / Long Frocks / Long Skirts / Palazzos. Complement the outfit with proper footwear. Personal Hygiene should be followed, and Hair should be well groomed.

##### **Smart Casuals for Girls:**

Jeans with long Kurtis / Long Skirts / Long Frocks.

Attire for Non-Academic Hours On Campus:

The Students should be neatly attired during Non-Academic Hours on Campus.

##### **Dress Code for Boys:**

Jeans / Track Suits / T-Shirts / Trousers / Shirts.

Dress Code for Girls:

Jeans / T-Shirts or Blouses / Salwar Suits / Palazzos / Leggings or Jeggings with Long Tops / Sarees / Long Skirts / Track Suits.

##### **DO'S AND DO'NTS FOR BOYS AND GIRL STUDENTS OF THE UNIVERSITY:**

- To wear modest clothing that reflects the essence of good personal grooming standards.
- To refrain from wearing Sleeveless Clothing; Shorts; Short Tops, etc.,

PLEASE NOTE: The decision as to what constitutes Appropriate Attire vests with the Authorities of The Apollo University.

#### **15. ELIGIBILITY FOR AWARD OF THE DEGREE**

The undergraduate degree will be of either 3- or 4-years of duration. Post-graduation programs may be of 2-years of duration for students who have completing 3-years or 4-years of Bachelor's program.

A student shall be declared as eligible for the award of the degree if the candidate has successfully secured the minimum number of required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.

After successful completion of the program, a provisional certificate cum memorandum of grades (PCMG) will be issued to the students. The PCMG includes the secured grades and class achieved in chosen program and specialization if any, along with grades and CGPA secured by the student. The original degree will be presented in the subsequent convocation.

#### **16. DISCRETION POWER**

Not with-standing anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

### **ANNEXURE 1**

#### **ELIGIBILITY FOR QUALIFYING EXAM FOR UNDER GRADUATE PROGRAMS**

<b>Program Type</b>	<b>Program Name</b>	<b>Eligibility</b>
Masters	<b>M.Sc Medical Imaging Technology</b>	Candidates must secure 50% in Bachelor of Imaging Sciences

**ANNEXURE 2**  
**PROGRAMS OFFERED BY SCHOOL OF HEALTH SCIENCES**  
**FROM ACADEMIC YEAR 2021-22**

<b>Sl. No.</b>	<b>Program</b>	<b>Expanded</b>	<b>Level</b>	<b>Minimum Duration in Years (N)</b>
1	B.Sc.	Anesthesiology & Operation Theatre Technology (AOT)	Bachelor's	3
2	B.Sc.	Emergency Medical Technology (EMT)	Bachelor's	3
3	B.Sc.	Imaging Technology (IMT)	Bachelor's	3
4	B.Sc.	Medical Laboratory Technology (MLT)	Bachelor's	3
5	B. Optom	Optometry (OPT)	Bachelor's	3
6	B.Sc.	Physician Assistant (PHA)	Bachelor's	3
7	B.Sc.	Renal Dialysis Technology (RDT)	Bachelor's	3
8	B.Sc.	Respiratory Therapy Technology (RTT)	Bachelor's	3

**ANNEXURE 3**  
**PROGRAMS OFFERED BY SCHOOL OF HEALTH SCIENCES**  
**FROM ACADEMIC YEAR 2022-23**

Sl. No.	Program	Expanded	Level	Minimum Duration in Years (N)
<b>Undergraduate Courses</b>				
1	B.Sc.	Anesthesiology & Operation Theatre Technology (AOT)	Bachelor's	3
2	B.Sc.	Biomedical Sciences (BMS)	Bachelor's	3
3	B.Sc.	Emergency Medical Technology (EMT)	Bachelor's	3
4	B.Sc.	Genetics and Molecular Biology (GMB)	Bachelor's	3
5	B.Sc.	Health Psychology	Bachelor's	3
6	B.Sc.	Imaging Technology (IMT)	Bachelor's	3
7	B.Sc.	Medical Laboratory Technology (MLT)	Bachelor's	3
8	B.Sc.	Occupational Therapy	Bachelor's	3
9	B. Optom	Optometry (OPT)	Bachelor's	3
10	B.Sc.	Physician Assistant (PHA)	Bachelor's	3
11	B.Sc.	Renal Dialysis Technology (RDT)	Bachelor's	3
12	B.Sc.	Respiratory Therapy Technology (RTT)	Bachelor's	3
<b>Post-Graduate Courses</b>				
13	M.Sc.	Clinical Psychology	Master's	2
14	M.Sc.	Health Informatics and Analytics (HI & A)	Master's	2
15	MPH	Public Health	Master's	2

**ANNEXURE 4**  
**PROGRAMS OFFERED BY SCHOOL OF HEALTH SCIENCES**  
**FROM ACADEMIC YEAR 2023-24**

<b>Sl. No.</b>	<b>Program</b>	<b>Expanded</b>	<b>Level</b>	<b>Minimum Duration in Years (N)</b>
<b>Undergraduate Courses</b>				
1	B.Sc.	Anesthesiology & Operation Theatre Technology (AOT)	Bachelor's	3
2	B.Sc.	Biomedical Sciences (BMS)	Bachelor's	3
3	B.Sc.	Emergency Medical Technology (EMT)	Bachelor's	3
4	B.Sc.	Genetics and Molecular Biology (GMB)	Bachelor's	3
5	B.Sc.	Health Psychology	Bachelor's	3
6	B.Sc.	Imaging Technology (IMT)	Bachelor's	3
7	B.Sc.	Medical Laboratory Technology (MLT)	Bachelor's	3
8	B.Sc.	Occupational Therapy	Bachelor's	3
9	B. Optom	Optometry (OPT)	Bachelor's	3
10	BPT	Physiotherapy	Bachelor's	4
11	B.Sc.	Physician Assistant (PHA)	Bachelor's	3
12	B.Sc.	Renal Dialysis Technology (RDT)	Bachelor's	3
13	B.Sc.	Respiratory Therapy Technology (RTT)	Bachelor's	3
<b>Post-Graduate Courses</b>				
14	M.Sc.	Clinical Psychology	Master's	2
16	M.Sc.	Health Informatics and Analytics (HI & A)	Master's	2
17	MPT	Physiotherapy	Master's	2
18	MPH	Public Health	Master's	2

## I – SEMESTER

Course Code	Course Name	Periods per week			Credits	Hours per week
		L	T	P		
MITT6501	Specialised radiographic Positioning	3	1	0	4	4
MITT6502	Instrumentation of conventional & specialised radiology equipment	3	1	0	4	4
MITT6503	Principles of Radiographic Exposure	3	1	0	4	4
MITT6601	Biostatistics and Research Methodology	3	0	0	3	3
MITL6501	Clinical Skills -1	0	0	16	8	16
--	Mentoring	0	0	0	0	1
--	Library	0	0	0	0	1
--	Extra-Curricular Activity (sports & Club Activities)	0	0	0	0	2
--	Co-Curricular Activity (Seminars/Case discussions)	0	0	0	0	1
--	Total	12	3	16	23	36

## II – SEMESTER

Course Code	Course Name	Periods per week			Credits	Hours per week
		L	T	P		
MITT6504	Advanced tech and Instrumentation of Ultrasound	3	1	0	4	4
MITT6505	Advanced tech and Instrumentation of Computed Tomography	3	1	0	4	4
MITT6506	Specialised Radiographic Procedures	3	1	0	4	4
MITT6602	Ethics and Pedagogy	3	0	0	3	3
MITL6502	Clinical Skills -2	0	0	16	8	16
--	Mentoring	0	0	0	0	1
--	Library	0	0	0	0	1
--	Extra-Curricular Activity (sports & Club Activities)	0	0	0	0	2
--	Co-Curricular Activity (Seminars/Case discussions)	0	0	0	0	1
--	Total	12	3	16	23	36

### III – SEMESTER

Course Code	Course Name	Periods per week			Credits	Hours per week
		L	T	P		
MITT7507	Advanced tech. & Instrumentation of MRI	3	1	0	4	4
MITT7508	Care of patients in Diagnostic Radiology	3	1	0	4	4
MITT7509	Nuclear medicine imaging technique	3	1	0	4	4
MITP7501	Research Project and Viva	0	0	3	3	3
MITL7503	Clinical skills 3	0	0	16	8	16
--	Mentoring	0	0	0	0	1
--	Library	0	0	0	0	1
--	Extra -Curricular Activity (sports & Club Activities)	0	0	0	0	2
--	Co-Curricular Activity (Seminars/Case discussions)	0	0	0	0	1
--	Total	9	3	19	23	36

#### IV – SEMESTER

Course Code	Course Name	Periods per week			Credits	Hours per week
		L	T	P		
MITT7510	Interventional Radiology Techniques	3	1	0	4	4
MITT7511	Radiation Safety and Protection	3	1	0	4	4
MITT7603	Management of Healthcare Organisations	3	0	0	3	3
MITP7502	Research Project and Viva	0	0	4	4	4
MITL7504	Clinical skills 4	0	0	16	8	16
--	Mentoring	0	0	0	0	1
--	Library	0	0	0	0	1
--	Extra-Curricular Activity (sports & Club Activities)	0	0	0	0	2
--	Co-Curricular Activity (Seminars/Case discussions)	0	0	0	0	1
--	Total	9	2	20	23	36

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
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**THEORY SYLLABUS**

<b>MITT6501</b>	<b>Specialised radiographic Positioning</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Paper-1</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Description**

This course provides in-depth knowledge and practical skills in radiographic positioning and imaging techniques for various anatomical regions. It covers general radiographic principles, osseous system positioning, vertebral column imaging, specialized radiography for the respiratory and gastrointestinal systems, and advanced techniques for skull imaging. Additionally, it includes bedside and theatre radiography, emphasizing the use of C-arm and image intensifiers.

**Course Objectives:**

- Upon completion of this course, students will:
- Understand patient positioning principles for high-quality diagnostic imaging.
- Develop proficiency in radiographic techniques for different anatomical structures.
- Learn to identify and adapt techniques for various pathological conditions.
- Gain expertise in bedside and trauma radiography.
- Understand the use of C-arm and image intensifiers in surgical and emergency settings.

<b>Unit 1</b>	<b>General Principles of Radiographic Positioning</b>	<b>12 hrs</b>
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- Age, sex, and anatomical variations, Postural differences (erect vs. horizontal techniques), Respiratory movements and diaphragm level considerations, Radiographic densities and patient preparation, Immobilisation techniques, Pathological conditions, injuries, fractures, and dislocations, Positioning terminology and identification systems

<b>Unit 2</b>	<b>Radiographic Positioning – Osseous System</b>	<b>12hrs</b>
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- **Upper Limb:** Fingers, thumb, hand, wrist, forearm, elbow, humerus, shoulder, and sternoclavicular joint
- **Lower Limb:** Foot, calcaneum, ankle joint, leg, knee, patella, femur (lower two-thirds)
- **Pelvic Girdle:** Pelvis, ilium, ischium, pubic bone, hip joint, and sacroiliac joint

**Unit 3                      Radiographic Positioning – Vertebral Column                      12hrs**

- Atlanto-occipital articulation, Cervical vertebrae and cervico-thoracic junction, Thoracic vertebrae, Lumbar vertebrae and lumbo-sacral articulation, Sacrum and coccyx

**Unit 4                      Radiographic Positioning – Thoracic and Abdominal Systems                      12 hrs**

- **Respiratory System:** Imaging techniques for lungs, sternum, and ribs (upper and lower)
- **Gastrointestinal System:** Routine abdominal radiographs and acute condition imaging
- **Excretory System:** KUB (Kidney, Ureter, Bladder) radiographs and acute urinary conditions

**Unit 5                      Skull, Beside and operation theatre radiography                      12 hrs**

- **Skull Imaging:** Basic views of the cranium, facial bones, sella turcica, temporal bone, mastoids, optic foramina, sinuses, mandible, and temporomandibular joint
- **Bedside Radiography:** Techniques for acute chest conditions, intestinal obstructions, abdominal perforations, vertebral injuries, and immobilized fractures
- **Theatre Radiography:** Introduction to C-arm image intensifier, exposure control, and training

**Course Learning Outcomes**

- Apply foundational and advanced principles of radiographic positioning, taking into account anatomical variations, patient posture, respiratory movement, and pathological conditions to ensure diagnostic accuracy.
- Demonstrate competence in performing radiographic procedures of the upper and lower limbs and pelvic girdle, selecting appropriate projections and ensuring correct alignment and patient safety.
- Conduct accurate radiographic imaging of the vertebral column, including specialized views of cervical, thoracic, lumbar, sacral, and coccygeal regions, with the ability to modify techniques based on clinical indications.
- Perform imaging of thoracic and abdominal systems, applying protocols for routine and emergency evaluations of the lungs, sternum, ribs, gastrointestinal tract, and urinary system.
- Execute specialized skull imaging procedures, including cranial, facial, and sinus views, while critically assessing image quality and ensuring anatomical coverage.

**Textbooks:**

- Ballinger, Philip W. – *Merrill's Atlas of Radiographic Positions and Radiologic Procedures*
- Bontrager, Kenneth L. – *Bontrager's Textbook of Radiographic Positioning and Related Anatomy*
- Long, Bruce W. – *Radiographic Positioning and Related Anatomy*

**Reference Books:**

- Bushong, Stewart C. – *Radiologic Science for Technologists: Physics, Biology, and Protection*
- Clark, Colin G. – *Clark's Positioning in Radiography*
- Whitley, Anthony S. – *Clark's Essential Physics in Imaging for Radiographers*
- Carlton, Richard R. – *Principles of Radiographic Imaging: An Art and a Science*





5. Understand and explain the construction, functioning, and advancements in fluoroscopy and radiographic tables.

**Textbooks:**

1. Bushong, S.C. – *Radiologic Science for Technologists: Physics, Biology, and Protection* (Latest Edition)
2. Fauber, T.L. – *Radiographic Imaging & Exposure* (Latest Edition)
3. Khan, F.M. – *The Physics of Radiation Therapy* (Latest Edition)

**Reference books:**

1. Clark, Colin G. – *Clark's Positioning in Radiography*
2. Whitley, Anthony S. – *Clark's Essential Physics in Imaging for Radiographers*
3. Carlton, Richard R. – *Principles of Radiographic Imaging: An Art and a Science*
4. Sutton, David – *Textbook of Radiology and Imaging*

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**THEORY SYLLABUS**

<b>MITT6503</b>	<b>Principles of Radiographic Exposure</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Paper 3</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Description**

This course provides an in-depth study of X-ray interactions with matter, radiographic image formation, and the factors affecting image quality. Students will explore the principles of X-ray production, the photographic process, sensitometry, and radiographic density and contrast. The course also covers resolution, image un sharpness, magnification, and distortion in radiography. Additionally, students will gain knowledge about film processing techniques, automatic film processors, darkroom design, and quality control procedures to ensure optimal image quality in diagnostic radiology.

**Course Objectives**

1. Upon completion of this course, students will be able to:
2. Understand the interactions of X-rays and gamma rays with matter and their clinical applications.
3. Learn the fundamentals of the photographic process and sensitometry in radiographic imaging.
4. Analyze the factors influencing radiographic image quality, including density and contrast.
5. Gain knowledge about resolution, unsharpness, and geometrical aspects of the radiographic image.
6. Understand the instrumentation of processing equipment, darkroom layout, and quality control procedures in radiographic imaging.

**Unit 1                      Interaction of X-rays and gamma rays with matter                      12 hrs**

- X-ray production, Interaction of radiation with matter- Compton effect, photoelectric effect, pair production, coherent scattering, Useful range and Clinical Application

**Unit 2                      The Photographic Process and Sensitometry                      12 hrs**

- **The Photographic process:** Introduction, Basic review of photographic emulsions, Photographic latent image, Film materials, Spectral sensitivity of film material, Speed and contrast of photographic materials, Intensifying screens and cassettes, Film processing
- **Sensitometry:** Photographic density, Opacity, Transmission, Production of Characteristic curve, Features of Characteristic curve, Variation in the characteristic curve with development,

Comparison of emulsions by their characteristic curve, Application of Characteristic curve, Information from the Characteristic curve

**Unit 3**

**Radiographic Image**

**12 hrs**

**Radiographic Density**

Acceptable range, Factors influence density, Radiographic Contrast, Components, Factors influences contrast, Management of Radiographic Image quality

**Unit 4**

**Resolution and Geometry of the radiographic image**

**12 hrs**

**Resolution**

- Line spread function & Modulation transfer function, Unsharpness in the Radiographic image and various factors contributing towards Unsharpness, Types of Unsharpness, Radiographic mottle

**Geometry of the radiographic image:**

- Magnification / Distortion -Types and factors
- Micro / Macro radiography

**Unit 5**

**Instrumentation of Processing Equipment**

**12hrs**

- Automatic film processor (AFP), Maintenance and Quality control tests in AFP, Layout and planning of the Darkroom, viewing accessories: viewing boxes, Magnifiers and viewing conditions.

**Course Outcomes**

After completing this course, students will be able to:

1. Explain different types of X-ray interactions with matter and their effects on image formation.
2. Describe the photographic process, including film materials, spectral sensitivity, and characteristic curves.
3. Evaluate radiographic density, contrast, and factors affecting image quality.
4. Demonstrate knowledge of radiographic resolution, unsharpness, magnification, and distortion.
5. Operate and maintain automatic film processors, apply quality control measures, and optimize darkroom conditions for effective radiographic processing.

**Textbooks:**

1. Bushong, S.C. – *Radiologic Science for Technologists: Physics, Biology, and Protection* (Latest Edition)
2. Fauber, T.L. – *Radiographic Imaging & Exposure* (Latest Edition)
3. Chesney, D.N., & Chesney, M.O. – *Radiographic Imaging*
4. Allisy-Roberts, P.J., & Williams, J. – *Farr's Physics for Medical Imaging*

**Reference Books:**

1. Dowsett, D.J., Kenny, P.A., & Johnston, R.E. – *The Physics of Diagnostic Imaging*
2. Klein, R.L. – *Radiographic Equipment & Quality Control*

3. Knoll, G.F. – Radiation Detection and Measurement
4. Sprawls, P. – The Physical Principles of Medical Imaging

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**THEORY SYLLABUS**

<b>MITT6601</b>	<b>Biostatistics and Research Methodology</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Elective-1</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Description**

- This course introduces students to the fundamentals of biostatistics and its applications in health science research. The course covers essential statistical concepts, including measures of central tendency and dispersion, sampling techniques, correlation and regression analysis, and epidemiological study designs. Additionally, students will learn methods for evaluating diagnostic tests, measures of agreement, and the structure and format of scientific documents, such as research protocols and manuscripts for publication. The course provides the necessary statistical foundation for analyzing and interpreting healthcare data effectively.

**Course Objectives**

- Upon completion of this course, students will be able to:
- Understand the role of biostatistics in health science research and differentiate between qualitative and quantitative data.
- Apply measures of central tendency and dispersion to summarize data effectively.
- Gain knowledge of sampling techniques and their impact on statistical inference.
- Analyze relationships between variables using correlation and regression techniques.
- Interpret and apply epidemiological study designs to health-related research.
- Evaluate the accuracy of diagnostic tests using sensitivity, specificity, and predictive values.
- Develop structured scientific documents, including research protocols and manuscripts, for academic and professional purposes.

<b>Unit 1</b>	<b>Introduction to Biostatistics, Measures of Central Tendency &amp; Dispersion</b>				<b>9 hrs</b>
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- Introduction to biostatistics and uses of statistics in health science research.
- Qualitative & quantitative variables and scales of measurements – definition, properties and examples.
- Measures of central tendency: mean, median and mode – definition, situation of application and computation.
- Quartiles and percentiles – definition and computation.



### **Course Outcomes:**

#### **After completing this course, students will be able to:**

1. Define and apply statistical measures such as mean, median, mode, variance, and standard deviation in research data analysis.
2. Identify appropriate sampling techniques for different research scenarios and understand their advantages and limitations.
3. Interpret correlation coefficients and regression models in biomedical research studies.
4. Differentiate between descriptive and analytical epidemiological study designs and apply them to real-world health science problems.
5. Compute and analyze sensitivity, specificity, and predictive values of diagnostic tests.
6. Construct well-organized research documents following scientific writing guidelines for publication.

#### **Textbooks:**

1. Daniel, W.W., & Cross, C.L. – *Biostatistics: A Foundation for Analysis in the Health Sciences* (Latest Edition)
2. Rosner, B. – *Fundamentals of Biostatistics* (Latest Edition)
3. Pagano, M., & Gauvreau, K. – *Principles of Biostatistics*
4. Dawson, B., & Trapp, R.G. – *Basic and Clinical Biostatistics*

#### **Reference Books:**

1. Katz, M.H. – *Study Design and Statistical Analysis: A Practical Guide for Clinicians*
2. Szklo, M., & Nieto, F.J. – *Epidemiology: Beyond the Basics*
3. Altman, D.G. – *Practical Statistics for Medical Research*
4. Hulley, S.B., Cummings, S.R., Browner, W.S., Grady, D.G., & Newman, T.B. – *Designing Clinical Research*

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**I YEAR: I SEMESTER**  
**THEORY SYLLABUS**

**MITL6501**

**Clinical skills I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**Course Description**

- This course introduces students to the fundamentals of biostatistics and its applications in health science research. The course covers essential statistical concepts, including measures of central tendency and dispersion, sampling techniques, correlation and regression analysis, and epidemiological study designs. Additionally, students will learn methods for evaluating diagnostic tests, measures of agreement, and the structure and format of scientific documents, such as research protocols and manuscripts for publication. The course provides the necessary statistical foundation for analyzing and interpreting healthcare data effectively.

**Course Objectives**

- Upon completion of this course, students will be able to:
- Understand the role of biostatistics in health science research and differentiate between qualitative and quantitative data.
- Apply measures of central tendency and dispersion to summarize data effectively.
- Gain knowledge of sampling techniques and their impact on statistical inference.
- Analyze relationships between variables using correlation and regression techniques.
- Interpret and apply epidemiological study designs to health-related research.
- Evaluate the accuracy of diagnostic tests using sensitivity, specificity, and predictive values.
- Develop structured scientific documents, including research protocols and manuscripts, for academic and professional purposes.

<b>Unit 1</b>	<b>Contrast Media &amp; Specialized Radiographic Procedures</b>	<b>30 hrs</b>
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- Preparation and administration of contrast media (Ionic & Non-ionic)
- Patient positioning and technique for:
  - Barium Swallow & Barium Meal
  - Barium Meal Follow Through & Enteroclysis
  - Barium Enema
  - IVU (Intravenous Urogram), MCU (Micturating Cystourethrogram), ASU (Ascending Urethrogram)
  - HSG (Hysterosalpingography) and Fallopian Tube Recanalization (FTR)
  - ERCP (Endoscopic Retrograde Cholangiopancreatography) & PTBD (Percutaneous Transhepatic Biliary Drainage)

- T-tube Cholangiography, Sialography, Dacrocystography, Sinography, and Fistulography
- Management of patients with adverse reactions to contrast media

**Unit 2                      Dental Radiography & Mammography                      30 hrs**

**Dental Radiography**

- Intraoral Techniques: Periapical, Bitewing, and Occlusal views
- Extraoral Techniques: OPG (Orthopantomogram) and Lateral Cephalometry
- Radiation protection techniques in dental radiography
- Checking of mains supply and exposure parameter selection

**Mammography**

- Patient preparation and positioning for CC (Cranio-caudal) and MLO (Mediolateral Oblique) views
- Digital Mammography and Breast Tomosynthesis
- Understanding and application of BIRADS classification
- Stereotactic biopsy procedure demonstration

**Unit 3                      X-ray Circuit Components & Equipment Handling                      30 hrs**

1. Identification and function of:
  - High Tension Transformers, Voltage Stabilizers, Rectifiers
  - High Tension Cables, Circuit Breakers, Magnetic Relays
  - Exposure Timers: Electronic, Ionization, Photo Timers
2. Handling of Portable and Mobile X-ray equipment
  - Operating theater and emergency room imaging techniques
  - Mobile Image Intensifier units
3. Hands-on training on Fluoroscopic Systems:
  - Image Intensifier functioning
  - Viewing and recording fluoroscopic images
  - Digital fluoroscopy and Panel-type image intensifiers

**Unit 4                      Principles of Radiographic Exposure & Image Quality                      30 hrs**

- Practical demonstration of:
  - X-ray interactions with matter: Compton effect, Photoelectric effect, Pair production
  - Measurement of Radiographic Density and Contrast
  - Effect of exposure parameters on image quality
- Evaluation of Radiographic Resolution & Unsharpness:
  - Line Spread Function & Modulation Transfer Function
  - Factors influencing radiographic mottle and unsharpness
- Image Geometry:
  - Magnification and distortion techniques
  - Application of Micro and Macro Radiography

- Validity: Sensitivity, specificity, PPV, NPV – definition and computation. Measures of agreement: Bland Altman plot, Kappa statistic – definition and importance (no computation).

## **Unit 5**

## **Film Processing & Quality Control Procedures**

**30 hrs**

1. Operation and Maintenance of Automatic Film Processor (AFP)
2. Darkroom Layout Planning and Maintenance
3. Quality Control Tests in:
  - Film-screen combination
  - Processing systems
  - Viewing accessories (viewing boxes, magnifiers)
4. Film Analysis:
  - Characteristic Curve (Sensitometry)
  - Interpretation of radiographic image artifacts

### **Textbooks:**

1. Bushong, S.C. – *Radiologic Science for Technologists: Physics, Biology, and Protection* (Latest Edition)
2. Fauber, T.L. – *Radiographic Imaging & Exposure* (Latest Edition)
3. Chesney, D.N., & Chesney, M.O. – *Radiographic Imaging*
4. Allisy-Roberts, P.J., & Williams, J. – *Farr's Physics for Medical Imaging*

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**I YEAR: II SEMESTER**  
**THEORY SYLLABUS**

<b>MITT6504</b>	<b>Advanced tech and Instrumentation of Ultrasound</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Paper 1</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Description**

This course provides an in-depth understanding of ultrasound imaging, covering fundamental principles, transducer technology, instrumentation, Doppler imaging, and various advanced ultrasound techniques. The course emphasizes both theoretical concepts and practical applications, ensuring students develop proficiency in ultrasound imaging for medical diagnostics.

**Course Objectives**

- To understand the basic physics and properties of ultrasound waves.
- To learn about transducer technology and different types of ultrasound transducers.
- To gain knowledge about ultrasound imaging instrumentation and display techniques.
- To explore Doppler imaging principles and advanced ultrasound techniques.
- To understand safety considerations, bio-effects, quality assurance, and interventional applications of ultrasound.

**Unit 1 Basics of Ultrasound Physics and Transducer Technology 12 hrs**

- Introduction to sound waves and ultrasound properties, Interaction of ultrasound with matter, Piezoelectric effect and piezoelectric materials, Transducer construction and types of transducers, Advances in modern ultrasound transducer technology

**Unit 2 Ultrasound Imaging Systems and Display Techniques 12 hrs**

- Display modes: A-mode, B-mode, M-mode, Gray-scale imaging and real-time ultrasound, Pulse echo imaging, Instrumentation: Beam former, pulse transmitter-receiver, CRT displays, Image storage: scan converter memory, photographic film, computer storage

**Unit 3 Doppler Imaging and Advanced Ultrasound Techniques 12 hrs**

- Doppler principles and instrumentation, Continuous wave and pulsed Doppler, Duplex scanning and spectral analysis, Color flow imaging, power Doppler, and harmonic imaging, Extended field of view and real-time compounding, Ultrasound contrast agents and their applications,

**Unit 4**                      **Image Quality, Artifacts, and Safety Considerations**                      **12 hrs**

- Image characteristics and artifacts in ultrasound imaging, Tissue characterisation and organ dynamics, Bio-effects of ultrasound and safe usage considerations, Ultrasound equipment quality assurance and performance evaluation, Doppler system quality assurance.

**Unit 5**                      **Specialized Ultrasound Applications and Protocols**                      **12 hrs**

- Interventional and intraoperative ultrasound, Ophthalmic ultrasound and elastography, 3D and 4D ultrasound imaging, Emergency ultrasound applications, Pre-conceptual and prenatal diagnostic techniques, Pediatric, obstetric, musculoskeletal ultrasound, Ultrasound and Doppler protocols

**Course Outcomes**

After completing this course, students will be able to:

1. Explain different types of X-ray interactions with matter and their effects on image formation.
2. Describe the photographic process, including film materials, spectral sensitivity, and characteristic curves.
3. Evaluate radiographic density, contrast, and factors affecting image quality.
4. Demonstrate knowledge of radiographic resolution, unsharpness, magnification, and distortion.
5. Operate and maintain automatic film processors, apply quality control measures, and optimize darkroom conditions for effective radiographic processing.

**Textbooks :**

1. Rumack, C. M., Wilson, S. R., Charboneau, J. W., & Levine, D. - Diagnostic Ultrasound, Elsevier
2. Kremkau, F. W. - Sonography Principles and Instruments, Elsevier
3. Hagen-Ansert, S. L. - Textbook of Diagnostic Ultrasonography, Elsevier
4. Miele, F. R. - Ultrasound Physics and Instrumentation, McGraw Hill

**Reference Books:**

1. Goldberg, B. B., & Kurtz, A. B. - Ultrasound in Obstetrics and Gynecology, Thieme
2. Baker, P. - Doppler Ultrasound in Cardiology and Radiology, Springer

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**I YEAR: II SEMESTER**  
**THEORY SYLLABUS**

<b>MITT6505</b>	<b>Advanced tech and Instrumentation of Ultrasound</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Paper 2</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Description**

This course provides a comprehensive understanding of computed tomography (CT), covering fundamental principles, imaging techniques, instrumentation, and clinical applications. It includes discussions on image formation, quality assurance, and advanced CT techniques such as angiography, perfusion imaging, and cardiac CT. Emphasis is placed on radiation safety, patient care, and emerging technologies in CT imaging.

**Course Objectives**

- Understand the principles and physics of computed tomography.
- Describe CT instrumentation, including detectors, slip-ring technology, and multi-slice imaging.
- Analyze CT image formation, display techniques, and post-processing methods.
- Recognize and address artifacts in CT images and ensure optimal image quality.
- Apply advanced CT techniques in clinical practice, including angiography, perfusion, and cardiac imaging.
- Understand patient radiation safety and quality assurance measures in CT imaging.

**Unit 1                      Fundamentals of Computed Tomography                      12 Hrs**

- Imaging principles in CT, CT scan instrumentation, History of Computer Tomography, Basic tomography principle and its types, Generations of computer tomography, Advances in detector technology, Slip ring technology, Helical CT, Single-slice and multi-slice CT scan systems.

**Unit 2                      Image Formation and Quality Assessment                      12 hrs**

- Isotropic imaging, Image display techniques, Image reconstruction technique, Pre and post-processing techniques, Image quality in single-slice and multi-slice helical CT scans, Patient radiation dose considerations in CT imaging.

**Unit 3                      CT Protocols and High-Resolution CT (HRCT)                      12hrs**

- Whole-body CT protocols for adults and pediatric patients, Documentation and artifact recognition, HRCT of lungs and temporal bone, technical aspects of HRCT, Volumetric and expiratory HRCT, HRCT protocols, Artifacts

**Unit 4****Advanced CT Imaging Techniques****12 hrs**

- CT angiography and fluoroscopy, Multidimensional reformations (MPR, Curved MPR, MIP), 3d imaging and 4d CT, CT perfusion scanning, Dentascan, CT colonoscopy and bronchoscopy, DICOM processing, Picture archiving and communication system (PACS) applications

**Unit 5****Cardiac Imaging, Maintenance, and Quality Assurance****12 hrs**

- CT coronary angiography, CT calcium scoring, Myocardial imaging, General care and maintenance of CT systems, Functional tests and quality assurance, Acceptable limits of variation and corrective actions.

**Course Outcomes**

Upon completion of this course, students will be able to:

1. Understand the fundamental principles and technological advancements in CT imaging.
2. Operate CT equipment and implement image acquisition techniques.
3. Analyze and optimize image quality while minimizing radiation dose.
4. Apply CT protocols effectively in clinical practice.
5. Perform quality assurance procedures and ensure safe operation of CT systems.

**Textbooks**

- Computed Tomography – Physical Principles, Clinical Applications & Quality Control by Euclid Seeram 2. Computed Tomography by Stewart C. Bushong

**Reference Books:**

- Mahesh, M. (2018). *CT Imaging: Fundamentals and Advances*. Lippincott Williams & Wilkins.
- Kalra, M. K., & Padole, A. (2020). *Radiation Dose Optimization in CT: Current and Emerging Strategies*. Springer.
- Brink, J. A., & Morin, R. L. (2018). *Dose, Image Quality and Radiation Protection in CT*. Springer.
- Van der Molen, A. J., & Geleijns, J. (2019). *Computed Tomography: Principles, Design, Artifacts, and Recent Advances*. Springer.

**AHS IMT**  
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**I YEAR: II SEMESTER**  
**THEORY SYLLABUS**

<b>MITT6506</b>	<b>Specialised Radiographic Procedures</b>	<b>L T P C</b>
	<b>Paper 3</b>	<b>3 1 0 4</b>

- **Course Description**

This course provides an in-depth understanding of contrast media, specialized radiographic procedures, and imaging techniques in diagnostic radiology. It covers the principles of contrast media usage, adverse reactions, and patient management. The course also explores imaging of the digestive, genitourinary, and biliary systems, along with specialized radiographic procedures such as sialography, sinography, and fistulography. Additional modules focus on dental radiography, mammography, and advancements in imaging technologies, ensuring students develop the necessary skills for safe and effective diagnostic imaging.

- **Course Objectives**

1. Upon completion of this course, students will be able to:
2. Understand the types, administration methods, and reactions of contrast media.
3. Gain knowledge of anatomical structures, associated pathologies, and radiographic appearances of the digestive, genitourinary, and biliary systems.
4. Learn and apply specialized imaging techniques such as ERCP, PTBD, sialography, and fistulography.
5. Develop competency in dental radiography, including intraoral, extraoral, and occlusal imaging.
6. Understand the principles, techniques, and advancements in mammography, including digital mammography and breast tomosynthesis.

**Unit 1**

**Contrast Media**

**12 hrs**

- Contrast media introduction – types – ionic and non-ionic contrast media, positive and negative, Contrast media – modes of administration, Adverse reactions to contrast medium, Management of patients with adverse reactions.

**Unit 2****Digestive and Genito urinary system****12 hrs****Digestive system:**

- Anatomy and physiology, Associated pathology and radiographic appearance, Plain radiography, Barium swallow, Barium meal, Barium meal follow-through, Enteroclysis, Barium enema

**Genito urinary system:**

- Anatomy and physiology, Associated pathology and radiographic appearance, Plain radiography, Intravenous urogram (IVU), Micturating Cystourethrogram (MCU), ascending Urethrogram (ASU), Hysterosalpingography (HSG), Fallopian Tube Re-canalisation (FTR)

**Unit 3****Biliary and Miscellaneous System****12 hrs****Biliary and System:**

- Related anatomy, Associated pathology and radiographic appearance, ERCP/ PTBD, T-tube cholangiography

**Miscellaneous System:**

- Sialography, Dacrocystography, Sinography, Fistulography

**Unit 4****Dental Radiography****12 hrs**

- Dental radiography, related anatomy, associated pathology and their radiographic appearances, intraoral, extraoral and occlusal views, orthopantomogram (OPG), checking of mains supply and equipment functionality, selection of exposure parameters, and radiation protection.

**Unit 5****Mammography****12 hrs**

- Anatomy and physiology, indications, contraindications, and techniques as per ICRP guidelines, immobilization and identification techniques, mammographic positioning and various modified projections, BIRADS classification, digital mammography (DR), breast tomosynthesis and its procedure, recent advances in mammography techniques including sono-mammography with their advantages and limitations, and the procedure for stereotactic biopsy.

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**Course outcomes:**

After completing this course, students will be able to:

- **Classify and evaluate various contrast media**, including their types, routes of administration, indications, adverse reactions, and appropriate emergency management strategies.
- **Perform specialized radiographic procedures for the digestive and genitourinary systems**, interpreting anatomical structures, identifying pathological conditions, and demonstrating proficiency in procedures like barium studies, IVU, MCU, ASU, and HSG.

- **Execute advanced imaging procedures of the biliary and miscellaneous systems**, including ERCP, PTBD, T-tube cholangiography, sialography, fistulography, and dacryocystography, with emphasis on anatomical localization and radiographic appearances.
- **Apply principles of dental radiography** by performing intraoral, extraoral, and occlusal imaging, ensuring accurate exposure selection, equipment calibration, and radiation protection in compliance with safety standards.
- **Demonstrate proficiency in mammographic techniques**, including breast positioning, image interpretation using BIRADS, and application of recent technologies such as digital mammography, breast tomosynthesis, and sono-mammography.
- **Critically evaluate patient-specific factors and clinical indications** to select, perform, and interpret appropriate specialized radiographic procedures, integrating anatomical knowledge, pathology, and current imaging advancements.

**Text book:**

- Bushong, S.C. – Radiologic Science for Technologists: Physics, Biology, and Protection (Latest Edition)
- Ballinger, P.W., & Frank, E.D. – Merrill’s Atlas of Radiographic Positions and Radiologic Procedures (Latest Edition)
- Bontrager, K.L., & Lampignano, J.P. – Textbook of Radiographic Positioning and Related Anatomy (Latest Edition)
- Hall, E.J., & Giaccia, A.J. – Radiobiology for the Radiologist (Latest Edition)
- Peart, O. – Mammography and Breast Imaging Prep

**Reference book:**

- Brant, W.E., & Helms, C.A. – Fundamentals of Diagnostic Radiology
- Thilander-Klang, A., & Aps, J.K. – Textbook of Dental Radiology
- Graham, D.T., Cloke, P., & Vosper, M. – Principles and Applications of Radiological Physics
- Wilkinson, M. – Essential Physics for Radiographers  
ICRP Publications – ICRP Guidelines on Radiation Protection

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**I YEAR: II SEMESTER**  
**THEORY SYLLABUS**  
**Ethics and Pedagogy**

**MITT6602**

**Paper 4**

**L T P C**

**3 0 0 3**

**Course Description**

This course provides a comprehensive understanding of research and professional ethics, focusing on ethical guidelines in medical research, informed consent, and publication ethics. It also introduces principles of clinical and professional ethics, followed by an in-depth exploration of pedagogical techniques, including adult learning principles, teaching-learning methods, and assessment strategies.

**Course Objectives**

- To understand ethical guidelines in medical research and professional practice.
- To explore the roles and responsibilities of institutional ethics committees (IEC).
- To analyze principles of adult learning and various educational methodologies.
- To develop competency in teaching-learning techniques and assessment methods.
- To integrate ethical considerations and pedagogy in medical imaging education.

**Unit 1**

**Research Ethics and Guidelines**

**9 hrs**

Research Ethics:

- Ethical considerations in medical research
- Importance of research integrity

ICMR Guidelines:

- Ethical principles in biomedical and health research
- Human and animal research ethics

Informed Consent Process:

- Components of informed consent
- Ethical concerns and challenges

Roles & Responsibilities of Institutional Ethics Committee (IEC)

Publication Ethics:

- Plagiarism and misconduct
- Authorship and conflicts of interest



## **Course Learning Outcomes**

Upon completion of this course, students will be able to:

1. Understand research ethics and adhere to ethical guidelines in biomedical studies.
2. Apply ethical principles in professional and clinical practice.
3. Implement effective teaching-learning methodologies in medical education.
4. Utilize educational technology to enhance learning experiences.
5. Design and evaluate assessment tools aligned with educational objectives.

### **Textbooks:**

- ICMR. (2023). *Ethical Guidelines for Biomedical Research on Human Participants*. Indian Council of Medical Research.
- Beauchamp, T. L., & Childress, J. F. (2021). *Principles of Biomedical Ethics*. Oxford University Press.
- Harden, R. M., & Laidlaw, J. M. (2020). *Essential Skills for a Medical Teacher: An Introduction to Teaching and Learning in Medicine*. Elsevier.

### **Reference Books:**

- National Bioethics Committee Reports (Latest editions).
- Biggs, J., & Tang, C. (2019). *Teaching for Quality Learning at University*. Open University Press.
- McKeachie, W. J., & Svinicki, M. D. (2020). *McKeachie's Teaching Tips: Strategies, Research, and Theory for College and University Teachers*. Cengage Learning.
- WHO Guidelines on Research Ethics (Latest edition).

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**I YEAR: II SEMESTER**  
**THEORY SYLLABUS**

<b>MITL6502</b>	<b>Clinical skills 2</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**Course Description**

This course is designed to provide hands-on experience in ultrasound imaging, computed tomography (CT), radiation safety, digital image processing, and advanced imaging techniques. Students will learn to operate imaging equipment, optimize image acquisition, ensure radiation safety compliance, and apply quality assurance measures. The course emphasizes technical skills, clinical application, and critical analysis of medical imaging data for accurate diagnosis and patient care.

**Course Objectives:**

- Develop technical proficiency in operating ultrasound, CT, and digital imaging systems.
- Understand and apply radiation protection principles in medical imaging.
- Optimize imaging parameters to improve diagnostic accuracy and reduce artifacts.
- Demonstrate competence in quality assurance protocols for different imaging modalities.
- Analyze and interpret medical images, ensuring adherence to clinical protocols.
- Utilize digital image processing and PACS for efficient image management.
- Engage in problem-solving through case-based discussions and practical applications.

<b>Unit 1</b>	<b>Ultrasound Imaging</b>	<b>30 hrs</b>
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- operation and handling of ultrasound machines
- Transducer selection and application for different examinations
- Doppler imaging techniques (color Doppler, power Doppler)
- Image optimization: adjusting gain, depth, focus, and TGC
- Scanning techniques for abdominal, obstetric, and musculoskeletal ultrasound

<b>Unit 2</b>	<b>Computed Tomography (CT)</b>	<b>30 hrs</b>
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- Understanding CT console operation and patient positioning
- CT protocol selection for different clinical indications
- Image reconstruction techniques (MPR, MIP, 3D rendering)
- Radiation dose optimization and ALARA principles in CT
- Evaluation of CT image quality and artifact recognition



- Hagen-Ansert, S. L. – *Textbook of Diagnostic Ultrasonography* (Elsevier)
- Kremkau, F. W. – *Sonography Principles and Instruments* (Elsevier)
- Martin, C. J., & Sutton, D. G. – *Practical Radiation Protection in Healthcare* (Oxford University Press)

**Reference Books:**

- ICRP Publications (Latest Editions) – *Recommendations of the International Commission on Radiological Protection*
- Brink, J. A., & Morin, R. L. – *Dose, Image Quality, and Radiation Protection in CT* (Springer)
- Kalra, M. K., & Padole, A. – *Radiation Dose Optimization in CT: Current and Emerging Strategies* (Springer)
- Miele, F. R. – *Ultrasound Physics and Instrumentation* (McGraw Hill)
- Turner, J. E. – *Atoms, Radiation, and Radiation Protection* (Wiley)
- Van der Molen, A. J., & Geleijns, J. – *Computed Tomography: Principles, Design, Artifacts, and Recent Advances* (Springer)
- Knoll, G. F. – *Radiation Detection and Measurement* (Wiley)

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**II YEAR: III SEMESTER**  
**THEORY SYLLABUS**

<b>MITT7507</b>	<b>Advanced tech. &amp; Instrumentation of MRI</b>	<b>L T P C</b>
	<b>Paper-1</b>	<b>3 1 0 4</b>

### **Course Description**

This course provides an in-depth understanding of Magnetic Resonance Imaging (MRI), including its fundamental principles, instrumentation, pulse sequences, image formation, contrast agents, clinical protocols, safety aspects, and advanced imaging techniques. It covers specialized applications in cardiac, musculoskeletal, and functional MRI (fMRI) and emphasizes quality assurance and system maintenance. The course is designed to equip students with the theoretical and practical knowledge required for proficient MRI operation and interpretation.

### **Course Objectives:**

- Understand the basic principles of MRI, including spin, precession, relaxation times, and pulse sequences.
- Gain knowledge of MRI system components, including magnets, RF coils, gradients, and shielding techniques.
- Learn about image formation processes, including Fourier transformation, K-space representation, and 3D imaging.
- Explore pulse sequences and their role in clinical imaging.
- Understand the use of MRI contrast agents, MR angiography, and MR spectroscopy.
- Learn clinical MRI protocols for different body systems and recognize common artifacts.
- Develop expertise in specialized MRI techniques, such as cardiac MRI, musculoskeletal MRI, and fMRI.
- Implement MRI safety protocols, system maintenance, and quality assurance measures.

### **Unit 1**

### **Basic Principles of MRI**

**12 hrs**

- Spin and Precession
- Relaxation Time (T1 and T2)
- Pulse Cycles
- T1-Weighted, T2-Weighted, and Proton Density Images

**Unit 2                    MRI Instrumentation and Image Formation                    12 hrs**

- Types of MRI Magnets (Permanent, Resistive, Superconducting)
- RF Transmitter & Receiver Coils
- Gradient Coils and Shim Coils
- RF Shielding and Computers in MRI
- 2D Fourier Transform and K-space Representation
- 3D Fourier Imaging and Maximum Intensity Projection (MIP)

**Unit 3                    MRI Pulse Sequences and Advanced Techniques                    12 hrs**

- Spin Echo & Turbo Spin Echo Sequences
- Gradient Echo & Turbo Gradient Echo Sequences
- Inversion Recovery Sequences (STIR, SPIR, FLAIR)
- Echo Planar Imaging and Fast Imaging Sequences
- Advanced Pulse Sequences
- Virtual Reality in MRI

**Unit 4                    MR Contrast, Clinical Protocols, and Artifacts                    12 hrs**

- MRI Contrast Agents (Gadolinium-based)
- MR Angiography (TOF & PCA Techniques)
- MR Spectroscopy
- Whole-body MRI Protocols
- MRI Artifacts and Safety Aspects

**Unit 5                    Specialized MRI Applications, Safety, and Quality Assurance                    12 hrs**

- Cardiac MRI
- Musculoskeletal MRI Protocols
- Abdominal MRI Protocols
- Functional MRI (fMRI) and BOLD Imaging
- MRI System Care and Maintenance
- Quality Assurance and Corrective Action

**Course Learning Outcomes**

- Understand MRI Principles – Explain spin, precession, relaxation times (T1, T2), and pulse sequences in MRI imaging.
- Differentiate MRI Image Contrast – Identify T1-weighted, T2-weighted, and proton density images and their clinical relevance.
- Operate MRI Systems – Demonstrate knowledge of MRI components, pulse sequences, and contrast media for various imaging techniques.

- Analyze Image Formation & Artifacts – Understand Fourier transformation, K-space, MRI artifacts, and methods to improve image quality.
- Apply MRI Safety & Quality Assurance – Follow MRI safety protocols and perform quality control to ensure optimal system performance.

**Textbooks:**

- Haacke, E. M. – *Magnetic Resonance Imaging: Physical Principles and Sequence Design* (Wiley)
- Westbrook, C. – *MRI in Practice* (Wiley-Blackwell)
- Bernstein, M. A., King, K. F., & Zhou, X. J. – *Handbook of MRI Pulse Sequences* (Elsevier)
- McRobbie, D. W., Moore, E. A., Graves, M. J., & Prince, M. R. – *MRI from Picture to Proton* (Cambridge University Press)
- Brant-Zawadzki, M., & Gillan, G. – *Clinical Magnetic Resonance Imaging* (Elsevier)

**Reference Books:**

- Kuhl, C. K., & Barkhof, F. – *Functional MRI: An Introduction to Methods* (Oxford University Press)
- Elster, A. D. – *Questions and Answers in Magnetic Resonance Imaging* (Mosby)
- Brown, R. W., Cheng, Y. C. N., Haacke, E. M., Thompson, M. R., & Venkatesan, R. – *Magnetic Resonance Imaging: Physical and Biological Principles* (Wiley)
- Nitz, W. R. – *MRI Physics for Radiologists* (Springer)
- Shellock, F. G. – *MRI Bioeffects, Safety, and Patient Management* (CRC Press)

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**II YEAR: III SEMESTER**  
**THEORY SYLLABUS**

<b>MITT7508</b>	<b>Care of Patients in Diagnostic Radiology</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Paper-2</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Description**

This course provides comprehensive knowledge and practical skills in patient care within the radiology department. It covers essential aspects such as patient handling, infection control, emergency response, nursing procedures, and communication. The course emphasizes the role of imaging technologists in ensuring patient safety, comfort, and ethical medical practices.

**Course Objectives:**

- Understand the responsibilities of healthcare professionals in imaging departments.
- Learn proper patient transfer and restraint techniques for safety and comfort.
- Acquire knowledge of infection control measures and sterilization techniques.
- Develop skills for handling emergencies and first aid in radiology.
- Communicate effectively with patients, ensuring informed consent and education.
- Understand protocols for patient care during imaging of different body systems.

<b>Unit 1</b>	<b>Introduction to Patient Care</b>	<b>12 hrs</b>
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- Responsibilities of the Healthcare Facility
- Responsibilities of the Imaging Technologist

<b>Unit 2</b>	<b>General Patient Care</b>	<b>12 hrs</b>
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- Patient Transfer Techniques
- Restraint Techniques
- Aspects of Patient Comfort
- Specific Patient Conditions
- Security of Patient Property
- Obtaining Vital Signs
- Laying Up a Sterile Trolley
- IV Injection Administration

<b>Unit 3</b>	<b>Nursing Procedures in Radiology</b>	<b>12 hrs</b>
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- General Abdominal Preparation
- Clothing of the Patient
- Giving an Enema
- Handling Emergencies in Radiology
- First Aid in the X-Ray Department

**Unit 4****Patient Care During Investigations****12 hrs**

- Care during Imaging of:
- Gastrointestinal (GI) Tract
- Biliary Tract
- Respiratory Tract
- Gynecology
- Cardiovascular System
- Lymphatic System
- Central Nervous System (CNS)

**Unit 5****Infection Control & Patient Education****12 hrs**

- Infection Control:
- Isolation Techniques
- Infection Sources & Transmission Modes
- Sterilization & Sterile Techniques
- Psychological Considerations
- Patient Education:
- Communication & Patient Communication Problems
- Explanation of Examinations
- Radiation Safety / Protection
- Interacting with Terminally Ill Patients
- Informed Consent

**Course Learning Outcomes**

- Demonstrate competency in patient handling and care techniques in radiology.
- Apply infection control protocols and safety measures effectively.
- Manage and assist patients with specific conditions in diagnostic imaging procedures.
- Provide first aid and emergency care in radiology settings.
- Communicate effectively with patients regarding examinations and radiation safety.

**Textbooks:**

- **Ehrlich & Daly** – *Patient Care in Radiology*
- **Torres, Lillian S.** – *Basic Medical Techniques and Patient Care in Imaging Technology*
- **Ball & Moore** – *Introduction to Radiographic Imaging Sciences and Patient Care*

**Reference Books:**

- **Bushong, Stewart C.** – *Radiologic Science for Technologists: Physics, Biology, and Protection*
- **Bontrager, Kenneth L.** – *Textbook of Radiographic Positioning and Related Anatomy*
- **Carlton & Adler** – *Principles of Radiographic Imaging: An Art and a Science*

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**II YEAR: III SEMESTER**  
**THEORY SYLLABUS**

<b>MITT7509</b>	<b>Nuclear medicine imaging technique</b>	<b>L T P C</b>
	<b>Paper-3</b>	<b>3 1 0 4</b>

**Course Description**

This course provides comprehensive knowledge and practical skills in patient care within the radiology department. It covers essential aspects such as patient handling, infection control, emergency response, nursing procedures, and communication. The course emphasizes the role of imaging technologists in ensuring patient safety, comfort, and ethical medical practices.

**Course Objectives:**

- Understand the responsibilities of healthcare professionals in imaging departments.
- Learn proper patient transfer and restraint techniques for safety and comfort.
- Acquire knowledge of infection control measures and sterilization techniques.
- Develop skills for handling emergencies and first aid in radiology.
- Communicate effectively with patients, ensuring informed consent and education.
- Understand protocols for patient care during imaging of different body systems.

<b>Unit 1</b>	<b>Basic Atomic &amp; Nuclear Physics</b>	<b>12 hrs</b>
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- Quantities and Units
- Atom Composition and Structure
- Nucleus Composition
- Radioactivity & Exponential Decay
- Specific Activity
- Parent/Daughter Decay
- Modes of Radioactive Decay

<b>Unit 2</b>	<b>Radiation Detectors &amp; Radionuclide Production</b>	<b>12 hrs</b>
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- **Radiation Detectors:**
- Gas-Filled Detectors (Ionization Chambers, Proportional Counters, Geiger-Müller Counters)
- Semiconductor Detectors
- **Production of Radionuclides:**
- Reactor-Produced Radionuclides (Principles & Applications)
- Accelerator-Produced Radionuclides
- Radionuclide Generators

**Unit 3****Instrumentation & Radiopharmacy****12 hrs**

- **Instrumentation in Nuclear Medicine:**
- Anger Camera (Gamma Camera) – Basic Principles
- System Components (Detector System, Collimators, Electronics)
- Image Display and Recording Systems
- Scanning Cameras
- **Radiopharmacy:**
- Radiopharmaceuticals & Tracer Techniques
- Preparation of Labeled Compounds (Technetium-99m Isotope)
- Cold Kits

**Unit 4****Imaging Techniques in Nuclear Medicine****12 hrs**

- **In Vivo Techniques:**
- Static and Dynamic Imaging
- Thyroid Imaging
- Bone, Respiratory, and Urinary System Imaging
- GI and Cardiovascular System Imaging
- Iodine-131 Uptake Studies & Therapy (Thyrotoxicosis, Thyroid Ablation)
- **Image Quality in Nuclear Medicine:**
- Spatial Resolution, Contrast, Noise, and Quality Assurance
- Variations in Image Perception (Physicians & Technologists)
- **SPECT & PET Imaging**

**Unit 5****Radiation Safety & Monitoring in Nuclear Medicine****12 hrs**

- **Radiation Safety Protocols:**
- Radiation Units & Quantities
- Maximum Permissible Dose (MPD)
- Safe Handling & Storage of Radioactive Materials
- Procedures for Handling Spills
- Disposal of Radioactive Waste
- **Radiation Monitoring Devices:**
- Survey Meters & Personnel Dosimeters
- Wipe Testing & Contamination Monitoring
- Isotope Calibrators & Area Monitors
- Inventory of Isotopes

### **Course Learning Outcomes**

- Demonstrate a strong understanding of nuclear physics concepts relevant to medical imaging.
- Identify and operate radiation detectors used in nuclear medicine.
- Explain radionuclide production and radiopharmaceutical preparation techniques.
- Apply knowledge of SPECT and PET imaging in clinical applications.
- Follow radiation safety protocols and use radiation monitoring devices effectively.

### **Textbooks:**

- Chandra, Ramesh – Physics of Nuclear Medicine
- Cherry, Sorenson & Phelps – Physics in Nuclear Medicine
- Christian, Paul – Nuclear Medicine and PET/CT: Technology and Techniques

### **Reference Books:**

- Saha, Gopal B. – *Physics and Radiobiology of Nuclear Medicine*
- Bushberg, Jerrold T. – *The Essential Physics of Medical Imaging*
- Powsner, Rachel A. – *Essential Nuclear Medicine Physics*

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**II YEAR: III SEMESTER**  
**THEORY SYLLABUS**

<b>MITL7503</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Clinical Skills 3</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**Course Description**

- This course provides hands-on training in advanced imaging techniques, patient care, safety protocols, and equipment handling in MRI and Nuclear Medicine. It focuses on practical applications of imaging technology, quality assurance, and clinical imaging protocols. The course is structured to equip students with essential skills for proficient imaging practice, patient management, and radiation safety in a clinical setting.

**Course Objectives:**

- Develop practical expertise in MRI system operation, nuclear imaging, and radiation safety.
- Train students in patient care techniques, infection control, and emergency management in diagnostic imaging.
- Provide hands-on experience with MRI pulse sequences, nuclear medicine radiopharmaceuticals, and quality control measures.
- Enhance proficiency in advanced imaging techniques such as PET-CT, MR spectroscopy, and angiography.
- Ensure competence in radiation protection, system maintenance, and safe disposal of radioactive waste.

**Unit 1                      Imaging Technology and Instrumentation                      30 hrs**

- MRI system operation: Console, RF coils, gradient coils, and shielding
- MRI pulse sequences: SE, TSE, GRE, STIR, FLAIR, EPI
- Nuclear Medicine: Radiation detection (Geiger-Müller counter, ionization chamber)
- Gamma camera operation and SPECT/PET imaging techniques
- Quality control tests for MRI and nuclear medicine systems

**Unit 2                      Patient Care, Safety, and Emergency Handling                      30hrs**

- Patient handling, immobilization, and communication techniques
- Infection control, sterilization, and radiation safety procedures
- Management of contrast reactions and radiological emergencies
- First aid and CPR training for imaging professionals
- Ethical and medico-legal considerations in radiology

**Unit 3                      Specialized Imaging and Advanced Modalities                      30 hrs**

- MRI contrast agents: Preparation, administration, and safety
- MR Angiography (TOF, PCA) and MR Spectroscopy
- Nuclear medicine radiopharmaceutical preparation and quality control
- Static and dynamic nuclear imaging techniques (Thyroid, Bone, Cardiac, Renal)
- PET-CT fusion imaging and applications

**Unit 4                      Clinical Imaging Protocols and Quality Assurance                      30 hrs**

- MRI protocols for brain, abdomen, and musculoskeletal imaging
- Nuclear medicine clinical procedures and image interpretation
- Radiation dose optimization in CT, MRI, and nuclear imaging
- Artifacts in MRI and nuclear medicine: Causes and correction
- Quality assurance in patient care and imaging techniques

**Unit 5    Radiation Protection, System Maintenance, and Waste Management    30 hrs**

- Radiation safety guidelines and personal dosimetry
- Safe handling, storage, and disposal of radioactive materials
- Routine maintenance and troubleshooting of MRI and nuclear medicine systems
- Quality control in imaging: SNR, uniformity, spatial resolution testing
- Case studies and clinical reporting of imaging findings

**Course Outcomes**

Upon completion of this course, students will be able to:

- Demonstrate proficiency in operating MRI and nuclear imaging equipment in a clinical setting.
- Perform patient handling, infection control, and emergency response in diagnostic radiology.
- Identify and correct imaging artifacts and optimize imaging techniques for accurate diagnosis.
- Interpret MRI and nuclear medicine imaging protocols and apply them to real-world clinical cases.
- Implement radiation safety protocols, perform quality control tests, and maintain imaging systems.

**Textbooks:**

- **Haacke, E. M.** – *Magnetic Resonance Imaging: Physical Principles and Sequence Design* (Wiley)
- **Westbrook, C.** – *MRI in Practice* (Wiley-Blackwell)
- **Bernstein, M. A., King, K. F., & Zhou, X. J.** – *Handbook of MRI Pulse Sequences* (Elsevier)
- **Christian, Paul** – *Nuclear Medicine and PET/CT: Technology and Techniques*
- **Ehrlich & Daly** – *Patient Care in Radiology*

**Reference Books:**

- McRobbie, D. W., Moore, E. A., Graves, M. J., & Prince, M. R. – *MRI from Picture to Proton* (Cambridge University Press)
- Chandra, Ramesh – *Physics of Nuclear Medicine*
- Saha, Gopal B. – *Physics and Radiobiology of Nuclear Medicine*
- Sherlock, F. G. – *MRI Bioeffects, Safety, and Patient Management* (CRC Press)
- Bushberg, Jerrold T. – *The Essential Physics of Medical Imaging*

**AHS IMT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY COURSE**  
**II YEAR: IV SEMESTER**

<b>MITT7510</b>	<b>Interventional Radiology Techniques</b>	<b>L T P C</b>
	<b>Paper-1</b>	<b>3 1 0 4</b>

**Course Description:**

This course provides an in-depth understanding of interventional radiology procedures, focusing on both vascular and non-vascular interventions. It covers the fundamental principles of Digital Subtraction Angiography (DSA), the instrumentation involved, patient care protocols, and various advanced interventional techniques. Additionally, the course highlights critical safety considerations in the Cath Lab, including radiation protection, equipment maintenance, and quality assurance practices.

**Course Objectives:**

**Students undergoing this course are expected to:**

1. Differentiate between vascular and non-vascular interventional procedures.
2. Describe patient preparation, informed consent, Post-procedure care and Recognize the role of a radiographer in interventional radiology.
3. Gain Proficiency in Non-Vascular Interventional Techniques.
4. Discuss neuro-interventional techniques, including embolization and laser-guided procedures.
5. Ensure Safety and Quality in Interventional Radiology.

Students will gain theoretical knowledge and practical insights into diagnostic and therapeutic interventional procedures, preparing them for roles in radiological and interventional imaging settings.

**Unit 1 INTRODUCTION ON INTERVENTIONAL PROCEDURES 12 hrs**

- Vascular and non-vascular interventional procedures
- Basic Principle and types of DSA
- Instrumentation of Angiographic / DSA unit. Single and biplane angiographic unit, X-ray tube, Image intensifier, Flat panel detector, Recording system, Angiographic table and Control. Advanced applications, Image processing, 3-D rotational angiography, Advancements and future direction of angiographic

**Unit 2 PATIENT CARE 12 hrs**

Patient care: Preparation for procedure – post procedure care – role of radiographer in interventional procedure.

- Informed consent, Interventional Radiology Team, Pressure injector,
- Nursing care and Equipment for patient monitoring.
- Needles, Catheters, guide wires, and other devices used for interventional procedures

**Unit 3                    NON VASCULAR INTERVENTIONAL PROCEDURES                    12 hrs**

- Diagnostic & Therapeutic interventional procedures.
- Brief review of different interventional procedures: PTC, PTBD, stenting – Nephrostomy – ureteric stenting – Guided biopsies of different organs and drainage collections/abscesses.
- Radiofrequency ablation
- Image guided nerve blocks
- Vertebroplasty

**Unit 4                    VASCULAR INTERVENTIONAL PROCEDURES                    12 hrs**

- Neuro interventional procedures – Embolization of extra or intracranial tumors vascular malformations– direct puncture – laser guided procedure. Basics of cardiac catheterization.
- Uterine artery embolization (Problems in obstetrics and gynecology)
- Angiography, Angioplasty, Venography and Lymphangiography
- Embolization, Thrombolysis
- Trans-jugular Intrahepatic Porto-systemic Shunt (TIPS).
- Balloon-Occluded Retrograde Trans-venous Obliteration (BRTO)

**Unit 5                    SAFETY CONSIDERATIONS IN CATH LAB                    12 hrs**

- Safety considerations in cath lab – room design – protective devices – radiation monitoring.
- Care, Maintenance and tests, General care – functional tests – Quality assurance program – Acceptable limits of variation – Corrective action.

**Textbooks:**

1. "Interventional Radiology: A Survival Guide" – *Kieran P. J. Murphy & Fergus V. Coakley*
2. Handbook of Interventional Radiologic Procedures" – *John A. Kaufman & Michael J. Lee*
3. Vascular and Interventional Radiology: The Requisites" – *John A. Kaufman & Michael J. Lee*
4. Interventional Radiology Procedures in Biopsy and Drainage" – *Deborah J. Rubens & Mark E.*

**Reference books:**

1. Grainger & Allison's Diagnostic Radiology" (Interventional Section) – Andy Adam et al.
2. "Fundamentals of Diagnostic Radiology" – William E. Brant & Clyde Helms
3. "Radiation Protection in Interventional Radiology" – ICRP Publication 117
4. "Textbook of Cardiovascular Intervention" – Craig A. Thompson & Emmanouil Brilakis
5. "Interventional Oncology: Principles and Practice" – Riad Salem & Jean-Francois Geschwind



- Radiation signages and their significance
- Technical protective considerations during radiography
- Radiation hazards evaluation
- Beam limiting and centering devices
- Filtration and exposure control
- Radiation protection in: Fluoroscopy
  - Mammography
  - Mobile radiograph
  - CT scan
  - Angiography

#### **Unit 4**

#### **Biological Effects and Radiation Monitoring**

**12 hrs**

- Radiation measuring instruments (Area monitoring, Personnel Dosimeters)
- Biological aspects of radiation protection
- Direct and indirect effects of radiation
- Deterministic and stochastic effects (Somatic & Genetic effects)
- Radiation effects at the cellular level
- Dose-response relationships
- Acute radiation syndromes
- Qualification and ethics for radiation workers

#### **Unit 5**

#### **Radiation Protection in Special Conditions and Advances**

**12 hrs**

Exposure dose considerations in:

- Pregnancy
- Infants
- Pediatrics
- Geriatrics
- Radiation workers
- 10th Day Rule / 14th Day Rule / 28th Day Rule

Radiation protection in:

- Nuclear medicine
- Radiation therapy

Advancements in radiation protection techniques

#### **Course Outcomes**

Upon completion of this course, students will be able to:

1. Understand radiation protection principles and exposure limits.
2. Apply radiation safety measures in different imaging modalities.
3. Evaluate biological effects and radiation risk factors.
4. Implement safety protocols for radiation workers and patients.
5. Utilize advancements in radiation protection for improved safety

**Textbooks:**

- Bushong, S. C. (2020). *Radiologic Science for Technologists: Physics, Biology, and Protection*. Elsevier.
- Martin, C. J., & Sutton, D. G. (2018). *Practical Radiation Protection in Healthcare*. Oxford University Press.
- Turner, J. E. (2017). *Atoms, Radiation, and Radiation Protection*. Wiley.

**Reference Books:**

- ICRP Publications (Latest editions). *Recommendations of the International Commission on Radiological Protection*.
- Knoll, G. F. (2020). *Radiation Detection and Measurement*. Wiley.
- Upton, A. C. (2019). *Radiation Protection and Dosimetry: Fundamentals and Applications*. Springer.
- National Council on Radiation Protection (NCRP) Reports (Latest editions).

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**II YEAR: IV SEMESTER**  
**THEORY SYLLABUS**

<b>MITT7603</b>	<b>Management of Healthcare Organizations</b>	<b>L T P C</b>
	<b>Paper-3</b>	<b>3 0 0 3</b>

**Course Description**

This course provides a comprehensive understanding of healthcare management, hospital administration, and digital healthcare systems relevant to radiology. It covers fundamental management principles, economic aspects of healthcare, quality assurance, and the integration of digital technologies like PACS, RIS, and HIS in radiology departments. The course also includes regulatory aspects such as the Pre-Natal Diagnostic Techniques (PNDT) Act and logistics management in healthcare.

**Course Objectives:**

- Upon completion of this course, students will:
- Understand core healthcare management principles, including decision-making, staffing, leadership, and motivation in hospital administration.
- Analyze economic aspects of healthcare, including budgeting, cost management, and financial planning in hospitals.
- Gain expertise in hospital administration, department management, clinical services, and quality assurance.
- Evaluate healthcare technologies and digital healthcare informatics, including PACS, RIS, and HIS.
- Understand legal frameworks related to healthcare technology and radiology.

<b>Unit 1</b>	<b>Principles of Healthcare Management</b>	<b>12 hrs</b>
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- Functions of management
- Decision-making processes
- Organizing and staffing in healthcare
- Leadership and motivation in hospital administration
- Organizational behavior and stress management

<b>Unit 2</b>	<b>Radiation Detectors &amp; Radionuclide Production</b>	<b>12 hrs</b>
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- Demand and supply in healthcare
- Nature of costs and cost control
- Marginal cost and breakeven analysis
- Budgeting and financial planning for hospitals
- Role of government in healthcare economics

**Unit 3      Hospital Administration and Healthcare Services Management      12 hrs**

- Departmentation in hospitals
- Management of clinical and support services
- Utility services in hospitals
- Evaluation of hospital services
- Quality management and accreditation

**Unit 4                      Healthcare Technology and Informatics                      12 hrs**

- Present trends and challenges in healthcare technology
- Planning and adoption of appropriate healthcare technology
- Evaluation methods for healthcare technology
- The Pre-Natal Diagnostic Techniques Act, 1994
- Hospital Management Information System (HMIS)
- Logistics management in healthcare

**Unit 5                      Radiology Information Systems and Digital Healthcare                      12 hrs**

- Radiology Information System (RIS)
- Hospital Information System (HIS)
- Design and management of radiology departments
- PACS and teleradiology applications
- Standard Operating Procedures (SOPs) in radiology

**Course Learning Outcomes**

Upon completion of this course, students will be able to:

1. Demonstrate a strong understanding of healthcare management principles.
2. Apply financial planning and budgeting strategies in hospital administration.
3. Organize and manage hospital services, including quality assurance and accreditation.
4. Evaluate and implement healthcare technologies and information systems.
5. Utilize radiology information systems, PACS, and teleradiology effectively.
6. Understand regulatory and ethical considerations in medical imaging.

**Textbooks:**

- Gupta, S. & Kant, S. – *Hospital Administration and Management: A Comprehensive Guide*
- Goel, S. L. & Kumar, R. – *Healthcare Management and Administration*
- McConnell, C. R. – *Umiker's Management Skills for the New Health Care Supervisor*
- Goyal, R. C. – *Hospital Administration and Human Resource Management*
- Carr, P. B. & Feldstein, P. J. – *Health Economics: Theory, Insights, and Industry Studies*

**Reference Books:**

- Brown, M. G. – *Healthcare Quality Management: Tools and Applications*
- Park, K. – *Preventive and Social Medicine*
- Sharma, S. K. – *Hospital Administration: Principles and Practice*
- Bushberg, J. T., Boone, J. M., & Seibert, J. A. – *The Essential Physics of Medical Imaging*
- Pandey, A. – *Healthcare Informatics and Hospital Management*

**AHS MIT**  
**M Sc. MEDICAL IMAGING TECHNOLOGY**  
**II YEAR: IV SEMESTER**  
**THEORY SYLLABUS**  
**Clinical Skills 4**

**MITL7504**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**Course Description**

This course provides practical training in interventional radiology techniques and radiation protection strategies to ensure safe and effective diagnostic and therapeutic imaging. The course is structured into five practical units, covering advanced catheter-based procedures, vascular and non-vascular interventions, patient care, radiation safety protocols, and quality assurance in interventional radiology and nuclear medicine.

**Course Objectives**

- **Train students in** vascular and non-vascular interventional procedures **using** Digital Subtraction Angiography (DSA), fluoroscopy, and ultrasound guidance.
- **Develop expertise in** handling interventional devices **such as** guidewires, catheters, stents, and embolization materials.
- **Provide hands-on experience in** radiation safety, monitoring, and quality assurance **in interventional and diagnostic imaging.**
- **Enhance students' knowledge of** radiation protection strategies in nuclear medicine, fluoroscopy, and PET-CT imaging.
- **Equip students with the necessary skills to implement** safety regulations, radiation dose optimization, and emergency preparedness **in medical imaging.**

**Unit 1          Instrumentation and Techniques in Interventional Radiology          30 hrs**

- Need, aim, and objectives of radiation protection
- Background radiation and sources
- History of radiation accidents
- Basic radiation units and quantities (Exposure, Absorbed Dose, Equivalent Dose, Effective Dose, Radiation Quality Factor, Tissue Weighting Factor, Mean Glandular Dose)

**Unit 2            Vascular and Non-Vascular Interventional Procedures            30 hrs**

- **Vascular Interventions:**
- Angioplasty and stent placement (coronary, carotid, renal arteries).
- Embolization techniques for tumors, aneurysms, and hemorrhages.
- Transjugular intrahepatic portosystemic shunt (TIPS) procedure.
- **Non-Vascular Interventions:**
- Ultrasound and CT-guided biopsies (liver, lung, kidney).
- Percutaneous nephrostomy, biliary drainage, and ureteric stenting.
- Vertebroplasty and radiofrequency ablation for pain management.

**Unit 3            Patient Care and Safety in Interventional Radiology            30 hrs**

- Patient preparation for invasive procedures and sedation protocols.
- Monitoring of vital parameters and managing complications during interventional procedures.
- Emergency management of contrast reactions and hemorrhagic events.
- Sterile field maintenance and infection control in interventional radiology.
- Radiation protection for patients, operators, and healthcare workers in the interventional suite.

**Unit 4            Radiation Safety and Protection in Medical Imaging            30 hrs**

- Hands-on use of dosimeters, survey meters, and ionization chambers.
- Radiation exposure calculations for X-ray, fluoroscopy, CT, and nuclear medicine.
- Shielding techniques: Lead aprons, thyroid shields, mobile barriers, and room shielding design.
- Safe handling and disposal of radioactive materials in nuclear medicine.
- Special considerations for radiation protection in pediatric and pregnant patients.

**Unit 5            Quality Assurance and Compliance in Radiation Protection            30 hrs**

- Routine quality control checks for **fluoroscopy, CT, and nuclear imaging systems**.
- Compliance with international radiation safety guidelines (**ICRP, NCRP, AERB**).
- Radiation safety audits and monitoring in hospital environments.
- Case study-based analysis of **radiation accidents and corrective measures**.
- Implementation of **dose reduction techniques in medical imaging**.

## Course Outcomes

Upon completion, students will be able to:

1. Demonstrate proficiency in handling interventional radiology equipment and techniques.
2. Perform patient preparation, monitoring, and post-procedure care in interventional radiology.
3. Assist in vascular and non-vascular procedures, including biopsies, embolization, and stenting.
4. Implement radiation safety measures and quality assurance protocols in interventional radiology and nuclear medicine.
5. Analyze radiation hazards, monitor exposure, and ensure compliance with safety regulations.

## Textbooks:

1. **Bushong, S. C.** – *Radiologic Science for Technologists: Physics, Biology, and Protection* (Elsevier).
2. **Haacke, E. M.** – *Magnetic Resonance Imaging: Physical Principles and Sequence Design* (Wiley).
3. **Christian, P.** – *Nuclear Medicine and PET/CT: Technology and Techniques* (Elsevier).
4. **Ehrlich & Daly** – *Patient Care in Radiology* (Elsevier).
5. **Bernstein, M. A.** – *Handbook of MRI Pulse Sequences* (Elsevier).

## Reference Books:

1. **ICRP Publications (Latest Editions)** – *International Commission on Radiological Protection Guidelines*.
2. **Knoll, G. F.** – *Radiation Detection and Measurement* (Wiley).
3. **Upton, A. C.** – *Radiation Protection and Dosimetry: Fundamentals and Applications* (Springer).
4. **McRobbie, D. W. & Moore, E. A.** – *MRI from Picture to Proton* (Cambridge University Press).
5. **Bushberg, J. T.** – *The Essential Physics of Medical Imaging* (Lippincott Williams & Wilkins).





