A Curriculum

For

B.Sc. (Honours) Medical Technology

(Radiography & Medical Imaging Technology)

CAM Institute of Allied Health Sciences & Technology

(A constituent Institute of Bhaikaka University)

(Academic Year 2024-25)

Vision

Our institute will be the most preferred destination for the aspirants who want to achieve the highest standard of excellence in the field of allied health sciences.

Mission

- To promote a collaborative working environment for the academicians and the students.
- To offer a curriculum emphasizing practical knowledge and clinical experience as to be implemented in authentic settings.
- To collaborate with clinicians and experts from basic biomedical sciences for education and research.

CURRICULUM

Discipline	Medical Technology
Program	B.Sc. (Honours) Medical Technology
Specialization	Radiography & Medical Imaging Technology
Subject Code	---
Tenure	4 years (Including 1 year of Internship)
Last Revised	July 2024

NOTIFICATION

Subject: Regulations and Curriculum pertaining to B.Sc. (Honours) Medical Technology (Radiography and Medical Imaging Technology)

In exercise of the powers conferred under section 22 (3) of Gujarat Private Universities Act, 2009, the Academic Council in its 9th meeting held on 22nd August 2024 under the agenda item no. 24.02.10 has approved the revised Curriculum of B.Sc. Honours in Medical Technology program (Choice Based Credit System) at Bhaikaka University.

The curriculum shall come into force from the Academic Year 2024-25.

By Order,
REGISTRAR

ACADEMIC REGULATIONS

1. TITLE OF THE PROGRAM:

This program shall be called as per the name given below under the discipline of Medical Technology at Bhaikaka University, Karamsad. It comes into effect from the Academic Year 2024-25. The relevant regulatory bodies reserve the right to make changes to the regulations at any period of time.

Name of the program shall be;

B.Sc. (Honours) Medical Technology (Radiography & Medical Imaging Technology)

2. ELIGIBILITY FOR THE ADMISSION:

The candidate who have passed 10+2 (Science) examination conducted by any recognized School Certification Board or Equivalent Examination; with principle subjects like Physics, Chemistry, Biology and/or Math and English. The student should have completed minimum of 17 years at the time of securing admission.

2.1 DURATION OF THE PROGRAM:

The program of B.Sc. (Honours) Medical Technology (Radiography & Medical Imaging Technology) comprises of 4 (four) academic years including 1 (one) year of internship at the respective area of Shree Krishna Hospital affiliated with Bhaikaka University.

2.2 MEDIUM OF INSTRUCTION:

English will be the medium of instruction for all the subjects and also for the examination of the program.| |

3. METHOD [S] OF INSTRUCTIONS:

- This program shall include teaching through lectures, practical, demonstration, group discussion, individual learning, kinesthetic or participative learning through traditional methods or by using ICT tools.| |
- Structured problem-based exercises shall be provided to simulate specific case examples| |
- Audio visual material and/or printed handouts shall be provided to supplement reading and classroom instruction.| |

4. CREDIT SYSTEM:

This program will have a curriculum in which every course will be assign certain credits reflecting its weight and contact periods per week as given below:

1 lecture (L)/week (15 Hours)* = 1 credit

1 Tutorial (T)/week (15 Hours)* = 1 credit

1 Practical (P)/week (30 Hours)* = 1 credit

* 1 credit of class room theory, tutorial and demonstration is equal to 15 hours of engagement in a year and 1 credit of practical class is equal to 30 hours of engagement in a year.

In addition to theory and laboratory practical's there may be other courses such as seminal. Clinical training/Hospital posting, projects etc., which will be assigned credits as per their contribution in the program without regards to contact periods.

5. ELIGIBILITY TO APPEAR IN ANNUAL EXAMINATION:

- The student must have attended at least 75% of the total classes conducted in each course of the year separately in theory, practical and clinical postings.
- The students must have secured 35% of the total marks in each courses of the academic year separately in theory and practical.

6. ASSESSMENT:

Assessments should be completed by the academic staff, based on the compilation of the student's theoretical & clinical performance throughout the education programme. To achieve this, all assessment forms and feedback should be included and evaluated.

5.1 INTERNAL ASSESSMENT

Internal assessment shall be done based on continuous evaluation of the student. It includes mainly two internal examinations (one terminal examination & one preliminary examination). It may also include several unit tests and assignments submitted by the students throughout the year in each subjects of the program. In order to award the internal marks in theory and practical, the average of the two internal examinations as well as unit tests, assignments, attendance and participation in curricular/extra-curricular activities shall be considered.

5.2 EXTERNAL ASSESSMENT

- External assessment shall include theory and practical examinations conducted as a part of the annual examinations of each subject (course) as per the schedule decided by the college and university.
- The scheme of question paper for theory and practical examinations will be as prescribed by the regulatory body.

7. ACADEMIC PROGRESSION:

- The student will not be allowed to appear for the annual examination of the third year if he/she has not cleared all the courses of the first and second year of the program.
- The student will not be allowed to enter in the internship (fourth year) of the program, if he/she has not cleared all the courses of final year of the program.
- These rules will be strictly applicable and no complaint/request will be entertained from the students who may be detained under these rules.

8. INTERNSHIP:

- There shall be one year of internship after the successful completion of third year of the program. Internship should be done at the hospital recognized by Bhaikaka University only.
- The student shall be awarded the degree only after successful completion of the internship.

9. AWARD OF GRADES:

- The student must secure minimum 35 % of marks in theory and practical examination separately to pass in the final University Examination.
- In case a student fails to secure minimum 35% marks in any theory or practical course, he/she shall reappear for the supplementary examinations or the annual examination of that course. However, his/her marks of the internal assessment shall be carried over and he/she shall be entitled for the grade obtained on passing.

9.1 ALLOCATION OF GRADE POINTS:

The student shall be awarded a final letter grade at the end of the academic year for each course as per the table shown below;

Table 1: Letter grades and Grade Points

Letter Grade	Grade Points	Marks
O (Outstanding)	10	≥90
A+ (Excellent)	9	80-89
A (Very Good)	8	70-79
B+ (Good)	7	60-69
B (Above Average)	6	50-59
C+ (Average)	5	40-49
P (Pass)	4	35-39
F (Fail)	3	<35
Ab (Absent)	0	--

9.2 DECLARATION OF CLASS:

The class shall be awarded on the basis of CGPA as follows;

Class	CGPA
First Class with Distinction	**≥ 7.50**
First Class	**6.00 to 7.49**
Second Class	**4.8 to 5.59**
Pass Class	**<4.8**

The class shall be awarded on the basis of following;

Class	Details
First Class with Distinction	A successful candidate obtaining 75% and more marks of the grand total aggregate in the first attempt shall be declared to have passed these subjects with Distinction
First Class	A successful candidate obtaining 60% and more and less than 75% of the marks of the grand total aggregate in the first attempt shall be declared to have passed these subjects with first class
Second Class	A successful candidate obtaining 50% and more and less than 60% of the marks of the grand total aggregate in the first attempt shall be declared to have passed these subjects with Second class
Pass Class	Those candidates who do not fall in any above criteria's, but fulfil the requirement of passing of the whole course, will be shown as "PASS" in the grade card/mark sheet

10. PROGRAM OBJECTIVES:

Program objectives aim at making the students being able to:

- Perform objective self-assessments of their knowledge and skills; learn and refine existing skills; and acquire new skills
- Apply newly gained knowledge or skills to patient care
- Enhance their personal and professional growth and learning by constant introspection and utilizing experiences
- Search (including through electronic means), and critically evaluate medical literature to enable its application to patient care
- Develop a research question and be familiar with basic, clinical and translational research in its application to patient care

11. PROGRAM SPECIFIC OBJECTIVES:

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

12. PROGRAM OUTCOMES:

PO1: **Improvement and understanding of paramedical science:**
Students will make use of their subject-matter expertise to effectively render healthcare services.

PO2: Patient treatment methods and clinical services:
Students will use fundamental scientific concepts to choose pertinent investigations while offering patient care in an effective and economical manner. They ought to establish plans for sickness avoidance alongside healthcare improvement**.**

PO3: Intellectual proficiency:
The student will be competent to supervise diagnostics and clinical administration procedures and troubleshoot concerns.

PO4: Aptitudes for interaction:
In order to give stakeholders and the healthcare team pertinent information, students will be able to express themselves concisely and adaptably. They will be provided with purposeful counseling approaches to promoting lifestyle changes that will optimize health.

PO5: Research/ Exploration:
The ability for students to think critically on their own will be significant, as will be their ability to communicate verbally as well as in writing.

PO6: Ethics and accountability:
Students will comprehend the fundamental principles of clinical ethics and legislation so they may use them in their practice as healthcare practitioners. Students should be able to:

- Describe and apply the fundamental ideas of clinical ethics to real-world scenarios and circumstances
- To provide patients with access to healthcare resources fairly, equally, and without bias, discrimination, or undue influence.
- Establish an understanding and effectively apply fundamental legal principles to their practice.
- Embrace professional responsibility for the beginning, maintaining, and closure of patientprovider conversations.

PO7: Leadership, mentor-ship and teamwork:
Where necessary, the student must assume a leadership position to assure optimal clinical outcomes and patient satisfaction. They must be able to effectively manage both themselves and other people, as well as respond to planned and unknown circumstances on their own and with confidence.

PO8: Responsibility and public accountability
The students will be exposed to community service that is guided by study and the practice of medicine. They will encourage creative solutions to effectively address community requirements. They will do their duties with a focus towards an emerging and enduring healthcare system.

PO9: Sustainability and the surroundings
Students will apply effective biological waste management and disposal strategies in order to preserve the environment, community wellness, and safety.

PO10: Continuous learning
The student should be committed to continuous improvement in skills and knowledge while harnessing modern tools and technology.

13. PROGRAM SPECIFIC OUTCOMES:

At the end of this specific program the student should be able to:

1. To undertake Mammography, CT scan and MRI procedures independently.
2. To assist in specialised radiological procedures.
3. Able to do the image processing.
4. To handle all radiological and imaging equipment independently.
5. To ensure radiation protection and quality assurance
6. To undertake care and maintenance of all radiological and imaging equipment
7. Able to evaluate images for technical quality
8. Able to identify and manage emergency situations.

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B.Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: First year

	Regular Subjects	Elective Subjects	Total
Subjects	07	01	**08**
Credit	40	02	**42**

CURRICULUM & CREDIT FRAME WORK

Regular Subjects

Course Code	Course Title	Hours/week			Marks		Total Marks	Credit
		L	T/D	P	Internal	External		
Core/Major Courses								
24BMT0101	Human Anatomy	3	1		30	70	**100**	**4**
24BMT0102	Human Physiology	3	1		30	70	**100**	**4**
24BMT0103	General Pathology	3	1		30	70	**100**	**4**
24BMT0104	General Microbiology	3	1		30	70	**100**	**4**
24BMT0105	General Biochemistry	3	1		30	70	**100**	**4**
24BMT0106	English	3	1		30	70*	**100**	**4**
24BMT0107	Health Care	2	--		20	40*	**60**	**2**
24BMT0108	Introduction to Medical Technology	1	-		60	--	**60**	**1**
24CES0101	Clinical Education (studentship)	--	13		100	--	100	13
	Total	**21**	**19**		**360**	**460**	**820**	**40**
	Total hours	**1280**			- - -	---	---	

Elective Subjects

Course Code	Course Title	Hours/week		Marks		Total Marks	Credit
		L	T/D	Internal	External		
24ELC0101	Yoga and Health	--	2	20	40*	**60**	**2**
24ELC0102	Basic emergency care and life support	--	2	20	40*	**60**	**2**

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B.Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Second year

	Regular Subjects	Elective Subjects	Total
Subjects	05	01	**06**
Credit	40	02	**42**

CURRICULUM & CREDIT FRAME WORK

(Regular Subjects)

Course Code	Course Title	Hours/ Week			Marks		Total Marks	Credit
		L	T/D	P	Internal	External		
Core/Major Courses								
24BLT0201	Radiation Physics and Medical Physics	4	--	--	30	70	**100**	**4**
24BLT0202	Radiographic Techniques- Basic	4	--	--	30	70	**100**	**4**
24BLT0203	Radiographic Photography & Image Processing	4	--	--	30	70	**100**	**4**
24BLT0204	Practical - Radiographic Technology-I	--	3	6	30	70	**100**	**6**
24BSC0201	Basics of Research Methodology	2	**1**	**--**	20	40	**60**	**3**
24CES0201	Clinical Education (Studentship)	--	19	--	--	--	**100**	**19**
Total		**14**	**23**	**6**	**140**	**320**	**560**	**40**
	Total hours	**1280**						**40**

Elective Subjects

Course Code	Course Title	Hours/ Week		Marks		Total Marks	Credit
		L	T/D	Internal	External		
24ELC0201	Phlebotomy	--	2	20	40*	**60**	**2**
24ELC0202	Computer	--	2	20	40*	**60**	**2**

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B.Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Third year

	Regular Subjects	Elective Subjects	Total
Subjects	04	01	**05**
Credit	40	02	**42**

CURRICULUM & CREDIT FRAME WORK

(Regular Subjects)

Course Code	Course Title	Hours/week			Marks		Total Marks	Credit
		L	T/D	P	Internal	External		
Core/Major Courses								
24BLT0301	Diagnostic Imaging Techniques	4	-	-	30	70	**100**	**4**
24BLT0302	Radiographic Techniques- Applied	4	-	-	30	70	**100**	**4**
24BLT0303	Radiographic Techniques- Advanced	4	-	-	30	70	**100**	**4**
24BLT0304	Practical- Radiographic Technology -II	-	4	8	40	160	**200**	**8**
24CES0301	Clinical Education (Studentship)	-	20	-	--	--	**100**	**20**
	Total	**12**	**24**	**8**	**130**	**370**	**600**	**20**
	Total hour	**1280**						**40**

Elective Subjects

Course Code	Course Title	Hours/ Week		Marks		Total Marks	Credit
		L	T/D	Internal	External		
24ELC0301	Leadership and Management Skills		2	20	40*	**60**	**2**
24ELC0302	AI in Health care		2	20	40*	**60**	**2**

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B.Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Fourth year

CURRICULUM & CREDIT FRAME WORK

Course Code	Course Title	ours / week			Marks		Total Marks	Credit
		L	T/D	P	Internal	External		
Core/Major Courses								
24BRT0401	Clinical Internship	--	28	-	50	150	**200**	**28**
24BRT0402	Research Project	--	12	--	30	70	**100**	**12**
	Total hours			**1280**	--	--	**300**	**40**

ROTATION DURING INTERNSHIP

(1 credit = 30 hours of clinical postings)

Area at Radiology department	Hours / week	Credit
Plain Radiographs (Including Mobile/Portable Radiographs, Mammography & Orthopantomography)	6	6
Diagnostic Radiographic Procedures	4	4
Interventional Procedures	2	2
Ultrasound & Colour Doppler	2	2
CT scan	6	6
MRI Scan	6	6
Radionuclide Scan	2	2
Research Project	12	12
Total hours	**1280**	**40**

Note:

1) Abbreviations: L-Lecture, T-Tutorial, D-Demonstration and P-Practical

2) Considering eight months per academic year as working months, total contact hours per year shall be 1280 (One thousand two hundred and eighty)

3) There shall be no annual Practical Examination in the first year of the program.

***The external examination will be taken at the institute level.**

****The credit of the course "Introduction to Medical Technology" shall not be reflected in the annual marksheet. However, it will be reflected in the transcript.**

Detailed Curriculum
Of
B.Sc. (Honours) Medical Technology
(Radiography & Medical Imaging Technology)

First Year

24BMT0108 (Introduction to Medical Technology)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons) in Medical Technology
Year of the Program: First year

Course Code	24BMT0108	Total Credit	1
Title of Subject	Introduction to Medical Technology	Total Hours	15

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

Course Objectives	1) To introduce the medical technology field and its applications. 2) To enhance understanding of basic medical concepts, techniques, and equipment. 3) To develop critical thinking and problem-solving skills related to medical technology. 4) To prepare students for advanced studies and practical applications in the respective field.

Course Content

Sessions	Description	Weightage
1	**Introduction to Medical Technology** History and Evolution of Medical Technology Overview of Medical Technology Applications Role of Medical Technologists in Healthcare	1 Hour 10%
2	**Medical Terminology** Common Medical Terms and Abbreviations Understanding routine laboratory procedures Communication in Medical Settings	2 hours 20%
3	**Basic Human Anatomy and Physiology** Introduction to Human Body Systems Major Organs and Their Functions Basic Physiological Processes	3 Hours 20%
4	**Biochemistry** Introduction Key Areas Importance Terms and Abbreviations	2 hour 10%
5	**Clinical Microbiology and Immunology** Introduction Key Areas Importance	2 hour 10 %

	Terms and Abbreviations	
6	**Pathology** Introduction Key Areas Importance Terms and Abbreviations	2 hour 10%
7	**Communication Skills** Etiquettes in Communication Oral Communication Written Communication	1 hour 10%
8	**Professionalism and Values** Institutional/ organizational values Institutional Rules & Regulations Maintaining Discipline: During College Hours(Theory & Laboratory Postings) Behavior Etiquettes: During College Hours(Theory & Laboratory Postings)	2 hour 10%

Learning Activities:

- **Lecture and Presentation _ Group Discussion**
- **Class Participation**:
  - Engage in discussions and role-playing exercises, demonstrating an understanding of the material

Assessment:

- Quiz:
- Multiple-choice and short-answer questions

24BMT0101 (Human Anatomy)

Course Code	24BMT0101	Total Credit	4
Title of Subject	Human Anatomy	Total Hours/week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	To provide students with basic knowledge of anatomical terminology, basic histology, and understanding of the structural and functional organization of the normal human body.

Course Content

Unit	Description	Weightage
1	**Introduction-Human body as a whole** **1.1** Definition of anatomy and its divisions 1.2 Terms of location, positions and planes 1.3 Cell and its organelles 1.4 Epithelium-definition, classification, function, describe with examples 1.5 Glands- classification, describe serous & mucous glands with examples 1.6 Basic tissues – classification with examples **Demonstration &Tutorials:** **1.7** Histology & types of epitheliums 1.8 Histology of serous, mucous & mixed salivary gland	10%
2	**Locomotion and support** 2.1 Cartilage- Types with example 2.2 Bone- Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull 2.3 Joints- Classification of joints with examples, synovial joint 2.4 Muscular system: Classification of muscular tissue 2.5 Names of muscles of the body **Demonstration &Tutorials:** 2.6 Demonstration of all bones showing parts, radiographs of normal bones & joints 2.7 Demonstration of muscles of the body (as functional groups)	10%

3	**Cardiovascular system** 3.1 Heart-size, location, chambers, exterior & interior 3.2 Blood supply of heart 3.3 Systemic & pulmonary circulation	10%
	3.4 Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery 3.5 Inferior venacava, portal vein, portosystemic anastomosis 3.6 Great saphenous vein 3.7 Lymphatic system- cisterna chyli & thoracic duct 3.8 Names and brief of regional lymphatics, axillary and inguinal lymph nodes **Demonstration &Tutorials:** **3.9** Demonstration of heart and vessels in the body 3.10 Normal chest radiograph showing heart shadows	
4	**Gastro-intestinal system** 4.1 Parts of GIT, Oral cavity [lip, tongue (with histology)], tonsil, dentition, pharynx, salivary glands, Waldeyer's ring 4.2 Esophagus, stomach, small and large intestine, liver, gall bladder, pancreas 4.3 Radiographs of abdomen	10%
5	**Respiratory system** 5.1 Parts of upper and lower Respiratory System: nose, nasal cavity, larynx, trachea, lungs 5.2 Names of paranasal air sinuses **Demonstration &Tutorials:** **5.3** Demonstration of parts of respiratory system 5.4 Normal radiographs of chest	10%
6	**Urinary system** 6.1 Kidney, ureter, urinary bladder, male and female urethra **Demonstration &Tutorials:** 6.2 Demonstration of parts of urinary system 6.3 Radiographs of abdomen-IVP, retrograde cystogram	10%
7	**Reproductive system** 7.1 Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology) 7.2 Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology) 7.3 Mammary gland – gross **Demonstration &Tutorials:** **7.4** Demonstration of section of male and female pelvis with organs *in situ* 7.5 Radiographs of pelvis – hysterosalpingogram	10%

8	**Endocrine glands** 8.1 Pituitary gland 8.2 Thyroid gland, parathyroid gland, 8.3 Suprarenal gland- (gross) **Demonstration &Tutorials:** 8.4 Demonstration of the endocrine glands	10%
9	**Nervous system** 9.1 Neuron	10%
	9.2 Classification of Nervous System 9.3 Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (Gross Anatomy) 9.4 Meninges, Ventricles & cerebrospinal fluid **9.5** Blood supply of brain (in brief) 9.6 Cranial nerves (only names) **Demonstration &Tutorials:** 9.7 Demonstration of all parts of brain	
10	**Sensory organs** 10.1 Skin: histology and appendages of skin 10.2 Eye: Parts of eye & lacrimal apparatus 10.3 Extra-ocular muscles & nerve supply 10.4 Ear: parts of ear- external, middle & inner ear and contents **Demonstration &Tutorials:** 10.5 Demonstration and histology of eyeball	10%

REFERENCE BOOKS

1. William Davis (P) understanding Human Anatomy and Physiology MC Graw Hill
2. Human Anatomy for Nursing & Allied Sciences - 1st edition, Dr. M.K.Anand, Dr. Meena Verma, The Arora Medical Publishers Pvt. Ltd.
3. Fattana, Human anatomy,(Description and applied), Saunder's & C P Prism Publishers, Bangalore – 1991
4. ESTER, M. Grishcimer, Physiology & Anatomy with Practical, Considerations, J.P. Lippin Cott. Philadelphia

Course Outcome: At the end of the course, Students will be able to:

CO1	Define and use basic anatomical terminology of location, positions and planes of human body
CO2	Identify and describe locations, relations, and functions of major organ system of human body
CO3	Correlate structural and functional organization of cells and basic tissue of human body
CO4	Execute this knowledge during their health care practice

24BMT0102 (Human Physiology)

Course Code	24BMT0102	Total Credit	4
Title of Subject	Human Physiology	Total Hours /week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objective	To provide a comprehensive understanding about functioning of the human body at the cellular, tissue, organ and system levels including mechanism of homeostasis, integration of various physiological processes with applications.

Course Content

1	**Blood and Muscle Physiology** 1.1 Blood **1.1.1** Composition & Function of Blood **1.1.2** Erythropoiesis 1.1.3 Blood group 1.1.4 Hemostasis 1**.2 Muscle** **1.2.1 Structure & classification** **1.2.2** Neuromuscular junction 1.2.3 Muscle contraction: Mechanism & action **Demonstration &Tutorials:** **1.3** Hb Estimation 1.4 RBC & WBC Count 1.5 Blood Group **1.6** Bleeding Time & Clotting Time	15%
2	**Digestive System and Excretory System** 2.1 Movement and Alimentary tract 2.2 Deglutition and Mechanism of Vomiting, Diarrhea 2.3 Digestive juices 2.4 Micturition 2.5 Function of Kidney 2.6 Regulation of acid-base balance	15%

3	**Cardiovascular and Respiratory System** 3.1 Heart rate and sound 3.2 Blood pressure 3.3 Mechanism of breathing 3.4 Transportation of Oxygen and Carbon dioxide 3.5 Pulmonary volume and capacity **Demonstration &Tutorials:** **3.6** Arterial Blood Pressure 3.7 Pulse, Heart rate, Breathing rate	20%
	3.8 Thermometry	
4	**Endocrinology and Reproductive System** 4.1 Contraceptives Measures and Menstrual cycle 4.2 Puberty 4.3 Pregnancy and Lactation 4.4 Hormones of Pituitary gland, **4.5** Hormones of Thyroid & Parathyroid Glands 4.6 Hormones of Adrenal Gland and Pancreas **Demonstration &Tutorials:** 4.7 Pregnancy Test	20%
5	**Embryology** 5.1 Spermatogenesis & oogenesis 5.2 Ovulation, fertilization 5.3 Placenta	15%
6	**Nervous System and Special Senses** 6.1 Neuron and Neuroglia 6.2 Properties of nerve fiber 6.3 Reflex mechanism and Receptors 6.4 Mechanism of vision and hearing 6.5 Taste and smell **Demonstration &Tutorials:** 6.6 1st, 2nd & 8th Cranial nerve **6.7** Examination of sensory system, motor system & reflex	15%

REFERENCE BOOKS

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism publishers
2. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton
3. Jain AK, Concise Physiology, Latest Ed.

Course Outcome: At the end of the course, Students will be able to:

CO1	State the basic terminology & functions of each organ system of the human body

CO2	Define, explain, and correlate basic physiological processes of each organ system of human body
CO3	Correlate and explain the integrated responses of the organ systems of the body to physiological and pathological stresses
CO4	Execute this knowledge during their health care practice

24BMT0103 (General Pathology)

Course Code	24BMT0103	Total Credit	4
Title of Subject	General Pathology	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	• To equip the students with the knowledge of basic steps of histopathology including sample receiving, fixation, tissue processing, section cutting, staining and bio-medical waste management • To understand basic concepts of haematology, clinical pathology, and blood banking including routine laboratory investigations like collection, transport and processing of various samples or specimen including blood and urine, blood grouping and Rh typing.

Course Content

Unit	Description	Weightage
1	**Histopathology** **1.1** Introduction to Histopathology 1.2 Receiving of specimen in the laboratory 1.3 Use & care of Microscope 1.4 Various Fixatives: Mode of action, Preparation and Indication 1.5 Tissue processing for routine paraffin sections 1.6 Section Cutting 1.7 Staining of tissues- H & E Staining 1.8 Bio-Medical waste management	25%
2	**Clinical Pathology** 2.1 Introduction to Clinical Pathology 2.2 Collection, Transport, Preservation, and Processing of various clinical specimens 2.3 Urine Examination- 2.3.1 Collection and Preservation of Urine 2.3.2 Physical, Chemical, Microscopic Examination	30%
3	**Hematology** 3.1 Introduction to Haematology 3.2 Normal constituents of Blood, their structure and function 3.3 Collection of Blood samples 3.4 Various Anticoagulants used in Haematology 3.5 Laboratory safety guidelines 3.6 SI units and conventional units in Clinical Pathology Laboratory 3.7 Hb Estimation , PCV, ESR	25%
4	**Blood Bank** 4.1 Introduction of blood banking 4.2 Blood grouping and Rh Types	20%

	Tutorial/ Demonstration 1) Blood Grouping Rh typing	

	2) Hb Estimation 3) Packed Cell Volume [PCV], 4) Erythrocyte Sedimentation rate [ESR] 5) Bleeding Time, Clotting Time 6) Histopathology- Section cutting and H & E Staining [For B.Sc. MLT only]	

REFERENCE BOOKS

- Bancroft : Theory and Practical of Histology techniques
- Textbook of Clinical Blood Banking Science by Zmijewski
- Manual for Clinical Pathology by Sabitry Sanyal
- Practical Pathology by Dr.P.Chakraborty & Gargi Chakraborty
- Haematology for students and practitioners by Ramnik Sood
- Histological techniques by K.Laxminarayan
- Practical Pathology by Dr. K.Uma Chaturvedi & Tejiindersingh

Course Outcome: At the end of the course, Students will be able to:

CO1	Demonstrate basic steps of histopathology including sample receiving, fixation, tissue processing, section cutting, staining and bio-medical waste management
CO2	Explain basic concepts of haematology & routine clinical investigations of Haematology laboratory
CO3	Describe composition of blood and methods of estimating different components of blood
CO4	Perform samples collection, processing, transportation and urine examination
CO5	Explain blood banking and perform blood grouping and Rh typing

24BMT0104 (General Microbiology)

Course Code	24BMT0104	Total Credit	4
Title of Subject	General Microbiology	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives

- To provide basic knowledge of history & development of microbiology, application of various microscopes, morphology & physiology of bacteria.
- To explain relationships between the microorganisms, infection and immunity
- To introduce various methods as well as instruments for sterilization and disinfection
- To incorporate the concept of different culture media, methods and biochemical tests
- To provide knowledge about hospital acquired infection and biomedical waste management

Course Content

Unit	Description	Weightage
1	**Historical development & microbiology** 1.1 History and Pioneers in Microbiology: Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch (Koch's Postulates).Nobel prize awarded for research in Microbiology 1.2 Development in medical microbiology & immunology	10%
2	**Microscopy** 2.1 Microscopy: instruments ,Types of microscopic techniques 2.2 Details of Light Microscope (Principles, Techniques & Applications) 2.3 Principle & Application of following microscope: Dark Field Microscopy, Phase contrast Microscopy, Fluorescent Microscopy, Confocal Microscopy & Electron Microscopy	15%
3	**Morphology & Classification** 3.1 Nomenclature and classification of microbes (in brief) 3.2 Size & Shape 3.3 Morphology of bacteria: Structures of a bacterial cell and their functions 3.4 Physiology of Bacteria: Nutrition, Gaseous requirement, temperature requirement and other growth requirements	15%
4	**Immunology** 4.1 Immunity (in brief) 4.2 Infection: Sources of infection, Modes of transmission, Factors predisposing to microbial pathogenicity, Types of infectious diseases 4.3 Types of Vaccine & Immunization schedule	15%

5	**Sterilization and Disinfection** 5.1 Sterilization and Disinfection (in detail) 5.2 Principles and use of equipments of sterilization (Namely Hot Air Oven, Autoclave, Incinerator & Pasteurization) 5.3 Anti septic and disinfectants	15%
6	**General Microbiology** 6.1 Culture media in diagnostic bacteriology 6.2 Culture methods **6.3** Identification of bacteria-biochemical tests 6.4 Antimicrobial sensitivity test	15%
7	**Hospital infection** 7.1 Causative agents, transmission methods 7.2 Prevention and Control Hospital Infection 7.3 Blood Borne Infections 7.4 Principles and practice Biomedical Waste Management	15%
	Tutorial/ Demonstration 1) Compound Microscope 2) Grams stain 3) Acid Fast staining 4) Demonstration and sterilization of equipments- Hot Air oven, Autoclave, Bacterial filters 5) Demonstration of commonly used culture media, culture methods: Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, MacConkey medium, LJ media, Robertson Cooked meat media 6) Visit to hospital for demonstration of Biomedical waste management	

REFERENCE BOOKS

- Ananthanarayana & Panikar's Textbook of Microbiology
- Roberty Cruckshank – Medical Microbiology – The Practice of Medical Microbiology
- Essentials of Medical Microbiology by Apurba S. Sastry & Sandhya Bhat
- Silverton: Introduction to Medical Laboratory Technology

Course Outcome: At the end of the course, Students will be able to:

CO1	Explain history and development of microbiology
CO2	Use and handle various types of microscopes with proper technique and care
CO3	Identify and differentiate various types of bacteria
CO4	Describe the role of immunity against pathogens, types of infection and importance of Immunization
CO5	Select and operate various sterilization and disinfection techniques/instruments used in clinical laboratory
CO6	Select specific culture media, perform different culture methods and biochemical test for isolation and identification of specific microorganisms
CO7	Prevent and control hospital infections and manage biomedical wastes in health care settings
CO8	Perform Antibiotic Sensitivity Test and interpret the results

24BMT0105 (General Biochemistry)

Course Code	24BMT0105	Total Credit	4
Title of Subject	General Biochemistry	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	• To provide basic concepts of routine laboratory investigations and volumetric analysis required of clinical biochemistry laboratory • To sensitize about code of ethics for Medical Laboratory Technician at Health care organizations • To provide fundamental knowledge of different bio-molecules like carbohydrate, protein, lipid, enzymes, vitamins and nucleic acids

Course Content

Unit	Description	Weightage
1	**Introduction, Specimen collection and Handling** 1.1 Introduction to Bio-chemistry including code of ethics for Medical Lab technicians and Medical Lab Organization a) Duties to Patient b) Duties to colleagues and other professionals c) Duties to yourself d) Duties to society **e)** Duties to your profession 1.2 Reception, Registration and Bio-chemical parameters investigated 1.3 Sample Collection and Handling 1.3.1 Types of vials used in blood /specimen collection 1.3.2 Anticoagulants 1.3.3 Preservatives 1.3.4 Blood collection 1.3.5 Processing of samples 1.3.6 Preservation & Disposal of samples 1.4 Biological and chemical hazards: Safety and first aid 1.5 Introduction to laboratory apparatus: 1.5.1 Pipettes - different types (Graduated, volumetric, Pasteur, Automatic etc.), Calibration of glass pipettes 1.5.2 Burettes, Beakers, Flasks, Funnels, Cuvettes	15%
2	**Units of measurements and Preparation of solutions** 2.1 Conventional and SI units 2.2 Preparation of solutions 2.2.1 Molecular weight, equivalent weight of elements and compounds, Normality, Molarity 2.2.2 Molar solutions, Normal solutions, Percent solutions	10%
3	**Carbohydrates** 3.1 Definition, biological importance, classification, 3.2 Qualitative tests of carbohydrates 3.3 Digestion & Absorption of carbohydrates	15%

4	**Lipids** 4.1 Definition, biological importance, classification, 4.2Acid value, Iodine value, saponification value 4.3 Digestion & Absorption of lipids	15%
5	**Amino acids and Proteins** 5.1 Definition, biological importance, classification 5.2 Qualitative tests of proteins 5.3 Digestion & Absorption of proteins	15%
6	**Vitamins** Classification of Vitamins, Sources, Daily requirements, Deficiency diseases (In Brief)	10%
7	**Enzymes** **7.1** Nature, Classification of Enzymes 7.2 Factors affecting enzyme activity 7.3 Enzyme Inhibition	10%
8	**Nucleic acids- Structure and functional aspects** **8.1** Purine bases, Pyrimidine bases, Nucleosides, Nucleotides 8.2 DNA: Types, Structure & functions 8.3 RNA: Types, Structure & functions	10%
	Tutorial/ Demonstration 1) Reception and registration 2) Collection of Capillary blood & Venous blood 3) Separation of Serum and plasma from blood 4) Laboratory glass ware: Identification, Handling, Care and Maintenance, Uses 5) Lab instruments: Centrifuges, Balances, Photo Electric colorimeter, Spectrophotometer 6) Preparation of Solutions: Percentage solutions, Normal solutions, Molar solutions 7) Qualitative identification tests of sugars 8) Qualitative identification tests of proteins and amino acids	

REFERENCE BOOKS

- Text book of Biochemistry by Satyanarayana
- TEITZ – Clinical chemistry
- Vasudevan (DM) Sreekumari (S) Text book of Biochemistry for Medical students
- Varley – Clinical chemistry
- Kaplan – Clinical chemistry

Course Outcome: At the end of the course, Students will be able to:

CO1	Execute codes of ethics for Medical Laboratory Technologists at respective health care settings
CO2	Collect, process, preserve and dispose various samples used in clinical biochemistry laboratory
CO3	State all the biochemical parameters with its clinical conditions and interpret the diagnostic tests.
CO4	Manage and handle safety, first aid and hazards of the clinical biochemistry laboratory.
CO5	Prepare and handle each reagent and samples used in clinical biochemistry laboratory.
CO6	Describe fundamental concepts of all the bio-molecules like carbohydrates, proteins, lipids, enzyme, vitamins and nucleic acids
CO7	Analyze and interpret qualitative tests of bio-molecules independently.

24BMT0106 (English)

Course Code	23BMT0106	Total Credit	4
Title of Subject	English	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External *	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	• Develop communication skills in English by training them in handling all the four language skills effectively. The learners will be able to listen, speak, read and write in English adequately so that they could participate in various activities and perform satisfactorily.

Course Content

Unit	Description	Weightage
1	**Reading** Short stories from the text: 1.1 The happy Prince 1.2 A Horseman in the sky 1.3 The Wolves of Cernogratz 1.4 The Mark of Vishnu 1.5 The Trust Property	25%
2	Grammar Part: 2.1 Prefixes / Suffixes 2.2 Phrasal Verbs 2.3 Registers 2.4 Writing paragraphs, developing points / ideas 2.5 Writing resume, Job applications, Leave Application. 2.6 Letters of invitations (inviting / accepting/ declining), 2.7 Letters of complaint to civil authorities 2.8 Connectives 2.9 Concords- Subject-Verb Agreement. 2.10 Homophones and Homonyms 2.11 Reading Comprehension	50%

3	**Ability Enhancement** 3.1 Use various notions and function of everyday usage: 3.1.1 Dialogue Writing 3.1.2 Notions and Function of Language 3.2 Give short formal and informal talks, speeches 3.2.1 Self-Introduction. 3.2.2 Welcome speech. 3.2.3 Vote of thanks. 3.2.4 Describing People / Object / Scene. 3.2.5 Asking questions (Wh'/Interrogative/Choice (Disjunctive)/ Question tags (tail question)) 3.2.6 Expansion of idea.	25%

	3.2.7 Discuss topic in Group Discussion.	
	There shall be no University Practical Examination. ***External exam will be taken at institute level**	

REFERENCE BOOKS

- Grant Taylor. English Conversation Practice. New Delhi: Tata McGraw Hill
- R.P.Bhatnagar and R.T.Bell (1999) **Communication in English**, Hyderabad: Orient Longma

Course Outcome: At the end of the course, Students will be able to:

CO1	Listen, speak, read, and write in English effectively, enabling to participate in various academic and professional activities proficiently.
CO2	Understand and apply key grammatical concepts enhancing vocabulary and language precision.
CO3	Be proficient in composing structured paragraphs, developing points/ideas, and crafting various types of formal and informal letters
CO4	Enhance their reading comprehension skills, enabling them to understand and interpret a variety of texts accurately and efficiently.
CO5	Practice and perform various everyday communication functions and participate in group discussion

24BMT0107 (Health Care)

Course Code	24BMT0107	Total Credit	2
Title of Subject	Health Care	Total Hours/Week	2

Examination Scheme

Continuous Assessment (20 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

Course Objectives	• To provide a foundational understanding of health and nursing, covering health definitions, determinants, national policies, and key health programs in India. • To emphasize nursing principles, patient care techniques, bedside management, and first aid skills, equipping students with essential knowledge and practical abilities for effective healthcare delivery.

Course Content

Unit	Description	Weightage
1	**Introduction to Health** 1.1 Definition of Health 1.2 Determinants of Health 1.3 Health Indicators of India 1.4 Health Team	10%
2	**Health Policy and Programmes** 2.1 Concept 2.2 National Health Policy 2.3 National Health Programmes (Briefly Objectives and scope) 2.4 Population of India and Family welfare Programme in India	10%
3	**Introduction to law and ethics in health care** **1.1** Medical ethics - Definition - Goal - Scope **1.2** Introduction to Code of conduct **1.3** Basic principles of medical ethics – Confidentiality **1.4** Malpractice and negligence - Rational and irrational drug therapy **1.5** Autonomy and informed consent - Right of patients **1.6** Care of the terminally ill- Euthanasia **1.7** Medico legal aspects of medical records – Medico legal case and type-Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information-Unauthorized disclosure - retention of medical records - other various aspects.	20%

4	**Introduction to Nursing** 4.1 What is Nursing? Nursing principles 4.2 Inter-Personnel relationships 4.3 Bandaging: Basic turns; Bandaging extremities; Triangular Bandages and their application 4.4 Nursing Position, Bed making, prone, lateral, dorsal, dorsal recumbent, Fowler's positions, comfort measures, Aids and rest and sleep 4.5 Lifting and Transporting Patients: Lifting patients up in the bed.	20%
	Transferring from bed to wheel chair. Transferring from bed to stretcher	
5	**Bed Side Management** 5.1 Giving and taking Bed pan, Urinal 5.2 Observation of stools, urine and sputum 5.3 Understand use and care of catheters, enema giving 5.4 Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion 5.5 Recording of body temperature, respiration and pulse **5.6** Simple aseptic technique: Sterilization and disinfection 5.7 Surgical Dressing: Observation of dressing procedures	20%
6	**First Aid** 6.1 Introduction to first aid: Definition and importance, Legal and Ethical consideration 6.2 Initial assessment and response 6.3 Common first aid procedures: Cardiopulmonary Resuscitation (CPR) Techniques for adults, children, and infants, Choking (Recognition and response), Bleeding and Wound care 6.3 Handling specific emergencies: Burns, Fractures & sprains, poisoning 6.4 Shock management: Recognizing shock and initial treatment	20%

REFERENCE BOOKS

1. Medical Ethics, by C.M. Francis, Jaypee Brothers
2. Current Problems in Medical Ethics, by George V. Lobo, St. Paul's Society, Allahabad.
3. Ethics for doctors, nurses & patients by H.P. Dunn, St. Pauls Bandar, Mumbai

Course Outcome: At the end of the course, Students will be able to:

CO1	Define health, identify its determinants, and assess health indicators specific to India, understanding the roles and functions within a healthcare team.
CO2	Analyze the national health policy and major health programs in India, including family welfare initiatives, and evaluate their objectives and scope.
CO3	Acquire and demonstrate fundamental nursing principles, including patient positioning, bandaging, and safe lifting and transporting techniques, ensuring effective and compassionate care.
CO4	To perform bed side management and aseptic techniques
CO5	To provide basic first aid techniques and respond to emergency situations with essential life-saving skills

Detailed Curriculum
Of
B.Sc. (Honours) Medical Technology
(Radiography & Medical Imaging Technology)

Second Year

24BLT0201 (Radiation Physics and Medical Physics)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Second year

Course Code	24BLT0201	Total Credit	4
Title of Subject	Radiation Physics and Medical Physics	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**The aim of the subject is to provide knowledge of physics involved in diagnostic radiology which includes:** ➢ Description of radiation detection & measurement, biological effect of radiation & protection from radiation. ➢ Description of electricity, physics behind production of x ray & fluoroscopy, control and maintenance of X-ray tube.

Course Content

Unit	Description	Weightage
	(Radiation Physics)	
1	**Principles of Radiation Detection and Measurement** 1.1 Gas-filled detectors (ionization chambers, proportional counters and Geiger Muller counters). 1.2 Scintillation detectors. 1.3 Thermo-luminescent dosimeters (TLD) and film badge. 1.4 Reasons for choice of air- ionization. 1.5 Roentgen and RAD. 1.6 Simple principles of dosimeters.	10%
2	**Biological Effects of Radiation** 2.1 Chemical effects of radiation - radiolysis of water; production of free radicals radical reactions, g-valve. 2.2 Stochastic effects and non-stochastic effects, chromosome aberrations and mutations. Radiation effects on whole body (early effects and late effects) Concept of doubling dose. Risk factors.	10%

3	**Radiation Protection** 3.1 Principle of radiation protection - historical development, maximum permissible exposure concept; annual dose equivalent limits (A.D.E.L.) A.L.A.R.A. (as low as reasonably achievable) concept; internationa recommendations and current code of practice for the protection of persons against ionizing radiation's from medical and dental use.	10%

4	**Protective Materials** 4.1 Lead, lead - impregnated substances, building materials, concept of barriers, lead equivalents and variations with quality. 4.2 Design of x-ray tubes related to protection. Structural shielding design (workload, use factor, occupancy factor, distance) departmental protection. Radiation protection of staff members, patients and public. 4.3 Protection instruments & personnel and area monitoring.	10%
	(Medical Physics)	
5	**Mains Supply:** 5.1 Generation of electrical energy. 5.2 Distribution of electrical energy. 5.3 Use of electrical energy. Poly-phase supplies, availability of different voltages, feeder cables, line voltage drop; mains switches, fuses, circuit breakers. Earthing, insulation, high tension cables construction & design.	8%
6	**Diagnostic High Tension Circuits:** 6.1 Self-rectified, half-wave, full-wave, 4- rectifiers, 3 phases, capacitor discharge, and constant potential. 6.2 Main voltage compensation, mains resistance compensation, compensations for mains frequency variation. 6.3 Control of tube voltage, kilo voltage compensation; filament circuit, control of tube current, space charge compensation. High tension (tube selector) switch. Meters- function; use of shunts. Meters commonly found in diagnostic x-ray equipment, position in circuits, reading meters.	8%
7	**Switching and Timing:** 7.1 Exposure timers- spring activated, synchronous, electronic, auto timers, exposure switching-mechanical contractors, electronic switching in low tension and high tension circuits. 7.2 Interlocking circuits - use of relays, tube overload protection. Circuit diagrams - simple circuit diagrams as illustration of sequence from mains supply to controlled x-ray exposures, block diagrams.	8%
8	**X-Ray Tubes:** 8.1 Rotating anode x-ray tubes, design, rating, and use of rating charts, care of the x-ray tubes; inherent filtration and additional filtration; practical considerations in the choice of focus; speed of anode rotation; angle of anode inclination. 8.2 Grid-controlled x-ray tube.	8%

9	**Control of Scattered Radiations:** 9.1 Cones, tube diaphragms, single and multi-leaf grids, structure and materials; grid ratio and lines /cm. Parallel and focused grids, stationary grids, crossed hatched grids. Gridded cassettes, grid movements, Potter-Bucky diaphragms; single stroke, reciprocating and oscillating mechanisms. 9.2 Beam centering devices - center finders, optical centering devices, light beam collimators.	8%
10	**Equipments:**	
10.1	**Fluoroscopy and Image Intensifiers:** 10.1.1 Direct fluoroscopy, fluoroscopy image, fluoroscopic screen, explorators (serial changers, spot film devices) and accessories. Radiation protection including integrating timer. Tilting tables. 10.1.2 Principles and construction of image intensifiers, television camera tubes and cathode ray tubes. Recording the intensified image, methods of viewing the intensified image. 10.1.3 Equipment for fluorography and cine-fluorography. Radiographic and fluoroscopic tables, telecommand tables.	8%
10.2	**Equipment for Special Procedures:** 10.2.1 Special trolleys and chairs. 10.2.2 Portable and mobile x-ray units, cordless mobile x-ray equipment, capacitor discharge mobile equipment. 10.2.3 Equipments for O.T. Bi-plane radiography, cranial and dental equipment, skull tables. 10.2.4 Mammography. 10.2.5 Mass-miniature radiography. 10.2.6 Tomography (conventional x-ray tomography is obsolete after availability of computed tomography (CT) scan, only historical importance), multi section cassettes, rapid cassette changer, rapid film changer. 10.2.7 Magnification radiography. 10.2.8 Subtraction radiography.	6%
10.3	**Care and Maintenance of X-Ray Equipment:** 10.3.1 General principles of routine care. General care in use and special care of mobile equipment. 10.3.2 Simple test; Uses of spinning top and step wedge, checks on generator output; check for integrity of tomography equipment; procedure for obtaining radiograph of the small area of body. Use of ma (Milli-ampere) and timer Wisconsin test tool, test of kilo voltage, Wisconsin test cassette, use of focal spot test tool, testing light beam diaphragm, failures of x-ray tubes and HT cables.	6%

List of reference books:

1	Chesney's Radiographic Imaging by John Ball& Tony Price.
2	Fundamental of X-Ray and Radiation Physics by Joseph Selman.
3	Radiologic Science for Technologists by Stewart C. Bhushong.
4	Hand book of Medical Radiology by C Ramamohan.

5	Essential Physics for Radiology and Imagine by Akash Ganguly and Rezaul Karim.
6	Physical Radiation Protection in Medical Radiography by Sherer, Elsevier Science.
7	Radiation Protection in Medical Radiography by AS, RT(R), FASRT Statkiewicz Sherer Mary Alice.
8	Radiation Protection in Medical Imaging and Radiation Oncology by Richard J. Vetter and Magdalena S. Stoeva.

Course Outcome: At the end of the course, Students will be able to:

CO1	Explain about basic and radiological physics; principles and law of electricity and electromagnetic waves and their applications.
CO2	Describe different types of radiation detectors and their working mechanisms.
CO3	Explain different types of biological hazards of radiation.
CO4	Apply principles of radiation protection and materials used for radiation protection.
CO5	Execute the production of X-ray, different the types of X-ray tube & Fluoroscopy and controlling of scatter radiation.
CO6	Demonstrate the care and maintenance of X- ray tube and other accessories used in diagnostic radiography.

24BLT0202 (Radiographic Techniques-Basic)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Second year

Course Code	24BLT0202	Total Credit	4
Title of Subject	Radiographic Techniques-Basic	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**This course aimed to provide in depth knowledge to practice plain x-ray radiographs for the different regions of human body, which includes:** ➢ Anatomical knowledge, indications, contra-indications, patient preparation and techniques while performing routine and supplementary x-ray projections. ➢ Development of skills for patient handling & use of different accessories to improve the radiographic image quality while taking radiographs.

Course Content

Unit	Description	Weightage
1	**Preparation of the room, apparatus and instruments:** 1.1 Positions of the patient: erect, sitting, supine, prone, lateral, oblique, decubitus etc., relative position of x-ray tube and patient, relevant exposure factors. 1.2 Use of accessories such as radiographic cones, grid and positioning aids. 1.3 Anatomic and physiological basis of the procedure, association of theory with practical work. Radiographic appearances, both normal and common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and types of subject. 1.4 Radiation protection, use of gonad & thyroid shield, practical methods reducing radiation dose to the patient.	10%
2	**Upper limb:** 2.1 routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus. 2.2 Supplementary projections for scaphoid, carpal tunnel, ball catcher's projections, head of the radius, supracondylar fracture and olecranon process.	10%

3	**Lower limb:** 3.1 Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, kneejoint, patella and femurs. 3.2 Supplementary projections for Talo-calcaneal joint, forced projections for torn ligaments, flat feet, club feet, intercondylar projections for loose bodies in the knee, axial projection for patella.	10%

4	**Shoulder girdle and thorax:** 4.1 Routine projections for the shoulder joint, scapula, acromio-clavicular joint, clavicle, Sterno-clavicular joint, sternum and ribs. 4.2 Supplementary projections for the axial projection of clavicle, bicipital groove, coracoid process, classification of tendons, subluxation, upper ribs, lower ribs and axillary ribs.	8%
5	**Pelvic girdle and hip region:** 5.1 Routine projections for the whole pelvis, Sacro-iliac joints, hip joint and neck of femur. 5.2 Supplementary projections for the greater and lesser trochanters of femur. Frog leg projection, ischeum, symphysis pubis, ileum, acetabulum and congenital dislocation of hip arthrodesis.	8%
6	**Vertebral column:** 6.1 Routine projections for atlanto-occipital joint, cervical spine, cervico -thoracic junction, thoracic spine, lumbar spine, lumbo-sacral region, sacrum and coccyx. 6.2 Supplementary projections for the intervertebral foramina, posterior arch of atlas, flexion and extension of cervical spine, scoliosis and kyphosis, sacroiliac joint.	10%
7	**Skeletal survey:** 7.1 Skeletal survey for metabolic bone diseases, metastasis, hormonal disorders, renal disorders.	4%
8	**Skull:** 8.1 Routine projections for cranium and facial bones. 8.2 Supplementary projections for trauma, towne & method, sella-turcica, optic foramina, jugular foramina, temporal bones, mastoids, petrous bone, zygomatic arches, orbits, maxillae, nasal bones, mandible, temporomandibular joints.	10%
9	**Nasal sinuses:** 9.1 Techniques for frontal, maxillary, ethmoidal and sphenoid sinuses, erect and horizontal projections for fluid levels.	5%

10	**Teeth:** 10.1 Routine projections of all teeth –: intra-oral and extra-oral projections. 10.2 Supplementary projections for localization of roots, children, edentulous subjects and use of occlusals and bitewings, Orthopantomography.	10%
11	**Chest:** 11.1 Routine projections for lungs, cardia and diaphragm. 11.2 Supplementary projections for opaque swallow, thoracic inlet, soft tissue neck, decubitus, apicogram, pediatric cases.	10%
12	**Abdomen:** 12.1 KUB, erect abdomen and decubitus projection. 12.2 Supplementary projections for acute abdomen.	5%

List of reference books:

1	Clark's Positioning in Radiography by A. Stewart Whitley, Gail Jefferson, Charles Sloane, KenHolmes, Craig Anderson, GrahamHoadley.
2	Merrill's Atlas of Radiographic Positioning and Procedures by Bruce Long Jeannean Rollins Barbara Smith

Course Outcome: At the end of the course, Students will be able to:

CO1	Demonstratet the radiographic positioning and related anatomy to carry out routine and supplementary X-ray projections.
CO2	Implement various technical factor & accessories during routine and supplementary X-ray projections of different body regions.
CO3	Interpret different radiographic anatomy and pathology.

24BLT0203 (Radiographic Photography & Image processing)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Second year

Course Code	24BLT0203	Total Credit	4
Title of Subject	Radiographic Photography and Image Processing.	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**The course is aimed to provide knowledge of dark room and the image processing and factor affecting image quality, which includes:** ➢ Knowledge of construction, planning and components of dark room. ➢ Description of x ray films and their construction, properties and types. ➢ Methods of image processing using conventional to digital radiography. ➢ Description of all the instruments/ equipments associated with dark room and image processing and their use to improve radiographic image quality.

Course Content

Unit	Description	Weightage
1	**Dark room planning:** 1.1 For a small hospital; 1.2 For a large hospital; -location of dark room, construction of dark room, ventilation, wall protection entrance to dark room - single door, double door, labyrinth.	8%
2	**Dark room:** 2.1 Instruction to staff, dry bench, hopper, drawer, cupboard, loading and unloading of cassettes, hangers, types of hangers and storage of hangers printing, wet bench, cleanliness, control of dust, dark room sink, hatches, drier. 2.2 Safe lights; direct and indirect, uses, factors affecting safelight performance safelight tests, viewing room, film dispensing.	8%

3	**X-ray films:** 3.1 Glass, cellulose and polyester bases. 3.2 Structure of x-ray films - emulsion, gelatin, base and super coating. 3.3 Types of x-ray films, single coated, dualities, spectral sensitivity, colour sensitivity. 3.4 Grains of film, speed of films, screen & non-screen films, various formats o films.	8%

4	**Films for special procedures** 4.1 Storage of film materials and radiographs, record of film stock and radiographs. 4.2 Deterioration of films on storage, characteristic curves - uses of step wedge. 4.3 Information on basic fog, film gamma, contrast, speed, film latitude, effects on development.	8%
5	**Intensifying screens:** 5.1 Fluorescence – phosphors. 5.2 Phosphors employed: - calcium tungstate, barium fluro-chloride etc. 5.3 Rare earths. 5.4 Construction of intensifying screens. 5.5 The influence of kilo-voltage in different phosphors. 5.6 Intensification factor. 5.7 Resolving power of intensifying screens. 5.8 Speed of screens. 5.9 Screen film contact tests types of intensifying screens. 5.10 Advantages and limitations of intensifying screens.	6%
6	**X-ray cassette:** 6.1 Construction of x-ray cassettes. 6.2 Types of cassettes. 6.3 Mounting intensifying screens on cassettes, identification of cassettes. 6.4 Care of cassettes.	4%
7	**Day Light Film Handling:** 7.1 Day light system using cassettes. 7.2 Day light system without cassettes.	6%
8	**Photochemistry:** 8.1 Chemistry of image formation, formation of latent image, conversion of latent image to visible image. 8.2 Meaning of PH, importance of PH in processing films.	8%

9	**Processing Methods:** 9.1 Preparation of solution, manual processing apparatus, control of temperature, replenishment, rapid processing. 9.2 Automatic processor - principle and features, water supply, use of thermostat, regeneration of solutions, maintenance, advantage and limitations. Processing of cut films and roll films. • **Developer:** Constituents, characteristic, manual and automatic processors, effects on developing time, temperature, agitation, replenisher, exhaustion. • **Rinsing:** Acid stop-bath, methods, objects. • **Fixer:** Constituents, characteristics, manual and automatic processors, fixing time and clearing time factors affecting fixing time, replenisher, exhaustion.	12%
	‖ **Washing and Drying:** Objects, methods, factors affecting washing and drying, wetting agents, comparison of different method.	
10	**The radiographic image:** 10.1 The emergent beam related to densities on film contrast - objective and subjective, long scale and short scale, radiation contrast, film contrast and radiographic contrast, density. 10.2 Sharpness, sources of un-sharpness, avoiding different un-sharpness.	8%
11	**Resolution:** 11.1 Factors affecting resolution: • Choice of kilo-voltage and Milli-amperage • Choice of short focus and broad focus • Selection of focus to film distance and object to film distance • Selection of cassettes avoiding scatter radiation, magnification, distortion, penumbra presentation of a radiograph - identification markers - name printer. • Viewing equipment & magnifiers for cut films and roll films.	8%
12	**Film faults:** 12.1 Fog - various fogging in films, causes and prevention. 12.2 Stains - types, causes and prevention 12.3 Spots and splashes - types, causes and prevention 12.4 Marks and prints - types, causes and prevention 12.5 Drying marks - types, causes and prevention 12.6 Faults in automatic processor - types, causes.	8%

13	**Computer photography:** 13.1 Digital radiography - principles, processing, equipment's, advantages. 13.2 Radiological information systems.	8%
14	**Reproduction of radiographs:** 14.1 Copying radiographs. 14.2 Magnification and Minfication. 14.3 Contact prints. 14.4 Types of papers. 14.5 Equipments	8%

List of reference books:

1	Chesney's Radiographic Imaging by John Ball& Tony Price.
2	Fundamental of X-Ray and Radiation Physics by Joseph Selman.
3	Radiologic Science for Technologists by Stewart C. Bhushong.

Course Outcome: At the end of the course, Students will be able to:

CO1	Explain construction of dark room and accessories & equipments of dark room.
CO2	Perform independently image processing inside darkroom following appropriate technique of loading and unloading of cassette, proper use of safelight, wet bench, dry bench and processing chemicals and extracting silver from used fixer solution through various methods like electrolysis, metallic replacement etc.
CO3	Define the faults in radiographs due to inappropriate x ray and image processing and methods to improve the image quality.
CO4	Describe about modern image processing techniques.

24BLT0204 (Practical: Radiographic Techniques-I)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B.Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Second year

Course Code	24BLT0204	Total Credit	6
Title of Subject	Practical: Radiographic Techniques-I	Total Hours/Week	6 (P) 3 (T/D)

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**The course is aimed to make students capable of performing different radiographic procedure independently using imaging modalities such as X-ray, mammography, dental x-ray and fluoroscopy.**

Course Content

Unit	Description	Weightage
1	**Radiography - plain views of upper limb:** • Hands • Fingers • Thumb • Wrists • Forearm • Elbow • Humerus	15%
2	**Radiography - plain views of shoulder:** • Shoulder joint • Acromio-clavicular joint • Scapula various views and projections • Clavicle • Sterno-clavicular joint	15%

3	**Radiography - plain views of lower limb:** • Foot • Toes • Tarsus & Os Calcis • Ankle • Tibia & fibula • Patella & knee joint • Femur • Hip joint, pelvis & sacro-iliac joint	15%
4	**Radiography of vertebrae:** • Cervical spine upper, cervical spine lower, cervico-thoracic & cervico-middle • Thoraco- lumbar, lumbo-sacral • Sacrum & coccyx • Ribs-upper & lower • Sternum	15%
5	**Radiography of skull plain views:** • AP, lateral & towns, sinuses, mandible, mastoids • Equipment • Teeth	15%
6	**Radiography of chest:** • Lungs & trachea • Heart-diaphragm	15%
7	**Radiography of G.I. Tract:** Plain x-rays abdomen-erect; liver & spleen	10%

List of reference books:

1	Philip W.Ballinger: Merrill's Atlas Of Radiographic Positioning And Radiological Procedures (Mosby)
2	Ra Swallow, E Naylor: Clarks Positioning In Radiography E J Roebuck, A S Whitley
3	Sante Lr: Roentgenologic Technique (Edwards Inc)
4	Goldman: A Radiographic Index
5	Ross And Gailway: A Handbook Of Radiography (Lewis)
6	Glenda J.Bryan: Diagnostic Radiography (Mosby)
7	Piles: Medical Radiographic Technique (Thoms).

8	L.C.Gupta & U.C.Sahn : Radiography for Technicians (Jayee Brothers)

Course Outcome: At the end of the course, Students will be able to:

CO1	Interact with patients & take clinical history to perform radiographic procedures.
CO2	Perform different radiographic procedure independently using X-ray, Mammography, Dental X-ray and Fluoroscopy and demonstrate radiographic skills in clinical procedures.
CO3	Implement the knowledge and skills from clinical learning experience under the supervision of radiologist or senior technologist.

24BSC0201 (Basics of Research Methodology)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Second year

Course Code	24BSC0201	Total Credit	2
Title of Subject	Basics of Research Methodology	Total Hours/Week	2

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

Course Objectives

- Understand the fundamental concepts and significance of research in Medical Technology.
- Learn about different types of research designs and methodologies.
- Gain knowledge on various data collection techniques and tools.
- Understand basic statistical concepts and data analysis techniques.
- Learn about ethical issues and guidelines in research.
- Develop skills in writing research proposals, reports, and scientific papers.
- Apply research methodology concepts in designing and conducting a small-scale research project.

Course Content

Unit	Description	Weightage
1	**Introduction to Research:** 1.1 Definition and purpose of research 1.2 Types of research: Basic, Applied, Clinical, and Translational 1.3 Importance of research in medical technology 1.4 The research process: Steps from idea to publication	15%
2	**Research Design**: 2.1 Types of research designs: Descriptive, Analytical, Experimental, Quasi-experimental 2.2 Qualitative vs Quantitative research 2.3 Cross-sectional and Longitudinal studies	20%
3	**Data Collection (in brief)** 3.1 Primary vs Secondary data 3.2 Data collection methods: Surveys, Interviews, Observations, Questionnaires 3.3 Tools for data collection: Designing surveys and questionnaires	15%

4	**Data Analysis (in brief)** 4.1 Introduction to statistical concepts: Mean, Median, Mode, Standard Deviation 4.2 Data analysis techniques: Descriptive and Inferential statistics 4.3 Interpreting and presenting data: Tables, Graphs, Charts	20%
5	**Ethical Considerations in Research** 5.1 Importance of ethics in research 5.2 Informed consent and confidentiality 5.3 Plagiarism and Research misconduct	15%
6	**Research Writing** 6.1 Structure of a research proposal: Title, Abstract, Introduction, Methodology, Results, Discussion, Conclusion, References 6.2 Referencing styles: APA, MLA, Chicago, Vancouver 6.3 Presenting research findings: Oral and Poster presentations 6.4 Writing research reports and scientific papers	15%

REFERENCE BOOKS| |

			Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar	
			The Practice of Research in Health Care" by Hugh McLaughlin	
			Biostatistics: A Foundation for Analysis in the Health Sciences" by Wayne W. Daniel	
4. Articles from relevant medical and scientific journals

Course Outcome: At the end of the course, Students will be able to:

CO1	Apply the basic principles of research methodology in the field of Medical Technology
CO2	Design a small research project in the respective field
CO3	Effectively communicate the research findings

Detailed Curriculum
Of
B.Sc. (Honours) Medical Technology
(Radiography & Medical Imaging Technology)

Third Year

24BLT0301 (Diagnostic Imaging Techniques)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Third year

Course Code	24BLT0301	Total Credit	4
Title of Subject	Diagnostic Imaging Techniques	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**The course is aimed to provide detailed knowledge of Imaging Modalities like CT scan, MRI & USG so that learner can independently operate or assist during different radiographic procedure. Which are as follows:** ➢ Detailed knowledge of working mechanism, components, different imaging parameters, safety aspects and quality assurance of MRI. ➢ Detailed knowledge of working mechanism, components, different imaging parameters, dose optimization and quality assurance of CT scan. ➢ Detailed knowledge of working mechanism, components, and quality assurance of USG.

Course Content

Unit	Description	Weightage

1	**Computed Tomography:** 1.1 History of computed tomography scan 1.2 Working principles of computed tomography scan 1.3 Generations of CT scan (first to seventh generation) 1.4 Instrumentation of CT scan 1.5 Data acquisition 1.6 Data presentation 1.7 Image reconstruction 1.8 2-D and 3-D images 1.9 Image display 1.10 Pixel and voxel 1.11 CT Number 1.12 Window level and window width 1.13 Scan artefacts 1.14 Patient positioning in computed tomography 1.15 Contrast materials and administration. 1.16 Basic diagnostic aspects 1.17 Interventional CT Guided procedures 1.18 Documentation. 1.19 Safety consideration - radiation dose 1.20 Quality assurance.	35%
2	**Magnetic Resonance Imaging:** 2.1 History of MRI 2.2 Working principle of MRI; the spinning proton - magnetizations, precession, Larmor frequency 2.3 Radio frequency pulse and proton - resonance, free induction decay signal, relaxation: T-1 & T-2. 2.4 Instrumentation - magnet, shim coils, gradient coils, radio frequencytransmitter and receiver coils, computer. 2.5 Pulse sequences - saturation recovery, spin echo, inversion recovery. 2.6 Image production – 2-D and 3-D pictures. 2.7 Image quality - signal to noise ratio, contrast to noise ratio. 2.8 Image artifacts. 2.9 Flow techniques - magnetic resonance angiography, spectroscopy. 2.10 MR contrast agents - paramagnetic and ferromagnetic 2.11 Documentation. 2.12 Safety consideration 2.13 Quality assurance.	35%

3	**Ultrasound Imaging:** 3.1 History 3.2 Ultrasound characteristics - nature, propagation, frequency, wavelength, velocity, amplitude, intensity, acoustic impendence, reflection, refraction etc. Interference with media, interface, attenuation. 3.3 Transducer - piezoelectric effect, construction, types of arrays mechanical & electronic. 3.4 Acoustic coupling media. 3.5 Ultrasound instrumentation. 3.6 Display modes – A-mode, B-mode, M-mode, real time imaging. 3.7 Grey scale imaging 3.8 Doppler methods - continuous wave Doppler, pulsed Doppler, duplex, and real time color flow imaging. 3.9 Ultrasound artifacts. 3.10 Patient preparation and handling 3.11 Basic diagnostic aspects 3.12 Interventional techniques - transducer sterilization, needles, diagnostic procedures, therapeutic procedures. 3.13 Documentation 3.14 Safety consideration - effects of healing & cavitations. 3.15 Quality assurance - phantoms, performance, accuracy, sensitivity, spatial resolution tests.	30%

List of reference books:

1	Physical Principles, Clinical Applications, and Quality Control by Euclid Seeram.
2	MRI in practice by Caroly n Roth, Catherine Westbrook, and John Talbot.
3	Essentials of Ultrasound Physics by James A. Zagzebski
4	Quality assurance and controlling diagnostic radiology and imaging by Satish kumar Bhargava.
5	Patient Dosimetry and Quality Control in Diagnostic Radiology by Suliman Ibrahim Idris.
6	Christensen's Physics of Diagnostic Radiology by Thomas S. Curry III and James S.Dowdey and Robert C. Murry Jr.

Course Outcome: At the end of the course, Students will be able to:

CO1	Identify hardware & describe working principle of different imaging modalities like CT, MRI, USG.
CO2	Analyze Anatomical Details Of Images Of Different Imaging Modalities Like CT, USG & MRI.
CO3	Demostrate Use Of Contrast Media While Performing Investigation On Imaging Modalities Like CT & MRI.
CO4	Explain Dose Optimization And Different Safety Aspects In Imaging Modalities Like CT, USG & MRI.
CO5	Identify Different Types Of Image Artefacts And Method Of Improving Image Quality In Imaging Modalities Like CT, USG & MRI.
CO6	Perform Different Quality Assurance check, Daily Or Weekly Calibration Of Equipment's.

24BLT0302 (Radiographic Techniques-Applied)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Third year

Course Code	24BLT0302	Total Credit	4
Title of Subject	Radiographic Techniques- Applied	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**To provide detailed knowledge of special radiographic procedure using imaging Modalities Such as X-ray or fluoroscopy unit, CT scan, MRI, Radio-isotopes imaging, & USG. Which are as follows:** ➢ Detailed knowledge of Indications, contraindications, patient preparation, contrast media, techniques/ Filming sequences of the radiographic procedures. ➢ Understanding of dose optimization techniques and safety aspects during radiographic procedures. ➢ Understanding of clinical, ethical & legal responsibilities of radiographer during radiographic procedures.

Course Content

Unit	Description	Weightage
1	**Introduction:** 1.1 Responsibility of radiographer during radiological procedures. 1.2 Preparation of patient for different procedures. 1.3 Contrast media - positive and negative, ionic & non – ionic 1.4 Adverse reactions to contrast media and patient management 1.5 Emergency drugs in the radiology department 1.6 Emergency equipments in the radiology department 1.7 Asepsis 1.8 Radiation protection – Ten-day rule. 1.9 The following should be dealt with indication, contraindications, patient preparation, contrast media used, method of administration of contrast media, accessories required, technique to be adopted, variation in normal technique in specific circumstances, films taken, complications, precautions and after-care of the patient.	15%

2	**Gastro - intestinal tract:** 2.1 Barium swallow - tracheo - esophageal fistula 2.2 Barium meal - single contrast and double contrast 2.3 Hypotonic duodenography 2.4 Barium meal follow through 2.5 Small bowel enema 2.6 Barium enema - gastrograffin enema for reducing intussuception 2.7 loopogram	17%

	2.8 **Additional investigation:** of I Radio isotope scanning • Computed tomography **Biliary tract:** 2.9 Oral cholecystography 2.10 Intravenous choledochography 2.11 Pre-operative choledochography 2.12 Post-operative choledochography -percutaneous extraction retained biliary calculi 2.13 Percutaneous transhepatic choledochography-biliary drainage. 2.14 Endoscopic retrograde choledochopancreatography **2.15 Additional investigation:** I Radio isotope scanning • Computed tomography • Magnetic resonance imaging	
3	**Urinary system:** 3.1 Excretion urography 3.2 Percutaneous renal puncture 3.3 Percutaneous nephrostomy 3.4 Percutaneous nephrolithotomy 3.5 Lithotripsy 3.6 Reterograde pyeloureterography 3.7 Micturating cysto-urethrography - urodynamic investigations 3.8 Ascending urethrography 3.9 **Additional investigation:** I Radio isotope scanning • Computed tomography • Magnetic resonance imaging	11%
4	**Reproductive system:** 4.1 Hystero salpingogram 4.2 Gynaecography 4.3 Pelvimetry 4.4 Vesiculography 4.5 **Additional investigation:** I Computed tomography I Magnetic resonance imaging	11%

5	**Cardio-vascular system:** 5.1 Angiography: • Percutaneous catheterization ׀ ׀ Catheterization sites, asepsis • Guide wire, catheter, pressure injector and accessories • Use of digital subtraction, single plane and biplane 5.2 Head and neck arteriography 5.3 Pulmonary arteriography 5.4 Coronary arteriography 5.5 Ascending aortography 5.6 Trans lumbar aortography 5.7 Celiac axis, superior mesenteric and inferior mesenteric	13%
	arteriography 5.8 Renal arteriography 5.9 Trans femoral arteriography 5.10 Interventional vascular radiography 5.11 **Additional investigation:** • Echo Cardiogram (Doppler) • Radio isotope scanning • Computed tomography • Magnetic resonance imaging	
6	**Venography:** 6.1 Peripheral venography - lower limb, upper limb 6.2 Central venography, superior venacavography, inferior venacavography, pelvic venography 6.3 Ascending lumbar venography, intra osseous venography, percutaneous, splenoportography 6.4 Transhepatic portography, selective retrograde venography - renal venography 6.5 Adrenal venography, hepatic venography, internal jugular venography, orbital venography 6.6 Interventional vascular radiography 6.7 **Additional investigation:** • Radio isotope scanning • Computed tomography • Magnetic resonance imaging	11%

7	**Central nervous system:** 7.1 Cervical myelography - cisternal puncture and lateral cervical puncture 7.2 Lumbar myelography 7.3 Myelography with water soluble and oily contrast media 7.4 Air encephalography 7.5 Ventriculography 7.6 Lumbar discography 7.7 **Additional investigation:** • Radio isotope scanning • Computed tomography • Magnetic resonance imaging	11%
8	**Respiratory system:** 8.1 Nasopharyngography 8.2 Larynogography 8.3 Bronchography 8.4 Percutaneous lung biopsy 8.5 **Additional investigation:** • Radio isotope scanning • Computed tomography • Magnetic resonance imaging	11%

List of reference books:

1	Radiological Procedures-A Guideline by Bhushan N. Lakhakar.
2	Guide to Radiological Procedures by Chapman & Nakielny
3	Hand book of Interventional Radiologic Procedures by Krishna Kandarpa and Lindsay Machan and Janette Durham, Wolters Kluwer.
4	Interventional Radiology by Bradley B.Pua.

Course Outcome: At the end of the course, Students will be able to:

CO1	Explain use of different types of contrast media during different radiological procedure.
CO2	Analyze different types of adverse reaction, management, & different types of emergency drugs & equipment's in radiology department.
CO3	Demonstrate anatomy and analyze indication, contra-indication of radiographic procedure.
CO4	Perform different radiological procedure independently.
CO5	Identify radiographic error and improve the quality of radiographic images.
CO6	Execute different angiographic procedures including post procedural care.

24BLT0303 (Radiographic Techniques-Advanced)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Third year

Course Code	24BLT0303	Total Credit	4
Title of Subject	Radiographic Techniques-Advanced	Total Hours/Week	4

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Objectives	**The aim of the subject is to provide detailed knowledge of working mechanisms, equipments and role of nuclear medicine in diagnosis field as well as advanced radiological procedure in diagnostic radiology, which are as follows:** ➢ Detailed knowledge of production of radionuclides. ➢ Working mechanisms of PET scan, SPECT scan, fusion imaging. ➢ In-vivo and in-vitro examination in nuclear medicine. ➢ Safety aspects in nuclear medicine ➢ Details of advanced radiological procedure

Course Content

Unit	Description	Weightage
1	**Nuclear medicine imaging:** 1.1 History 1.2 Isotopes, radionuclides, & radiopharmaceuticals. 1.3 Positron emission tomography (PET) 1.4 Single photon emission computed tomography (SPECT) 1.5 Fusion imaging 1.6 Radio immune assay (RIA) 1.7 Documentation 1.8 Safety considerations - radiation dose 1.9 Quality assurance	60%

2	**Recent advances in radiology:** **Miscellaneous:** 2.1 Arthrography 2.2 Sialography 2.3 Lymphography 2.4 Sinography & Fistulography 2.5 Dacrocystography 2.6 Xeroradiography 2.7 Thermography 2.8 Kymography 2.9 Duplication radiography 2.10 Macro radiography 2.11 High kilo voltage technique	40%
	2.12 Soft tissue radiography 2.13 Multiple radiography 2.14 Subtraction radiography 2.15 Foreign body localization 2.16 Mobile radiography 2.17 Theatre radiography 2.18 Domiciliary radiography 2.19 Forensic radiography 2.20 Tomography	

List of reference books:

1	Nuclear Medicine basics – Chandra.R
2	Principles & practice of Nuclear medicine – Early.P.J
3	Physics and Radiobiology of Nuclear Medicine – Gopal.
4	Essentials of Nuclear Medicine Imaging – Mettler
5	Radionuclide Imaging artifacts – Wells & Bernier

Course Outcome: At the end of the course, Students will be able to:

CO1	Explain the production, safety aspects of radionuclides or radiopharmaceuticals.
CO2	Explain the use of different types of radionuclides or radiopharmaceuticals during different types of N.M. procedure.
CO3	Demonstrate the working mechanism of PET scan, SPECT scan, fusion imaging.
CO4	Identify safety aspect and quality assurance in department of nm.
CO5	Explain and perform advanced radiographic procedures.

24BLT0304 (Practical: Radiographic Techniques-II)

Name of the Institute: CAM Institute of Allied Health Sciences & Technology
Name of the Program: B. Sc. (Hons.) Medical Technology (Radiography and Medical Imaging Technology)
Year of the Program: Third year

Course Code	24BLT0304	Total Credit	8
Title of Subject	Practical- Radiographic Techniques-II	Total Hours/Week	8 (P) 4 (T/D)

Examination Scheme

Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
30	05	05	160	200

Course Objectives	The aim of the subject is to make learner capable of performing different radiographic procedure of different regions, independently using imaging modalities such as X-ray, Fluoroscopy, CT Scan & MRI. and also to provide practical knowledge so they can assist radiologist during special procedure & USG examination.

Course Content

Unit	Description	Weightage
1	Barium Swallow Exam (E) Radiology Technique	5%
2	Barium Meal Exam (E)	5%
3	Barium Follow Through Exam	5%
4	Barium enema Exam (E)	5%
5	Hypotinic Duodenography	5%
6	Barium Double Contrast Study (E)	5%
7	Intravenous Pyelography (E)	5%
8	Angiographic Studies 1. Arterial 2. Venous	30%
9	Lymphangiographic Studies	5%

10	Myleographic Studies	5%
11	Ventriculographic Studies	5%
12	Bronchographic Studies	5%
13	Macro Radiography Studies	5%
14	M.M.R.	5%
15	Mammography	5%
Note: (E) Indicates Practicals Prescribed for University Examination.		

List of reference books:

1	Scarrow, Contrast Radiography (Schering Chemicals)
2	Bhushan N. Lakhar, Radiological Procedure

Course Outcome: At the end of the course, Students will be able to:

CO1	Describe indications, contraindication and able to prepare patients for the radiographic procedures.
CO2	Perform various radiographic procedure independently using X-ray, Mammography, Dental X-ray and fluoroscopy.
CO3	Assist Radiologist during special radiographic procedures.
CO4	Execute the skill of patient handling for taking proper clinical history which will lead to accurate diagnosis.
CO5	Use diagnostic equipment independently for different procedures.
CO6	Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR Images.

List of reference books (Common):

1 Piles : Medical Radiographic Technique (Thomas)

2 Santel.R. : Roentgenologic Technique (Edwards Inc)

3 Philip Wballiger : Merils Atlas Of Radiographic Positions And Radiological Procedures (Mosby)

4 Goldman : A Radiographic Index

5 Patesson : Printed Notes For Radiographers In India (Cmai)

6 Achwaz : Unit Step Radiography (Thomas)

7 Ross & Galloway : A Hand Book Of Radiography (Lewis)

8 Glenda J. Bryan : Diagnostic Radiography (Churchill Livingstone)

9 Jacobi & Paris : Textbook Of Radiological Technology (Mosby)

10 Scarrow : Contrast Radiography (Schering Chemicals)

11 Vanderplasts : Medical X-Ray Technique (Mac Millan)

12 Stephen Chapman& Richare Nakielny : A Guide To Radiological Procedures (Jaypee Brothers)

13 R.F. Fatr & P.J. Ahisy : : Physics For Medical Imaging (Saunders)

14 D.N. Chesney & M.O. Chesney : : X-Ray Equipment For Student Radiographers (Cbs)

15 Christensen, Curry & Dowdey : An Introduction Of Physics To Diagnostic Radiography (Lea & Febiger)

16 Cullinan : Illustrated Guide Techniques (Blackwell)

17 Jamdrell, Thompson & Ashworth : : X-Ray Physics And Equipment (Blackwell)

18 Adrian K.Dixon : : Body C.T. - A Handbook (Churchill Livingstone)

19 John M. Stevens, Alan R. Valentine & : Computed Cranial & Spinal Imaging (Williams & Wilkins) Brian E. Kendall

20 John R. Haaga, Charles F. Lanzion, : Computerised Tomography And Magnetic Resonance Imaging Of The Whole David J. Sartoris & Elias A.Aerhouni Body (Vol.1 & 2) (Saunders).

21 Philip T. English & Christine Moore : MRI For Radiographers (Springer)

22 Rehani: : Diagnostic Imaging - Quality Assurance.

24 Roger C. Sounders : Clinical Sonography : A Practical Guide (Little Brown & Company)

25 Pes Palmer : : Manual Of Diagnostic Ultrasound (Who)

26 Sandra L Hagen Ansert: Text Book Of Diagnostic Ultrasonography (Bi Publications).