



A Curriculum

For

B.Sc. (Honours) in Medical Technology

(Radiotherapy 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	Radiotherapy 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 Program

In exercise of the powers conferred under Rule section 22(3) of Gujarat State Private Universities Act 2009, the Academic Council in its 9th meeting held on 22nd August 2024 under the agenda item No. 24.02.10, is pleased to approve the Curriculum for **B.Sc. (Hons) Medical Technology (Radiotherapy Technology)** Program 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 (Radiotherapy Technology)

2. ELIGIBILITY FOR THE ADMISSION:

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

2.1 DURATION OF THE PROGRAM:

The program of B.Sc. (Honours) in Medical Technology (Radiotherapy 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 practicals 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 course 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.

6.1 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 subject 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.

6.2 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, 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. To train students to work in conjunction with radiation oncology team including radiation oncologist, medical physicists and other members, in the application of prescribed doses of ionizing radiation for the treatment of malignant or benign disease.
2. To develop skills in management, administration of prescribed radiation treatment, and provisions of patient support.

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 patient-provider 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 execute all routine radio therapeutic procedures as per prescription and direction of Radiation Oncologist.
2. To operate the radiotherapy equipment used in treatment of cancer patient independently and maintain the equipment under the guidance of Medical Physicist.
3. To demonstrate and apply adequate knowledge about the safe handling of medical radiation sources, keeping in mind the radiation protection of staff, patients and public.
4. To demonstrate patient management skills.
5. Communicate with other members of healthcare team, customers and patients in an effective manner.
6. Upgrade knowledge and skills in a changing healthcare scenario.

Name of the Institute: CAM Institute of Allied Health Sciences & Technology

Name of the Program: B. Sc. (Hons) in Medical Technology (Radiotherapy 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) in Medical Technology (Radiotherapy 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								
24BRT0201	Fundamental of Physics	4	--	--	30	70	100	4
24BRT0202	Radiation Biology and onco-pathology	4	--	--	30	70	100	4
24BRT0203	Principles of Radiotherapy and oncology	4	--	--	30	70	100	4
24BRT0204	Practical – Radiotherapy Technology	--	4	4	30	70	100	6
24BSC0201	Basics of Research Methodology	2	1	--	20	40	60	3
24CES0201	Clinical Education (Studentship)	--	19	--	--	--	100	19
Total		14	24	12	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) in Medical Technology (Radiotherapy 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								
24BRT0301	Radiation Physics	4	-	-	30	70	100	4
24BRT0302	External Beam Therapy	4	-	-	30	70	100	4
24BRT0303	Principles and Practice of Radiotherapy	4	-	-	30	70	100	4
24BRT0304	Practical Radiotherapy Technology	-	6	4	40	160	200	8
24CES0301	Clinical Education (Studentship)	--	20	--	--	--	100	20
	Total	12	26	4	130	370	600	40
	Total hours	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) in Medical Technology (Radiotherapy Technology)

Year of the Program: Fourth year

CURRICULUM & CREDIT FRAME WORK

Corse Code	Corse Title	Hours/ 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 = 15 hours of clinical postings)

Clinical area at hospital	Hours/ week	Credit
Elekta Synergy platform	6 hours/week	6 credits
Varian True beams	6 hours/week	6 credits
CT Stimulation	6 hours/week	6 credits
Mould Room	4 hours/week	4 credits
Brachytherapy	3 hours/week	3 credits
Treatment Planning System	3 hours/week	3 credits
Total	28 hours/ week	28 credits
Research Project	12 hours/week	12 credits
TOTAL	40 hours/week	40 credits

Note:

1) Abbreviations: L-Lecture, T-Tutorial 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
(Radiotherapy 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 hours 10%
5	Clinical Microbiology and Immunology Introduction Key Areas Importance Terms and Abbreviations			2 hours 10 %
6	Pathology Introduction Key Areas Importance Terms and Abbreviations			2 hours 10%
7	Communication Skills Etiquettes in Communication Oral Communication			1 hour 10%

	Written Communication	
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 hours 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	<p>Introduction-Human body as a whole</p> <p>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</p> <p>Demonstration & Tutorials:</p> <p>1.7 Histology & types of epitheliums 1.8 Histology of serous, mucous & mixed salivary gland</p>			10%
2	<p>Locomotion and support</p> <p>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</p> <p>Demonstration & Tutorials:</p> <p>2.6 Demonstration of all bones showing parts, radiographs of normal bones & joints 2.7 Demonstration of muscles of the body (as functional groups)</p>			10%
3	<p>Cardiovascular system</p> <p>3.1 Heart-size, location, chambers, exterior & interior 3.2 Blood supply of heart 3.3 Systemic & pulmonary circulation</p>			10%

	<p>3.4 Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery</p> <p>3.5 Inferior venacava, portal vein, portosystemic anastomosis</p> <p>3.6 Great saphenous vein</p> <p>3.7 Lymphatic system- cisterna chyli & thoracic duct</p> <p>3.8 Names and brief of regional lymphatics, axillary and inguinal lymph nodes</p> <p>Demonstration &Tutorials:</p> <p>3.9 Demonstration of heart and vessels in the body</p> <p>3.10 Normal chest radiograph showing heart shadows</p>	
4	<p>Gastro-intestinal system</p> <p>4.1 Parts of GIT, Oral cavity [lip, tongue (with histology)], tonsil, dentition, pharynx, salivary glands, Waldeyer's ring</p> <p>4.2 Esophagus, stomach, small and large intestine, liver, gall bladder, pancreas</p> <p>4.3 Radiographs of abdomen</p>	10%
5	<p>Respiratory system</p> <p>5.1 Parts of upper and lower Respiratory System: nose, nasal cavity, larynx, trachea, lungs</p> <p>5.2 Names of paranasal air sinuses</p> <p>Demonstration &Tutorials:</p> <p>5.3 Demonstration of parts of respiratory system</p> <p>5.4 Normal radiographs of chest</p>	10%
6	<p>Urinary system</p> <p>6.1 Kidney, ureter, urinary bladder, male and female urethra</p> <p>Demonstration &Tutorials:</p> <p>6.2 Demonstration of parts of urinary system</p> <p>6.3 Radiographs of abdomen-IVP, retrograde cystogram</p>	10%
7	<p>Reproductive system</p> <p>7.1 Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)</p> <p>7.2 Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology)</p> <p>7.3 Mammary gland – gross</p> <p>Demonstration &Tutorials:</p> <p>7.4 Demonstration of section of male and female pelvis with organs <i>in situ</i></p> <p>7.5 Radiographs of pelvis – hysterosalpingogram</p>	10%
8	<p>Endocrine glands</p> <p>8.1 Pituitary gland</p> <p>8.2 Thyroid gland, parathyroid gland,</p> <p>8.3 Suprarenal gland- (gross)</p> <p>Demonstration &Tutorials:</p> <p>8.4 Demonstration of the endocrine glands</p>	10%
9	<p>Nervous system</p> <p>9.1 Neuron</p>	10%

	<p>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)</p> <p>Demonstration & Tutorials: 9.7 Demonstration of all parts of brain</p>	
10	<p>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</p> <p>Demonstration & Tutorials: 10.5 Demonstration and histology of eyeball</p>	10%
REFERENCE BOOKS		
<ol style="list-style-type: none"> 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
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
			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 1 st , 2 nd & 8 th 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
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
			100
Course Objectives	<ul style="list-style-type: none"> 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]	
<p>REFERENCE BOOKS</p> <ul style="list-style-type: none"> • 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
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
			100
Course Objectives	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Ananthanarayana & Panikar’s Textbook of Microbiology • Roberty Cruickshank – 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
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
			100
Course Objectives	<ul style="list-style-type: none"> • 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, 4.2 Acid 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 <ul style="list-style-type: none"> ● 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 *
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
			100
Course Objectives	<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> • 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
Internal examinations	Projects / Assignments	Attendance	Annual examination
10	05	05	40
			TOTAL
			60
Course Objectives	<ul style="list-style-type: none"> 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. (Hons) Medical Technology
(Radiotherapy Technology)
Second Year**

24BRT0201 (Fundamental of Physics)

Course Code	24BRT0201	Total Credit	4
Title of Subject	Fundamental of Physics	Total Hours/Week	4
Examination Scheme			
Continuous Assessment (30 marks)			External
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
100			
Course Objectives	<ul style="list-style-type: none"> • Acquire knowledge of basic applied mathematics: algebra, geometry, trigonometry and basic statistics. • Understand basics of electromagnetic radiation, atomic Structure and radioactivity. • Understand basics of electricity & magnetism, electromagnetic induction and transformer & rectifier. • Explain basics of radiation physics including X-ray production and X-ray tube technology. 		
Course Content			
Unit	Description		Weightage
1	Applied Mathematics: 1.1 Elementary use of algebraic symbols and signs, Fractions & Decimals. 1.2 Indices: Power of 10 simple equations, Logarithms. 1.3 Fundamentals of Trigonometry 1.4 Fundamentals of Geometry, Application of similar Triangles in finding focal spot. 1.5 Divergence from a point source. 1.6 Graphical representation of a data – linear & semi log plot, 1.7 Measurement of angles. Geometry of triangles, 1.8 Proportion, Inverse square law, Elementary explanation of exponential law. 1.9 Basic statistics: Distribution, differentiation, Integration, Vector Algebra.		10%
2	Electromagnetic Radiation, Atomic Structure and Radioactivity: 2.1 Electromagnetic waves and their properties, Inverse square law 2.2 The quantum theory of Radiation (Planck's concept of quanta, Photon and its characteristic properties), 2.3 The electromagnetic spectrum, Fluorescence and Phosphorescence, Photoelectric emission, Photocell, Intensity and quality of electromagnetic radiation. 2.4 The structure of the Atom: Nucleus, Atomic number (Z), Mass number (A), Ionization & Excitation, Isotopes, And the Periodic Table. 2.5 Radioactivity, Properties of alpha, beta, gamma radiation, Radioactive transformation process (Radioactive displacement law), Radioactive decay (Radioactive disintegration law), decay constant, half-life, Units of Radioactivity 2.6 Radioactive nuclides in medicine 2.7 Radioactive disintegration process and radiation emission and daughter products. 2.8 Properties of radium and its daughter elements. 2.9 Radioactive equilibrium. 2.10 Production of artificial radioactive isotopes. 2.11 The principles of the nuclear reactor. 2.12 The curie and specific gamma ray emission.		25%
3	Fundamental of Electricity (Basic of Electronics): 3.1 Electric charges and units of electric charge, Coulombs law, Electric induction, electric potential & potential difference, Capacitance and Capacitors, Resistance.		25%

	<p>3.2 Conductors, Insulators and Semiconductors, Electric current, Ohm's law & Kirchhoff's law, circuit laws (Combination of Potential difference in series and parallel, meters, Electrical energy & Power, heating effect of a current.</p> <p>3.3 The magnetic effects of an electric current (Electromagnetism), electromagnetic induction, Mutual induction and Self-induction.</p> <p>3.4 Alternating current, The A.C. transformer theory, and construction, Types of transformers its practical aspects, Transformer losses and regulation and rating, Types of transformers used in X-ray equipment.</p> <p>3.5 Thermionic emission. The vacuum diode, Variation of anode current with anode voltage and filament temperature in the vacuum diode, the effect of gas in the diode, the thermionic gas diode. Meaning of rectification (full wave & half wave rectification).</p> <p>3.6 Principles of semiconductors, p-n junction diode, High voltage rectifier circuits (self-rectifying circuit, Half-wave pulsating voltage circuit, Full-wave pulsating voltage circuits, shock proofing. Advantages of semiconductor devices over thermionic devices</p>	
4	<p>X-rays (Basics of Radiation Physics):</p> <p>4.1 Conductivity of electricity through gases at low pressure, Cathode rays – production and properties. Sources of electrons (Discharge through gases, Thermionic emission and photoelectric emission), Discovery of an electron, Concept of electron volt.</p> <p>4.2 Discovery of X-rays, Production & properties of X-rays. Bremsstrahlung, Factors influencing the intensity and quality of X-rays, Construction and working of Modern Xray tube (fixed anode and rotatory anode tubes), The physics of X-spectra i.e., the spectrum of radiation from an X-ray tube (Continuous spectrum and line or characteristic spectrum), Factors upon which the X-ray emission depends, Soft and Hard X-rays, Distribution of X-rays in space, The diagnostic X-ray tubes (inserts and shields), filament design, anode design (fixed and rotatory), methods of cooling, Basic X-ray Circuit. Linear accelerator – Transmission Type Target.</p> <p>4.3 Fine focus and large focus. Importance of Focal spot. Line focus principle and shape of the anode surface, Anode heel effect.</p> <p>4.4 Basic interactions between X-rays and matter: Coherent scattering, Photoelectric effect, Compton scattering, Pair production and Photodisintegration, Attenuation and absorption, Reduction in intensity due to absorption and attenuation and the inverse square law(Exponential formula), Filtration, Attenuation coefficients and half value layer. Energy absorbed from X-rays, Factors affecting transmission of a homogenous beam through an object (geometry, thickness, wavelength of beam, composition of an object), Transmission of a heterogeneous X-rays beam,</p> <p>4.5 Transmission of X-rays through body tissues: Relative amount of scattered radiation in an X-ray beam during its passage through a patient. The practical aspects of X-ray absorption and transmission in body tissues. The physics of the radiograph. The basic of the X-ray measurements.</p> <p>4.6 The units of Exposure (Roentgen) and Absorbed dose (gray) and their simple principles of dosimeters. The fluorescent effect of X-rays. The photographic film as a dosimeter, X-ray quality specification and measurement, Kilo voltage peak, half value thickness. Routine methods of checking quality. Definition of KERMA.</p> <p>4.7 Dosimetry quantities (mean energy imparted, the specific energy, exposure and exposure rate, absorbed dose and absorbed dose rate, concept of karma,</p> <p>4.8 Protection quantities (dose equivalent and effective dose equivalent) and Definition of Rem & Sievert. Linear Energy Transfer (LET) - Low & High LET Radiation.</p>	40%

REFERENCE BOOKS

- 1) The Physics of Radiation Therapy 5 th Edition-FM Khan.
- 2) The Physics of Radiology, -Harold E. Johns and John Robert Cunningham.
- 3) Introduction to Radiological Physics and Radiation Dosimetry, - Frank H. Attix.
- 4) Radiation Oncology Physics: A Handbook for Teachers and Students,-
IAEA Ervin B. Podgoršak.

- 5) Treatment Planning in Radiation Oncology -Faiz M Khan.
- 6) Textbook of Radiological Safety -K. Thayalan
- 7) The Physics of Radiology and Imaging - K Thayalan, Ramamoorthy Ravichandran
- 8) Meredith WJ, Massey JB . Fundamental physics of radiology

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

CO1	Develop a solid foundation in applied mathematics, including algebra, geometry, trigonometry, statistics, and calculus, enabling them to solve complex problems in radiological sciences.
CO2	Gain a comprehensive understanding of electromagnetic radiation, atomic structure, and radioactivity, including their properties, interactions with matter, and applications in medical imaging.
CO3	Acquire knowledge of fundamental electrical principles, electronic components, and circuits, particularly as applied to X-ray equipment and image production.
CO4	Describe X-ray generation, properties, and interactions with matter, including factors affecting image quality and patient dose.
CO5	Apply radiation protection principles, dosimetry concepts, and the calculation of radiation doses, ensuring safe practices in radiological procedures.

24BRT0202 (Radiation Biology and Oncopathology)

Course Code	24BRT0202	Total Credit	4
Title of Subject	Radiation Biology and Oncopathology	Total Hours/Week	4
Examination Scheme			
Continuous Assessment (30 marks)			External
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
			100
Course Objectives	<ul style="list-style-type: none"> • Acquire knowledge of basic of mechanism of ionizing radiation on malignant cell and normal tissue and how to achieve therapeutic ratio. • Understand basic of how malignant tumor differ from benign tumor, etiopathology and natural history of cancer, staging & grading of cancer. • Understand detail pathology of site wise cancer i.e. GU Cancer, GI Cancer etc. 		
Course Content			
Unit	Description	Weightage	
1	Radiation Biology: 1.1 Physics and chemistry of radiation absorption 1.2 Therapeutic ratio, Radiation biology continuum, Tissue Heterogeneity 1.3 Interaction of Ionizing radiation with biologic materials. 1.4 Biochemical repair of the DNA Damage: BER / NER / SSB / Mismatch repair 1.5 Cytogenetic effects of radiation 1.6 Cell survival curves and cell survival theory 1.7 Cellular repair: Sublethal damage, potentially lethal damage 1.8 Ionizing radiation and cell cycle 1.9 Densely Ionizing radiation : Linear energy transfer, Relative biologic effectiveness 1.10 Oxygen Effect 1.11 Radiosensitizers, Radioprotectors and bio reductive drugs 1.12 Growth kinetics of normal tissues and Tumors: Growth fraction, 1.13 Volume doubling time, cell loss factor 1.14 Early and late effects of normal tissues 1.15 Time dose fractionation relationships: NSD Model, LQ model 1.16 Radiation protection	50%	
2	Applied Anatomy and Pathology: 2.1 Tumors : Definition, formation of tumors, characteristics of benign and malignant tumors, spread of tumors. 2.2 Types of benign tumors & malignant tumors: a) Epidemiology b) Etiology c) Carcinogenesis d) Characteristic of neoplasia (Natural History) e) Histological classification of neoplasia f) Spread of neoplasia g) Staging and grading systems	25%	
3	Pathology of Common Malignant Disease of Individual sites (In brief): a) Skin cancer b) Head and neck tumors c) Brain tumors	25%	

- | | |
|--|--|
| <ul style="list-style-type: none"> d) GI tract tumors (esophagus, rectum, and anus) e) Lung cancer f) Lymphomas g) Breast cancer h) Gynecological cancers i) Genitourinary Cancers j) Pediatric Tumors and others | |
|--|--|

REFERENCE BOOKS

- 1) Radiation Oncology Physics: A Handbook for Teachers and Students,-IAEA Ervin B. Podgoršak
- 2) Radiology for the Radiologist- Eric J Hall and Amato J Giaccia
- 3) Textbook of Pathology 8th Edition – Harsh Mohan
- 4) Practical Radiotherapy Planning Fourth Edition – Ann Barrett , Jane Dobbs
- 5) Basic Radiation Oncology – Murat Beyzadeoglu, Gokhan Ozyigit, Cuneyt Ebruli

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

CO1	Master radiation's impact on cells and tissues, including DNA damage, repair, and cellular reactions.
CO2	Grasp radiation therapy fundamentals, including dosage, treatment scheduling, and using radiation-enhancing or protecting drugs.
CO3	Demonstrate normal and cancerous tissue biology, including growth patterns, radiation effects, and treatment planning.
CO4	Prioritize radiation safety for patients, staff, and the public, while also mastering tumor characteristics, pathology, and treatment planning and collaborating with other healthcare professionals.

24BRT0203 (Principles of Radiotherapy and Oncology)

Course Code	24BRT0203		Total Credit	4
Title of Subject	Principles of Radiotherapy and oncology		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	<ul style="list-style-type: none"> • Acquire knowledge about interaction of usage of various modalities of cancer E.g. Surgery, radiotherapy and chemotherapy. • Understand what are the presenting symptoms of cancer and how cancer shows effect on our body. • Understand various techniques of delivery radiotherapy, its side effects and how to prevent and manage side effects. • Understand various fractionation schedule of radiotherapy. • Understand how important imaging in oncology, palliative care and utility of radiotherapy in emergency. 			
Course Content				
Unit	Description			Weightage
1	Neoplasia characteristics and staging 1.1 Development of neoplasia within the patient 1.2 Clinical signs and symptoms of neoplasia, 1.3 Physical effects of neoplasia on the body 1.4 Staging of Cancer (TNM classification).			25%
2	Special Techniques 2.1 External Beam Therapy & Brachytherapy: Rationale, Preparation of Patient, Techniques including 3D-CRT, IMRT, VMAT, 4-D Imaging, Stereotactic radiosurgery, Dose, Volume, Time, Fractionation, Simulation, Reduplication of Treatment, Results, Survival. 2.2 Altered Fractionation Schedules 2.3 Re-irradiation			25%
3	Biological effects of cancer therapy 3.1 Acute and Late Effects of Radiation Therapy 3.2 Care & assistance during Sedation / Anesthesia 3.3 Physical effects of radiotherapy, chemotherapy, surgery and other treatments, in combination and alone on the body. 3.4 Prevention and treatment of the acute side effects of radiotherapy and associated treatments 3.5 Complications associated with cancer and its treatment, Causes of death 3.6 Emergency in radiotherapy.			25%
4	Other therapy modalities 4.1 Role of imaging in radiotherapy. 4.2 Role of surgery in cancer management. 4.3 Role of chemotherapy in cancer management. 4.4 Neoadjuvant, adjuvant and concurrent chemotherapy			25%

	4.5 Palliative and supportive care in cancer. 4.6 Organ preservation in oncology 4.7 Cancer pain and management	
REFERENCE BOOKS: <ol style="list-style-type: none"> 1. The Physics of Radiation Therapy 5 th Edition-FM Khan. 2. Handbook of radiotherapy physics: theory and practice - P Mayles, A Nahum, JC Rosenwald 3. Textbook of Pathology 8th Edition – Harsh Mohan 4. Practical Radiotherapy Planning Fourth Edition – Ann Barrett, Jane Dobbs 5. Basic Radiation Oncology – Murat Beyzadeoglu, Gokhan Ozyigit, Cuneyt Ebruli 		

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

C01	Describe tumor development, symptoms, physical impact, and staging.
C02	Demonstrate advanced therapy methods, including treatment planning, delivery, and outcomes.
C03	Explain acute and long-term side effects, patient care, and emergency procedures.
C04	Analyze the role of imaging, surgery, chemotherapy, and supportive care in cancer management.
C05	Implement organ preservation, pain management, and palliative care strategies & deliver effective and compassionate cancer care.

24BRT0204 (Radiotherapy Techniques-I)

Course Code	24BRT0204		Total Credit	6
Title of Subject	Practical –Radiotherapy Techniques-I		Total Hours/Week	4 (T/D) 4(P)
Examination Scheme				
Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100
Course Objectives	<ul style="list-style-type: none"> • Understand about patient disease, patient general condition, shifting the patient into treatment room & couch, patient positioning using immobilization devices, plan verification and patient specific quality assurance for various types of plans. • Familiarization with necessity and preparation of immobilizing devices for Head & Neck, Breast, Abdomen/Thorax and Pelvis patients for External beam radiotherapy. • Observation of CT simulation processes for radiotherapy. • Observation of radiotherapy Treatments as per Doctor's Prescription in radiation therapy chart. • Study of Inverse square law, Beam Quality factors, Mould room procedures, making of custom field shaping blocks, calculation of Magnification factor and Mechanical QA for Linac. 			
Course Content				
Practical	Description			Weightage
1	RADIOTHERAPY: 1.1 Familiarization with the workflow of radiotherapy treatments 1.2 Knowledge of various parts of CT-Simulator and Linear accelerators. 1.3 Process of CT-Simulation and making various site-specific immobilization devices for radiotherapy Treatments for Head & Neck cancers (E), Breast cancer (E), Abdomen/Thorax cancers (E) and Pelvis cancers. (E) 1.4 Understanding of working and use of various CT-Simulator and Linac Accessories, Beam Direction devices and control consoles. 1.5 Study of Inverse Square Law to understand the beam divergence property for a point source and use of it to calculate the change in beam intensity at various distances from source. (E) 1.6 Study of beam quality factor for High Energy Photon beams. (E) 1.7 Study of Mechanical Quality Assurance tests of Linear Accelerator. (E) 1.8 Study of mould room procedures and custom shielding cutout blocks and calculation of magnification factor. (E)			50%
2	Radiotherapy workflow through observation for following cases: 2.1 Esophagus cancer 2.2 Cervix cancer 2.3 Breast cancer			50%

	2.4 Glottis cancer 2.5 Nasopharyngeal cancer 2.6 Bronchogenic cancer 2.7 Whole Brain 2.8 Cranio-Spinal Axis Irradiation (optional) 2.9 Irregular Field (including Mantel Field) 2.10 Special Techniques (Rotation/ Arc etc.) 2.11 Newer Techniques (optional)	
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Course Outcome: At the end of the course, Students will be able to:

C01	Master radiotherapy equipment and physics.
C02	Perform patient simulation and immobilization.
C03	Analyze the radiotherapy workflow and treatment planning.
C04	Ensure treatment quality and safety.
C05	Handle advanced radiotherapy techniques.
C06	Apply practical experience in a radiotherapy setting.

24BSC0201 (Basics of Research Methodology)

Course Code	24BSC0201	Total Credit	2	
Title of Subject	Basics of Research Methodology	Total Hours/Week	2	
Examination Scheme				
Continuous Assessment (30 marks)			TOTAL	
Internal examinations	Projects / Assignments	Attendance		Annual examination
10	05	05	40	60
Course Objectives	<ul style="list-style-type: none"> ● 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		15%	

	6.3 Presenting research findings: Oral and Poster presentations 6.4 Writing research reports and scientific papers	
<p>REFERENCE BOOKS</p> <ul style="list-style-type: none"> • "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 • 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
(Radiotherapy Technology)
Third Year**

24BRT0301 (Radiation Physics)

Course Code	24BRT0301		Total Credit	4
Title of Subject	Radiation 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	<ul style="list-style-type: none"> • Understand radiation properties, interactions, detection, and measurement principles for effective radiation therapy. • Learn about radiation effects on living organisms and implement safety measures to protect patients and staff. • Master the generation, characteristics, and therapeutic applications of these radiations. • Calculate and deliver accurate radiation doses to tumors while minimizing damage to healthy tissues. • Apply radiation protection principles, treatment planning techniques, and quality assurance measures for optimal patient outcomes 			
Course Content				
Unit	Description			Weightage
1	Principles of Radiation detection and measurement: 1.1 Gas-filled detectors (ion chambers, proportional counters and Geiger Muller counters) scintillation detectors, thermo-luminescent dosimeters (TLD). 1.2 Reasons for choice of air ionization. 1.3 Roentgen and Rad. 1.4 Simple principles of dosimeters. 1.5 Thimble chamber –electronic equilibrium and dose buildup. 1.6 Secondary Dosimeter. 1.7 Elementary principles of Scintillation detectors, Thermoluminescence dosimeters, Semi-conductor devices.			10%
2	Biological Effects of Radiation: 2.1 Chemical effects of radiation, radiolysis of water, production of free radicals, radical's reactions, G-value. 2.2 Effects - Stochastic and non-stochastic effects, chromosome aberrations and mutations. 2.3 Radiation effects on whole body (early effects and late effects). 2.4 Concept of doubling dose.			10%
3	Radiation Protection: 3.1 Philosophy of radiation protection – historical development, Maximum permissible exposure concept; Annual dose equivalent limits (ADEL) ALARA concept; international recommendations and current code of practice. 3.2 Annual dose limits for public & Radiation workers. Protection of Public and Radiation workers. 3.3 Protective materials: Concrete, lead, lead – impregnated substances, building materials, concept of barriers, lead equivalents and variations with quality. 3.4 Teletherapy Bunker (Room) Design (Telecobalt, Linear Accelerator).			10%

	<p>3.5 Radiation protection features taking into account the work load, use factor, occupancy factor.</p> <p>3.6 Wall features with respect to primary beam and secondary radiation.</p> <p>3.7 Ceiling thickness depending on occupancy on the floor above Teletherapy room.</p> <p>3.8 Positioning of Air</p> <p>3.9 conditioning outlets.</p> <p>3.10 Design of Brachytherapy room: difference between public area and restricted areas.</p> <p>3.11 Radioactive source movement, control and maintenance of records. Protection instruments and personnel and area monitoring. (Survey meters, area monitors, pocket dosimeters and contamination monitors).</p>	
4	<p>Production of X- and Gamma Ray Beams for Therapeutic purposes:</p> <p>4.1 Tubes and high-tension circuits for the production of X-ray from 5 to 500 curie Kv. Insulation and cooling problems in Radiotherapy tubes.</p> <p>4.2 Mains voltage compensation. Control of tube voltage.</p> <p>4.3 The control panel and control. The filament circuit.</p> <p>4.4 Timers' safety devices and interlocks,</p> <p>4.5 Basic principles of mega voltage X-ray Machines.</p> <p>4.6 Distribution of Radiation around the target.</p> <p>4.7 Gamma ray beam unit.</p>	10%
5	<p>Interaction of X and Gamma Rays with Matter:</p> <p>5.1 Photoelectric absorption; Compton scattering; pair production. Dependence on the nature and atomic number of the absorber and on the radiation energy.</p> <p>5.2 Range of secondary electron and its practical importance.</p> <p>5.3 Principles of filtration, protection and beam definition.</p> <p>5.4 Filters, beam – flattening devices, diaphragms and applicators.</p>	10%
6	<p>Measurement of X and Gamma Rays:</p> <p>6.1 The roentgen and the rad,</p> <p>6.2 Quality. Half value thickness and its measurement,</p> <p>6.3 Methods of measurement; ionization; photographic; scintillation; calorimetric; thermoluminescent, their relative advantages.</p> <p>6.4 Ionization dosimeters; dose – rate, integrating and capacitor types.</p> <p>6.5 The Geiger – Muller counter.</p> <p>6.6 Scintillation counters and dosimeters.</p>	10%
7	<p>Practical Dosage Measurements and Calculation:</p> <p>7.1 Initial calibration. Site of focal spot or source; alignment of applicator or diaphragm turntable and of the applicator of diaphragm.</p> <p>7.2 Variation of dose rate across the beam in air.</p> <p>7.3 Phantoms and phantom materials. Bolus materials.</p> <p>7.4 Air, surface and depth doses; factors affecting them.</p> <p>7.5 Calculation of treatment times.</p> <p>7.6 Isodose curves.</p> <p>7.7 The effect of focal spot or surface source site; penumbra.</p> <p>7.8 Energy absorption in the body tissues and its effects on depth dose.</p>	
8	<p>Protection:</p> <p>8.1 Protective materials in common use,</p> <p>8.2 Room and machine radiation – protection in X- and Gamma – ray beam installations,</p> <p>8.3 Care and custody of small sealed radioactive sources (for example radium, caesium-137, Strontium 90).</p> <p>8.4 Precautions to be taken in the use of dispensing of radioactive solutions.</p> <p>8.5 Personnel-monitoring methods. Department survey. Film badges, capacitor</p>	10%

	chambers and survey meters. Geiger-Muller detector. 8.6 Relevant protection recommendations and current code of practice	
9	Technical aspects of X and Gamma Ray Therapy: 9.1 Tumor location and verification, principles of simulators, 9.2 Field combinations and treatment planning, 9.3 Beam direction devices, 9.4 Compensating filters (for example wedges) 9.5 Physical principles of moving field and grid therapy, 9.6 Special aspects of Radiotherapy using mega voltage radiations, including electron beam therapy.	10%
10	Clinical Dosimetry for Photon and Electron Beams 10.1 Dose distribution along beam axis 10.2 Dose distribution off axis 10.3 Variation of dose rate with distance and collimator settings 10.4 Manual calculation of treatment times 10.5 Beam modifiers (bolus, wedge, compensators) 10.6 Computer dose calculations 10.7 Definition of volumes and their significance 10.8 Single, parallel and multi-field technique 10.9 Effect of change of energy, beam direction, beam collimation, irradiation Geometry 10.10 Calculated and applied doses and beams against professional knowledge	10%
REFERENCE BOOKS 1. The Physics of Radiation Therapy 5 th Edition-FM Khan. 2. Introduction to Radiological Physics and Radiation Dosimetry, - Frank H. Attix Kuppusamy T Basic radiological physics		

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

CO1	Grasp radiation properties, interactions, detection, measurement, and dosimetry for accurate treatment planning and delivery.
CO2	Learn about radiation's impact on the human body, implement safety measures, and design radiation facilities.
CO3	Acquire X-ray and gamma-ray expertise: Master radiation production, beam characteristics, and treatment techniques for various cancer types.
CO4	Ensure patient safety and treatment optimization: Apply radiation protection principles, quality assurance, and clinical dosimetry for optimal patient outcomes.

24BRT0302 (External Beam Therapy)

Course Code	24BRT0302	Total Credit	4
Title of Subject	External Beam Therapy	Total Hours/Week	4
Examination Scheme			
Continuous Assessment (30 marks)			External
Internal examinations	Projects / Assignments	Attendance	Annual examination
20	05	05	70
			TOTAL
Course Objectives	<ul style="list-style-type: none"> • Understand principles and functioning of various radiotherapy equipments such as Kilo voltage X-ray machines, Tele-Cobalt therapy machine, Particle Accelerators and Linear Accelerators. • Knowledge of External beam characteristics of Photons and Electrons beams. • Understand basics of External beam treatment planning principles and procedures including various Immobilizations, Mould room techniques, Simulation, Dose prescription & reporting, treatment plan verification methods, QA methods and Emergency procedures. • Acquire the knowledge of basic and advance radiotherapy techniques such as 3D-CRT, IMRT, IGRT, VMAT, SRS, SBRT, Tomotherapy, TBI, TSET, Gamma Knife, etc. • Understand various types of Brachytherapy, various Brachytherapy sources, Manual and After loading system and various Brachytherapy clinical applications. 		
Course Content			
Unit	Description		Weightage
1	Radiation equipment 1.1 Principles and functioning of low energy x-rays 1.2 Principles and functioning of Tele-cobalt machines 1.3 Principles and functioning of linear accelerators		10%
2	Dose delivery to the patient 2.1 Immobilization of patient 2.2 Interpretation of the treatment prescription and plan 2.3 Setting up of the prescribed beam parameters and check against reference marks 2.4 Preparation, fixation and care of in vivo dosimeters (if available) 2.5 Registration of the delivered beam parameters on a daily basis 2.6 Documentation of portal verification and results of in vivo dosimetry 2.7 Surveying the patient during the treatment procedure		10%
3	Special techniques 3.1 Total body irradiation 3.2 Hemi-body irradiation 3.3 Conformal Beam Radiation Therapy 3.4 Intensity Modulated Radiation Therapy 3.5 Stereo tactic radiotherapy 3.6 Intra-operative radiotherapy 3.7 Image guided radiotherapy 3.8 Tomotherapy		10%
4	Technical Aspects of the use of Radioactive Sources in the Body:		5%

	<p>4.1 Construction, measurement, testing and properties of small sealed radioactive sources,</p> <p>4.2 Dose calculations involving the inverse square law,</p> <p>4.3 Physical principles of moulds and implants,</p> <p>4.4 Superficial beta ray therapy. Measurement beta ray dose.</p> <p>4.5 Clinical beta-ray appliances.</p> <p>4.6 Physical principles of the clinical use of unsealed radioactive sources.</p>	
5	<p>Construction of Cobalt –60 Teletherapy Units:</p> <p>5.1 Types of source drawers (cylindrical/ Rotating Drum)</p> <p>5.2 Isocentric Setup and design of the Unit</p> <p>5.3 Collimation: Primary, secondary & tertiary</p> <p>5.4 Laser beam, Beam direction devices, back pointer, pin & arc principles.</p> <p>5.5 Beam modifying devices: Wedge Filters, Tissue compensators. Blocks, Breast cone.</p> <p>5.6 Radiation safety aspect</p> <p>5.7 Understanding why strength of Teletherapy source at a given distance, definition of RHM / RMM</p>	5%
6	<p>Construction of Linear Accelerator</p> <p>6.1 Isocentric Setup and design of the Unit</p> <p>6.2 Collimation: Primary, secondary & tertiary, Symmetric/Asymmetric.</p> <p>6.3 RF production, Accelerator Tube, Bending Magnets</p> <p>6.4 Targets of X-ray and Electron beam production</p> <p>6.5 Radiation safety aspect: Ionization chamber, quality assurance checks.</p> <p>6.6 Definition of TMR, TPR with respect to high energy x-ray beams</p> <p>6.7 Concept of monitoring units instead of timer as in Telecobalt</p> <p>6.8 Measurement of output factor and its calibration</p> <p>6.9 Multileaf collimator: 3D conformal /</p> <p>6.10 Stereotactic Radiation therapy & Surgery/IMRT.</p> <p>6.11 Portal imaging/IGRT.</p>	10%
7	<p>BRACHYTHERAPY</p> <p>7.1 Knowledge of use of radionuclides and after loading equipment (low, medium, high and pulsed dose rate)</p> <p>7.2 Preparation of the source holders (applicators, catheters)</p> <p>7.3 Preparation of the patient including radiographs for dosimetry and preparation of the moulds</p> <p>7.4 Monitoring of the patient before, during and after treatment</p> <p>7.5 Accurate and complete recording of documentation of all the parameters relevant to the treatment</p> <p>7.6 Aftercare of the used radioactive sources with emphasis on safety</p> <p>7.7 Clinical Dosimetry for Brachytherapy</p>	10%
8	<p>OTHER TREATMENT MODALITIES</p> <p>8.1 Gene therapy</p> <p>8.2 Photodynamic therapy</p> <p>8.3 Unsealed radioactive nuclides</p> <p>8.4 Radiation enhancers - hypothermia, radiosensitizers</p>	5%
9	<p>LOCALISATION AND SIMULATION</p> <p>9.1 Principles and functioning of simulators</p> <p>9.2 Patient positioning, knowledge of fixation techniques</p> <p>9.3 Knowledge of simulation techniques for a broad range of indications and use of contrast media</p> <p>9.4 Contour taking techniques and reference marking</p> <p>9.5 Use of CT and MR images</p>	10%

	9.6 Data recording and transfer	
10	QUALITY ASSURANCE - METHODS 10.1 Equipment and auxiliary materials (to include care of) 10.2 Treatment procedures - accuracy, reproducibility and verification 10.3 Data handling 10.4 Monitoring and evaluation of QA procedures 10.5 Calibration of instruments 10.6 Emergency procedures	10%
11	MOULD ROOM TECHNIQUES 11.1 Immobilization Devices & techniques for patients and their preparation 11.2 Beam shaping devices (block, compensators etc.) and their preparation 11.3 Bolus material and their preparation 11.4 Moulds for Brachytherapy	10%
12	BASIC RADIOLOGIC IMAGING TECHNIQUES 12.1 Radio logic Film – types, exposure, development 12.2 Production of Radiographic Image using simulator, CT Scanner or conventional x-ray machines 12.3 Improving Image Quality 12.4 Fluoroscopy 12.5 Dark Room Procedures	5%
REFERENCE BOOKS 1) The Physics of Radiation Therapy 5 th Edition-FM Khan. 2) The Physics of Radiology, -Harold E. Johns and John Robert Cunningham. 3) Introduction to Radiological Physics and Radiation Dosimetry, - Frank H. Attix. 4) Radiation Oncology Physics: A Handbook for Teachers and Students,- IAEA Ervin B. Podgoršak. 5) Treatment Planning in Radiation Oncology -Faiz M Khan 6) Textbook of Radiological Safety -K. Thayalan 7) The Physics of Radiology and Imaging - K Thayalan, Ramamoorthy Ravichandran		

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

CO1	Describe the principles and operation of radiation sources used in therapy, including X-ray machines, cobalt-60 units, and linear accelerators.
CO2	Acquire skills in patient immobilization, treatment planning interpretation, and dose delivery techniques to ensure accurate and consistent radiation administration.
CO3	Demonstrate specialized treatment modalities like IMRT, stereotactic radiotherapy, and brachytherapy for complex cancer cases.
CO4	Apply radiation protection principles, equipment safety, and quality assurance measures to minimize risks to patients and staff.
CO5	Develop skills in patient positioning, contouring, and treatment plan creation using imaging and simulation technologies.
CO6	Apply knowledge of radiation physics, biology, and equipment to deliver effective and safe cancer treatment.
CO7	Integrate knowledge of radiation equipment, treatment techniques, and quality assurance to provide high-quality patient care.

24BRT0303 (Principles and Practice of Radiotherapy)

Course Code	24BRT0303		Total Credit	4
Title of Subject	Principles and Practice of Radiotherapy		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	<ul style="list-style-type: none"> • Knowledge of clinical applications of External beam treatment planning principles and procedures including various Immobilizations, Mould room techniques, Simulation, Dose prescription & reporting, use of conventional and complex treatment plan, treatment plan verification methods, QA methods and Emergency procedures. • Understanding of clinical applications of various basic and advance radiotherapy techniques such as 3D-CRT, IMRT, IGRT, VMAT, SRS, SBRT, Tomotherapy, TBI, TSET, Gamma Knife, etc. • Acquire skills of proper patient positioning, immobilization, daily reproduction errors and corrections in clinical applications. • Learn what is work up, treatment recommendation and radiotherapy treatment in the management of various cancer. • Learn research methodology, importance of psychological support in cancer patient, legal aspects and some basics of emergency procedures. 			
Course Content				
Unit	Description			Weightage
1	Diagnostic Workup and Treatment principles and Radiotherapy Techniques.			10%
2	Radiotherapeutic Management of the following Cancer and occasional Benign Diseases 2.1 Skin cancer 2.2 Head and neck tumor 2.3 Brain tumor 2.4 GI tract tumors (esophagus, rectum, anus) 2.5 Lung cancer 2.6 Lymphomas 2.7 Breast cancer 2.8 Gynecological cancers 2.9 Prostate cancer 2.10 Bladder cancer 2.11 Seminoma 2.12 Pediatric Malignancies			25%
3	Clinical applications of techniques of Radiotherapy: Teletherapy techniques 3.1 Use of conventional fields SSD, SAD, Rotation 3.2 Use of complex treatment plans – quality assurances, verification etc.			10%

	<p>3.3 Use of radiation sensitizers & radiation protectors and their importance with respect to timing of the radiotherapy exposure</p> <p>3.4 Patient positioning, immobilization, daily reproduction errors and corrections</p>	
4	<p>4.1 Combination of Teletherapy and Brachytherapy Post & Pre-operative Radiotherapy</p> <p>4.2 Special Techniques: 3D Conformal RT, IMRT, SRS/SRT -</p> <p>4.2.1 Patient setup, Immobilization</p> <p>4.2.2 Simulation / CT Simulation and Verification with quality assurance checks</p> <p>4.2.3 Use of Immobilization devices & Frames – careful handling</p> <p>4.2.4 Daily reproduction and quality assurances</p> <p>4.2.5 Port filming and isocenter verification</p> <p>4.3 Clinical applications of Special teletherapy techniques.</p> <p>4.3.1 Total body irradiation</p> <p>4.3.2 Hemi-body irradiation</p> <p>4.3.3 Conformal Beam Radiation Therapy</p> <p>4.3.4 Intensity Modulated Radiation Therapy</p> <p>4.3.5 Stereo tactic radiotherapy</p> <p>4.3.6 Intra-operative radiotherapy</p> <p>4.3.7 Image guided radiotherapy</p> <p>4.3.8 Tomotherapy</p> <p>4.3.9 Total Skin electron treatment</p>	25%
5	<p>PSYCHOSOCIAL MANAGEMENT</p> <p>5.1 Procedures for adaptation and rehabilitation of the person with cancer- Body Mechanics, Moving & Transferring Patients- Patients with Spinal cord injury, Fractured Extremity, Agitated & Confused patients</p> <p>5.2 Pediatric , Geriatric Patients.</p> <p>5.3 Patient with Ostomy, Gastric tube, Tracheotomy.</p> <p>5.4 Assisting with Drug and Contrast Administration,</p> <p>5.5 Counseling skills</p> <p>5.6 Role of effective communication</p> <p>5.7 Complementary therapies</p> <p>5.8 Stress and stress management</p> <p>5.9 Hospice and terminally ill</p>	5%
6	<p>QUALITATIVE AND QUANTITATIVE METHODS OF RESEARCH</p> <ul style="list-style-type: none"> • Basic statistics, Interpretation of Research Publications • Report writing 	5%
7	<p>MEDICAL, LEGAL AND ETHICAL ASPECTS</p> <p>7.1 Getting the consent of the patient</p> <p>7.2 Confidentiality, Data handling and information control</p> <p>7.3 Non-discriminatory practice</p> <p>The professional role of the Radiotherapy technologists</p>	5%
8	<p>HEALTH AND SAFETY</p> <p>8.1 Waste management and source Disposal</p> <p>8.2 Legislation: National and international</p> <p>8.3 Health and safety at work</p> <p>8.4 Emergency procedures</p> <p>8.5 Cardiopulmonary resuscitation procedures (CPR)</p>	5%

	8.6 Self Help Groups & NGO`s and other organizations funding agencies	
9	RECENT ADVANCES IN RADIOTHERAPY. 9.1 3D CRT, IMRT, Particle Beam Therapy, IGRT, Radiation Sensitizer and Protectors, Cyber Knife, Tomotherapy, Gamma Knife	10%
REFERENCE BOOKS 1) The Physics of Radiation Therapy 5 th Edition-FM Khan 2) Walter and Millers Textbook of Radiotherapy: Radiation Physics, Therapy and Oncology 3) Practical Radiotherapy Planning Fourth Edition – Ann Barrett, Jane Dobbs 4) Basic Radiation Oncology – Murat Beyzadeoglu, Gokhan Ozyigit, Cuneyt Ebruli 5) Handbook of Evidence – Based Radiation Oncology 3 rd Edition – Eric K. Hansen, Mark Roach III.		

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

CO1	Acquire comprehensive knowledge of radiation therapy techniques, including conventional and advanced modalities, for optimal cancer treatment.
CO2	Learn to manage patients undergoing radiotherapy, including psychosocial support, symptom management, and rehabilitation.
CO3	Understand radiation protection principles, quality assurance measures, and legal and ethical considerations in radiotherapy practice.
CO4	Stay updated with the latest advancements in radiotherapy, including research methodologies and emerging technologies.

24BRT0304 (Practical: Radiotherapy Techniques II)

Course Code	24BRT0304		Total Credit	6
Title of Subject	Practical: Radiotherapy Techniques II		Total Hours/Week	6
Examination Scheme				
Continuous Assessment (30 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
30	05	05	160	200
Course Objectives	<ul style="list-style-type: none"> • Understand principles and functioning of various radiotherapy equipments such as Kilo voltage X-ray machines, Tele-Cobalt therapy machine, Particle Accelerators and Linear Accelerators. • Knowledge of External beam characteristics of Photons and Electrons beams. • Understand basics of External beam treatment planning principles and procedures including various Immobilizations, Mould room techniques, Simulation, Dose prescription & reporting, treatment plan verification methods, QA methods and Emergency procedures. • Acquire the knowledge of basic and advance radiotherapy techniques such as 3D-CRT, IMRT, IGRT, VMAT, SRS, SBRT, Tomotherapy, TBI, TSET, Gamma Knife, etc. • Understand various types of Brachytherapy, various Brachytherapy sources, Manual and After loading system and various Brachytherapy clinical applications. 			
Course Content				
Unit	Description			Weightage
1	RADIOTHERAPY 1.1 Cobalt-60 machine: various parts, it working its Accessories, Beam 1.2 Direction devices and control console. (E) 1.3 Linear Accelerator: Various parts, it's working its Accessories, Beam 1.4 Direction devices and control console. (E) 1.5 Simulation and Treatment Techniques (E)			25%
2	Execution of Treatment as Per Doctor's Prescription in radiation therapy chart 2.1 Ability to understand the, patients' disease, patients' general condition, shifting the patient into treatment room & couch, patient positioning, use of immobilization devices and preparation of the same, verification and quality assurances align <ul style="list-style-type: none"> a. Cancer Esophagus b. Cancer Cervix c. Cancer Breast d. Glottic cancer e. Nasopharyngeal cancer f. Bronchogenic cancer g. Whole Brain h. Cranio-Spinal Axis Irradiation (optional) i. Irregular Field (including Mantel Field) j. Special Techniques (Rotation/ Arc etc.) k. Newer Techniques (optional) 			25%
3	Brachytherapy: 3.1 Manual after loading applicators: Various types: I/c, I/Vaginal, I/L Principles, its care, sterilization, uses, safety measures. Remote After Loading machines, - LDR / HDR: Parts, working, operation and precautions.			20%

	3.2 Various after loading sources for Interstitial Implantation: Physical features. 3.3 Preparation of Radioactive Source for Brachytherapy	
4	I/c application cancer cervix. 4.1 Application, simulation study of dose distribution, preparation of sources, loading of sources and treatment and care and removal and storage of sources.	10%
5	I/L Radiotherapy application. 5.1 Application, simulation, study of dose distribution, preparation of sources, loading of sources and treatment and care and removal and storage of sources.	10%
6	Advanced Training 6.1 Dynamic Wedges 6.2 Stereo Tactic Radiotherapy / Surgery 6.3 3D CRT 6.4 IMRT 6.5 Portal Imaging Method 6.6 HDR Brachytherapy	10%

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

CO1	Students will learn about radiation therapy equipment, patient care, and treatment planning.
CO2	Students will explore brachytherapy, advanced treatment methods, and clinical applications.
CO 3	Students will gain practical experience, develop problem-solving abilities, and ensure patient safety through quality assurance.