

# **CURRICULUM AND SYLLABUS**

FOR

**TWO YEARS DIPLOMA COURSE IN RADIOTHERAPY TECHNOLOGY**

*Offered by*

**DR. B. BOROOAH CANCER INSTITUTE**

**GUWAHATI – 781016**

*Affiliated under*

**SRIMANTA SANKARDEVA UNIVERSITY OF HEALTH SCIENCES, ASSAM**

## TWO YEARS DIPLOMA COURSE IN RADIOTHERAPY TECHNOLOGY

1. **Name of the course** : Diploma programme in Radiotherapy Technology
2. **Duration of the course** : Two Years
3. **Number of seats** : Ten (10)
4. **Admission Eligibility** :
  - i) 10+2 Science Standard with minimum 45% marks
  - ii) Both male and female
5. **Medium of Instruction** : English shall be the medium of instruction
6. **Justification of the project** : Shortage of Radiotherapy Technologist in the country as a whole. The shortage is more acute in North Eastern Region. This course will open up job avenues.
  
7. **Chairman of the course** :  
Dr. A.C. Kataki  
Director  
Dr. B. Borooah Cancer Institute  
Guwahati -16
  
8. **Course Co-ordinator** :  
Dr. N. K. Kalita  
Chief Consultant & Head  
Department of Radiation Oncology  
Dr. B. Borooah Cancer Institute  
Guwahati -16
  
9. **Teaching Faculties** :
  1. Dr. N. K. Kalita, MBBS, MD
  2. Dr. A. K. Kalita, MBBS, DMRD, DMRT, MD
  3. Dr. M. Bhattacharyya, MBBS, DMRT, MD
  4. Dr. U. Bhuyan, MBBS, MD, MSc (Nu-Med)
  5. Dr. B. K. Das, MBBS, MS
  6. Dr. R. Begum, MBBS, MD
  7. Dr. C. Bhuyan, MBBS, MD
  8. Dr. J. Dev Sharma, MBBS, MD
  9. Dr. T. Rahman, MBBS, MS
  10. Dr. D. Barman, MBBS, MD
  11. Dr. S. M. Bhagabaty, MBBS, MD
  12. Dr. K. Bhagabaty, MBBS, Dip. Pal. Med
  13. Dr. D. Guha
  14. Mr. U. Gogoi, B.Sc. (Hons), DRP
  15. Mr. Shachindra Goswami, Msc, DRP
  16. Ms. Mithu Barthakur, Msc, DRP
  17. Mr. Pranjal Goswami, Msc, DRP

9. Non teaching staff :
1. Sri P. C. Barman
  2. Mr. H. K. Deka
  3. Mr. S. K. Das
  4. Mr. A. K. Das
  5. Md. Abdul Halim
  6. Mr. L. A. Sharma
  7. Mr. Jaiguru Saha
  8. Mr. Rahul Nath Bhowmik
  9. Mr. Gitartha Chaudhury
  10. Mr. Bapan Das
  11. Mr. Nabajit Sharma

10. **Machines & Equipments** :

**Teletherapy Equipments:**

- (a) One Thetratron-780 machine for external radiotherapy
- (b) One Phoenix machine for external radiotherapy
- (c) One Dual Energy Linear Accelerator (2 photons, 5 electrons) with 3D-CRT & IMRT facilities.
- (d) One Low Energy Linear Accelerator (6 MV photon, 6 electrons) with 3D-CRT facility
- (e) One Radiotherapy Simulator
- (f) One CT Simulator.

**Brachytherapy Equipments:**

- (a) One Micro Selectron HDR for Brachytherapy.

**Dosimetry Equipments:**

- (a) One CD Hi-Tech Secondary Standard Dosimeter
- (b) One UNIDOSE E-Secondary Standard Dosimeter
- (c) One Farmer Dosimeter
- (d) One Radiation Field Analyser
- (e) One Well Type Chamber
- (f) Three Radiation Survey meters
- (g) TLD badge as per requirement
- (h) One TLD reader
- (i) One Male Rando Phantom

- (j) One Female Rando Phantom
- (k) Four Water Phantoms
- (l) Gamma Zone Monitor
- (m) One Styrofoam cutter
- (n) Mould room accessories- as per requirements
- (o) One Orfit Mould Heater
- (p) IMRT QA Kit

**Treatment Planning System:**

- (a) One 3-D Computerized Treatment Planning System (Plato)
- (b) Precise Treatment Planning System
- (c) CMS XIO Treatment Planning System

**11. Syllabus for the course** : The syllabus for this course to be conducted by Dr. B. Borooah Cancer Institute is prepared on the basis of the syllabus of such course at Tata Memorial Hospital, Mumbai. The copy of syllabus enclosed.

# Curriculum For Diploma programme in Radiotherapy Technology

## **Introduction:**

Education is an arrangement with objectives of learning and development. Curriculum development is scientific process. It is guided by the needs of the systems of users. The needs, expectations and aspirations of stakeholder/clients in the technician education system must be reflected in the curriculum. All academic activities are to be followed as per the curriculum.

Design, development and implementation of the academic curriculum must be done with utmost care and effectiveness. The design, review and revision of curriculum should be based on scientific principles of theories of educational/ technology. Since 1995-96 the process of curriculum development has been designed to make curriculum development on strong base of scientific principles backed by hard data and authentic information rather than course committee approach.

There are four domains of development.

Personal development domain

Social development domain ( To execute process of curriculum development)

Learning skills domain

Professional Skills domain

## **Aims / Objectives of the Diploma Programme:**

In the recent decades, radiation therapy has come to play an increasingly vital role in the treatment of cancer. High quality patient care in radiation therapy depends upon the team work. The radiation oncologist or the radiation therapist, the engineers, the medical physicist specializing in radiation therapy, the radiation technologist, the dosimetrist and the nurse are all important members of the team.

The quality of patient care provided by the radiation therapist is dependent upon, among the other factors, precisely administered treatments. Without such precision, it is not possible to optimally balance maximum probability of cure or palliation and acceptable levels of complications. Quality assurance related to the whole treatment process is essential if such results are to be obtained. At the technical level, an effective quality assurance program must establish and monitor adherence to

machine performance criteria, ensure accurate dose delivery to the correct site, maintain accurate records and assure the appropriate utilization of facilities.

As the use of radiation therapy increases, the need for adequate number of well-trained personnel also rises. This, in turn, focuses attention on the need for high quality training program and the availability of training materials for use in those programs.

The team approach to quality assurance. The contribution of radiation therapy to the treatment of many types of cancer are well established, the appropriate and effective use of this patient care modality requires the collaborative and complementary efforts of various professionals, each with defined responsibility.

The aims of this course are:

- 1) To induce life long learning skills, attitudes for social and personal development
- 2) To provide trained manpower
- 3) To provide leadership qualities
- 4) To create awareness of importance of cleanliness in our day to day activities
- 5) To create awareness of health hazards due to carcinogenic materials
- 6) To assist in development of new methods and techniques for the radiotherapy treatment of various cancer diseases and to have correct diagnosis of the diseases and subsequent proper implementation of radiotherapy to have fast cure of patient.
- 7) To develop radiotherapy treatment managerial skills and trained radiotherapy technologist.

## COURSE AND SCHEME OF EXAMINATION

Year/ Semester : First Year

SR. No.	SUBJECT TITLE	PAPER	TOTAL MARKS
1.1	Principles of Medical Physics	I  (Radiation Physics)	100
1.2	Radiation Units and Measurements		
1.3	Imaging in Oncology		
1.4	Basic Radiotherapy Techniques		
2.1	Introduction to Anatomy	II  ( Clinical Radiation Oncology)	100
2.2	Introduction to Physiology and Pathology		
2.3	Introduction to Clinical Oncology		
3	Practicals (Radiation physics and Clinacal Radiation Oncology)	III	100

### Posting Schedule:

After completion of the 1<sup>st</sup> year, students will be appointed in different radiotherapy units for hands on training.

Year/ Semester : Second Year

SR. No.	SUBJECT TITLE	PAPER	TOTAL MARKS
4.1	Radiation Instrumentation	I (Radiation Physics – I)	100
4.2	Advanced Medical Physics		
5.1	Advanced Radiation Therapy Techniques	II (Radiation Physics – II)	100
5.2	Radiation Protection		
6.1	Radiation Biology - I	III (Clinical Radiation Oncology-I)	100
6.2	Clinical Radiation Oncology - I		
7.1	Radiation Biology - II	IV (Clinical Radiation Oncology-II)	100
7.2	Clinical Radiation Oncology - II		
8	Practical on Radiation Physics	V	100
9	Practical on Clinical Radiation Oncology	VI	100
10	Project and Internal Assessment		100



Books recommended for the course :

Author	Title	Edition	Year of publication	Publisher & address
F.M. Khan	Physics of Radiation Therapy	-	1994	Williams & Wilkins
Cherry, Pam	Practical Radiotherapy Physics & Equipment	-	1998	Greewich Medical Media, London
DOBBS, JANE	Practical Radiotherapy Planning	-	1999	Arnold, London
Ross and Wilson	Anatomy Physiology in Health & Illness	Latest		Churchill & Living Stone
Perez et-al	Principles of radiation Oncology	4 <sup>th</sup>		Lippincott-Raven Pub; Philadelphia
Rath G.K. et-al	Text book of Radiation Oncology	Latest	2000	Churchill Living Stone
Dinshaw K.A.	Technology Transfer Programme in Brachytherapy Proceeding	-		TMH, Mumbai
HALL Eric J	Radiobiology for the Radiologist	Latest	1994	Lippincott Williams & Wilkins, Philadelphia
Carlton Richards R.	Delmars Principles of Radiographic Positioning And Procedures pocket guide	Latest		Delmar Pub; AL-Bany
Bulter, Paul	Applied Radiological Anatomy	Latest		Cambridge Univ. Press Cambridge
Brooker M. J.	Computed Tomography for Radiographers	Latest		MTP Press Ltd. Lancaste

REFERENCES:

Author	Title	Edition	Year of publication	Publisher & address
Hendee, William	Radiation therapy Physics	-	1994	Williams & Wilkins
Sidhva J. N.	Cranial Computed Tomography	-	1984	Media Promoters & Pub, Mumbai
Lufkin, Robert B.	The MRI manual	-	1988	Mosby, St. Louis
Carlton Richards R.	Principles of Radiographic imaging: An art and a science	-	2000	Delmar , New York
Levitt S. H.	Technological basis of radiation therapy	-	1999	Lippincott Williarns & Wikins, Philabeltia
Weir, Jamie	Imaging atlas of human anatomy, 1997	-	1997	Mosby Year Book, Missouri

Tortora, Gerard	Principles of anatomy and Physiology	-	2000	JOHN Wiley & Sons Inc, Newyork
AMPI	Physical aspects of high energy electron accelerators in radiation therapy	-	1982	Assn. of Medical Physicists of India, Mumbai
Atomic Energy R. B	Safety code for medical diagnostic X-ray equipment & installations AERB Code No. SC/Med-2	-	1986	Atomic Energy Regulatory Board, Mumbai
Atomic Energy R. B	Transport of radioactive materials AERB Code No. SC/TR-1	-	1986	Atomic Energy Regulatory Board, Mumbai
Bushong, Stewart C.	Radiological Science for technologists-physics, biology and protection	-	1997	Mosby, St. Louis
Journals	Radiotherapy Oncology	-	-	----
Journals	International journal of Radiation Oncol Biology Physics	-	-	----

#### **Requirement to appear for Examination**

Candidate should put in a minimum of 80% attendance to be eligible to appear for the Examinations.

#### **Passing Criteria**

To pass a candidate shall secure a minimum of 50% marks individually in each paper in the examinations. A candidate failing in any one paper will have to reappear in all the papers in the repeat examination conducted by the authority.

## DETAILED CONTENT-1.1 – Principles of Medical Physics

CHAPTER	CONTENTS	MARKS
CHAPTER-1	<b>Elements of Atomic &amp; Nuclear Physics:</b> 1.1 Atomic & Nuclear structure. 1.2 General introduction to the properties of radiation.	
CHAPTER-2	<b>Radioactivity:</b> 2.1 Isotopes and production of radio isotopes. 2.2 Radioactive decay 2.3 Half life 2.4 Mean life 2.5 Transient and Secular equilibrium. 2.6 Isotopes used in medicine.	
CHAPTER-3	<b>Interaction of Ionizing radiation with matter:</b> 3.1 Photoelectric, Compton effect & Pair production process & their clinical importance. 3.2 Attenuation & absorption coefficients 3.3 Exponential law 3.4 Half value layer & simple calculations.	
CHAPTER-4	<b>Basic Teletherapy machines:</b> 4.1 Superficial & deep X-ray machine 4.2 Different types of Tele-isotope unit. 4.3 Installation properties. 4.4 Machine Properties 4.5 Penumbra, its properties and practical applications 4.6 Quality Assurance and Calibration of Tele-cobalt units 4.7 Mould room techniques  <b>Practical: Tele Cobalt Machines and Associated Treatment Accessories</b>	

## DETAILED CONTENT-1.2 – Radiation Units And Measurements

CHAPTER	CONTENTS	MARKS
CHAPTER-1	<p><b>Radiological Units:</b>                      Bequerrel                      Curie                      Roentgen                      Gray                      RAD &amp; Sievert                      Measurements and applications of above radiological units and their application in radiological safety.                      Air Kerma, Exposure Rate, Dose Rate</p>	
CHAPTER-2	<p><b>Principles of Radiation Dosimetry:</b>                      Basic concept, % depth dose (PDD)                      Tissue air ratio (TAR)                      Peak Scatter factor (PSF/BSF) and tissue maximum ratio (TMR) and their use in treatment time calculation.                      Isodose curves.                      Manual addition of isodose curves.                      Equivalent square calculations for simple and complex fields.</p>	
CHAPTER-3	<p><b>Treatment Planning System:</b>                      Hardware – Treatment planning                      Computer principles – input data – peripherals – digitizer – printer – plotter – CT based _ PC based systems – Radiotherapy planning.                      Basics of Three dimensional beam data acquisition system.                      Record keeping, treatment chart – notes – Computerization. VARiS. Hospital network.  <b>Practical:</b>                      Plotting isodose curves for various beam arrangements                      Treatment Planning Systems</p>	

### DETAILED CONTENT-1.3 – Imaging in Oncology

CHAPTER	CONTENTS	MARKS
CHAPTER-1	<p><b>X-Ray:</b>            Production of X-ray by physical process (characteristic and continuous X-ray spectrum)            Factors affecting quality of X-ray emission.            Angular distribution of X-ray machines (Diagnostic and Therapeutic) Generators and X-ray tubes.            Mammography unit – C-Arm Machine- CT scanner</p>	
CHAPTER-2	<p><b>Diagnostic Imaging:</b>            Radiographic imaging, Films Radio-graphic &amp; Fluoroscopic screens, intensifying screens. Image intensifier.            Densitometry parameters of a radiographic film. [Density, Contrast, Gamma, Latitude and Speed]            Film processing procedure, screens and grids.            Factors affecting image and minimization of patient exposure in radiography &amp; fluoroscopy</p>	
CHAPTER-3	<p><b>Simulator:</b>            Simulator including technology- machine parameters,            Mechanism,            Image receptor,            Lasers and Image Intensifier,            Various simulation techniques for different sites</p>	
CHAPTER-4	<p><b>Other Imaging Modalities:</b>            Magnetic resonance imaging (MRI)            Ultra Sonography (USG)            Positron Emission Tomography (PET)            Angiography</p>	

**DETAILED CONTENT-1.4 – Basic Radiotherapy Techniques**

CHAPTER	CONTENTS	MARKS
CHAPTER-1	1.1 Single and multiple field techniques for all treatment sites (from head to feet) with appropriate immobilizing device (s).	
CHAPTER-2	2.1 Fix, Rotation, Arc and Skip therapy procedures. 2.2 Use of Rubber traction, POP, Orfit, Body frame in treatment technique 2.3 Evaluation of patient setup for simple techniques	
CHAPTER-3	3.1 Use of beam Modifying devices, such as wedges, Tissue compensators, Mid Line Block (MLB) in the treatment of respective sites. 3.2 Customized shielding blocks and its properties. Practical: Patient setup- Basic treatment techniques.	

**DETAILED CONTENT-2.1 – Introduction to Anatomy**

CHAPTER	CONTENTS	MARKS
	<b>Introduction to Anatomy with respect to:-</b>	
CHAPTER-1	Brain and Spinal Cord	
CHAPTER-2	Head and Neck	
CHAPTER-3	Thorax and Abdomen	
CHAPTER-4	Pelvis and Pelvic Organs	
CHAPTER-5	Upper Limb, Lower Limb	
CHAPTER-6	Osteology and Lymphatic System	
CHAPTER-7	Organs of Senses, Ductless glands	

## DETAILED CONTENT-2.2– Introduction to Physiology and Pathology

CHAPTER	CONTENTS	MARKS
	<b>Introduction to Physiology with respect to:-</b>	
CHAPTER-1	Normal Cell, Structure of general tissues	
CHAPTER-2	Composition and Function of Blood and Lymphatic System	
CHAPTER-3	Digestive system, Liver and Spleen	
CHAPTER-4	Urogenital System (male and female)	
CHAPTER-5	Brain and Spinal Cord	
CHAPTER-6	Respiratory System	
CHAPTER-7	Hormones	
	<b>Introduction to Pathology with respect to:-</b>	
CHAPTER-8	General Pathology of Tumours	
CHAPTER-9	Local and General Effects of Tumours and its Spread	
CHAPTER-10	Sites and mechanism of Metastasis	
CHAPTER-11	Environmental factors in tumour formation	
CHAPTER-12	Staging of Tumours	

## DETAILED CONTENT-2.3– Introduction to Clinical Oncology

CHAPTER	CONTENTS	MARKS
CHAPTER-1	1.1 What is Oncology? Detection and Diagnosis, and Extent of Disease, 1.2 Anatomic Staging of the Disease, 1.3 Histopathologic Classification, 1.4 Treatment of Cancer, 1.5 Principles of Radiation Oncology and Cancer Radiotherapy, 1.6 Teletherapy Unit, Telecobalt Unit, Telecaesium Unit, 1.7 Linear Accelerator, 1.8 Brachytherapy : Intracavitary Insertions, Interstitial Implants, Surface Applicators, Curative or Radical Intent, Palliative Intent	
CHAPTER-2	2.1 General Aspect of Radiotherapy: Form of Treatment, 2.2 Radio-sensitive Tumours, Radio-resistant tumours, Tumours of Limited Sensitivity 2.3 Curability of Cancer, 2.4 General Principles – Radiation Factors, Tumour Lethal Dose-TLD, Normal Tissue Tolerance, Therapeutic Ratio, 2.5 Units of Quality of Radiation – Given dose, Incident Dose, Skin Dose, Model Dose, Quality or Wavelength of Radiation, Beam Flattening, Beam Wedging, Time factors, Fractionation, 2.6 Importance of Beam Directed X-ray therapy	



## DETAILED CONTENT-4.1 – Radiation Instrumentation

CHAPTER	CONTENTS	MARKS
CHAPTER-1	<b>Advanced Teletherapy Machines &amp; Accessories:</b> 1.1 Medical Linear accelerator and heavy ion accelerator. 1.2 Machine properties. 1.3 Quality Assurance & Calibration. 1.4 Beam directing, modifying and defining devices. 1.5 Accessories	
CHAPTER-2	<b>Radiation Detection:</b> 2.1 Basic principles of radiation detection. 2.2 Ionization chambers and G.M. counters. 2.3 Gamma ray spectrometer 2.4 High purity Germanium Detector 2.5 Multi-channel analyzer 2.6 Photographic film Dosimeters 2.7 Thermoluminescence dosimeter 2.8 Film badges 2.9 Semiconductor detectors 2.10 Clinical Dosimeter such as secondary standard Dosimeters  <b>Practical: Teletherapy machines- Modern Linear accelerators and associated properties</b>	

## DETAILED CONTENT-4.2 – Advanced Medical Physics

CHAPTER	CONTENTS	MARKS
CHAPTER-1	1.1 Physical Aspects and properties of 3-Dimensional Conformal Radiation Therapy 1.2 Role of Multi Leaf Collimator (MLC) in conformal therapy and its comparison with conformal block	
CHAPTER-2	2.1 Principles of photon and electron dosimetry and dose calculations 2.2 Electron Arc Therapy 2.3 Total Skin Electron Therapy	
CHAPTER-3	3.1 Concept of static wedge, wedge angle, hinge angle. Comparison its properties with Dynamic wedge. 3.2 Detailed treatment time calculations and its verification with planning computer output.	
CHAPTER-4	4.1 Three- Dimensional compensation 4.2 Thermo- luminescence in radiation dose estimation. Internal commission on radiation units and measurements (ICRU-50) recommendations and its applications.	

## DETAILED CONTENT-5.1 – Advanced Radiation Therapy Techniques

CHAPTER	CONTENTS	MARKS
CHAPTER-1	Practical application of 3D-CRT ( conformal radiotherapy) TSET (Total Skin Electron Therapy) TBI (Total Body Irradiation) Electron arc SRS (Stereotactic Radio Surgery)/ SRT (Stereotactic Radio Therapy) IMRT (Intensity Modulated Radiotherapy)	
CHAPTER-2	Different types of Brachytherapy sources, their properties Various Brachytherapy procedures such as surface mould, Intracavitary & Interstitial applications. ICRU 38 recommendations and its applications. Simulation techniques for various Brachytherapy procedures.	
CHAPTER-3	Manual afterloading system Remote afterloading systems LDR (Low Dose Rate) and HDR (High Dose Rate) machines, their properties and practical applications.  <b>Practical:</b> 1) Patient setup – Advanced treatment techniques 2) Special procedures (Teletherapy) 3) Selectron & Micro-Selectron (Brachytherapy)	

## DETAILED CONTENT-5.2 – Radiation Protection

CHAPTER	CONTENTS	MARKS
CHAPTER-1	<b>Biological Effects of Radiation:</b> 1.1 Sources of exposure in environment 1.2 Somatic – general effects 1.3 Genetic effects 1.4 Effects on cellular levels 1.5 Effects on organs 1.6 Stochastic and non-stochastic effects	
CHAPTER-2	<b>Biological Models:</b> 2.1 Treatment fractionation 2.2 NSD (Nominal Standard Dose) 2.3 CRE (Cumulative Radiation Effects) 2.4 TDF (Time Dose Fractionation) 2.5 LQM (Linear Quadratic Models ) and their practical applications.	
CHAPTER-3	<b>Radiation Protection:</b> 3.1 Maximum permissible levels for radiation workers and general public. 3.2 ICRP recommendations. 3.3 Shielding calculations for Teletherapy and Brachytherapy installations. 3.4 PRINCIPLES OF Time, Distance and shielding 3.5 Personnel Monitoring 3.6 National/International agencies associated in Radiation Safety. 3.7 Planning of Radiotherapy department 3.8 Half Value Thickness (HVT) & Tenth Value Thickness (TVT) and its relevance in shielding calculations.	

## DETAILED CONTENT-6.1 – Radiation Biology-I

CHAPTER	CONTENTS	MARKS
CHAPTER-1	Basic structure of a Cell, Effect of Radiation on Cells: Radiosensitizing Agents; Radioprotectors. Immediate Cell death, Effect on Cancer Cell: Direct, Indirect.	
CHAPTER-2	Effect of radiation on Normal Tissue: Introduction, Pathogenesis of Early and Late Radiation Effects, Normal tissue and organ Effects of Irradiation on Skin, Oral Cavity, Oropharynx and salivary glands, Orbit, Lung, Gastrointestinal Tract, Haemopoietic Tissues, Bone and Cartilage, Kidney, Testicle, Ovary, Nervous System, Systemic Effects of Irradiation, Carcinogenic Effects.	
CHAPTER-3	Radiation Modifiers: Radio Sensitizer, Radioprotectors, Hyperthermia.	
CHAPTER-4	Irradiation Side Effects- Early and Late complications. The biological hazards of irradiation; effects on the whole body; effects on the embryo and the foetus; like shortening, leukemogenesis and carcinogenesis, genetic and somatic hazards for exposed individuals and populations.	

**DETAILED CONTENT-6.2 –**  
**Clinical Radiation Oncology-I**

CHAPTER	CONTENTS	MARKS
CHAPTER-1 CHAPTER-2	Care of Patient- Before, during and after radiotherapy. Oropharynx Cancers, Nasopharynx, Hypopharynx, Pyriiform fossa Post wall and P.C. area Tumours of Larynx and Paranasal Sinus: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-3	Central Nervous System: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-4	Eye Tumours and Spinal Cord Tumours: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-5	Carcinoma Breast: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-6	Lung and Mediastinum: : Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-7	Oesophageal Cancers: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, Symptoms at presentation, Diagnosis, Staging, Treatment	

DETAILED CONTENT-7.1 – Radiation Biology-II

CHAPTER	CONTENTS	MARKS
CHAPTER-1	Radiation Modifiers: Radio Sensitizer, Radioprotectors, Hyperthermia.	
CHAPTER-2	Irradiation Side Effects- Early and Late complications. The biological hazards of irradiation; effects on the whole body; effects on the embryo and the foetus; like shortening, leukemogenesis and carcinogenesis, genetic and somatic hazards for exposed individuals and populations.	

## DETAILED CONTENT-7.2 – Clinical Radiation Oncology-II

CHAPTER	CONTENTS	MARKS
CHAPTER-1	1.1 Cervix, Body Uterus Cancers: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, 1.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-2	2.1 Ovary, Vagina and Vulva Cancers: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology, 2.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-3	3.1 Testicular Cancers, Prostate and Urethra Tumours: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology 3.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-4	4.1 Lymphoma and Leukemia: Incidence, Aetiology, Pathology 4.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-5	5.1 Paediatric Tumours: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology 5.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-6	6.1 Tumours of Kidney, Tumours of bladder: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology 6.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-7	7.1 Carcinoma Rectum and Anal Canal: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology 7.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-8	8.1 Soft Tissue Sarcomas and Osteosarcomas: Incidence, Aetiology, Anatomy, Lymphatic drainage, Pathology 8.2 Symptoms at presentation, Diagnosis, Staging, Treatment	
CHAPTER-9	9.1 Metastatic Lesions- Lung, Brain, Bone and Liver: Incidence, Aetiology, Pathology 9.2 Symptoms at presentation, Diagnosis, Treatment	
CHAPTER-10	Radiation Syndromes, Radiotherapy Emergencies	