An Ordinary Meeting of the Board of Studies of the department was held on 20.08.2011 at 11:00 a.m. in the Chamber of Chairman, Department of Radiotherapy.

The following Members attended the meeting:

1. Prof. Shahid Ali Siddiqui (In Chair)
2. Prof. M. Amandullah Khan
3. Prof. Rakesh Bhargav
4. Dr. Mohd. Akram
5. Mr. M.A. Bilal Hussain
6. Dr. Hamid Mustafa
7. Dr. Shadab Alans

In the beginning the Chairperson welcomed the New assigned members of the Board of Studies and then the items of the agenda were discussed.

ITEM NO.1
The Minutes of the last Meeting held on 10.09.2009 were confirmed.

ITEM NO.2
The New revised syllabus for DMRT & MD (Radiotherapy) was unanimously accepted by all the Members.

ITEM NO.3
Regarding the inclusion of environmental component in the MBBS syllabus as suggested by UGC, Members were of the opinion that the component regarding the radiotherapy is already taught to the students. However, slight modification in the syllabus was made and decided that syllabus will be covered within the number of classes allocated for Radiotherapy.

ITEM NO.4
The new syllabus for BRITT Course was prepared and unanimously accepted by all the members.

ITEM NO.5
(i) Teaching schedule for MBBS, BDS and BRITT was made in consultation with all the teachers involved and assigned accordingly.
ITEM NO. 6

List of Examiners & Moderators for MD/DMRT examination is prepared and sent to Asstt. Controller (Exams.) in a sealed envelope.

ITEM NO. 7

The Annual report of the department for the session 2010-11 is prepared and read out before the members. All the members of Board of Studies have unanimously approved the Report.

ITEM NO. 8

The following remuneration agreed for the BRTT classes:

- Theory Classes: Rs.200/- per class
- Practical/ Demonstration: Rs.150/- per class

Regarding the other remuneration for BRTT Course: like,

- Preparation of MCQ, Moderation and Invigilation duty, Co-ordinator Asstt. Co-ordinator application form processing, Clerical Assistance, etc. for the BRTT Admission Test.
- Exam fee for Annual examination Setting of Paper, Moderation, invigilation, exam-superintendent, Paper correction, Tabulation, etc.

The Members have decided that the Chairman of the department should write to the Controller of Examination to fix the remuneration as per the University rules at par with the other equivalent courses.

Under any other item, the books to be recommended for the preparation of MCQ for the PG Admission Test is taken up.

The members have recommended the following books as reference books for the MCQ preparation:

1. Cancer Principles and Practice of Oncology
   Vincent De Vita, Samuel Hellman, Steven A. Rosenberg.
2. Principles and Practice of Radiation Oncology
   Edward C. Halperin, Carlos A. Perez, Luther W. Brady, et al.

The meeting ended with a vote of thanks by the Chairperson to the members of Board of Studies.
MINUTES

(Meeting No. 28)

Dated-09.10.2012

An Ordinary meeting of the Board of studies of the Department of Radiotherapy was held on 01.09.2012 in the Chamber of the Chairman, Deptt. of Radiotherapy.

The following Members attended the meeting:

1. Prof. Amanullah Khan
2. Dr. Seema Qavi
3. Mr. M.A. Bilal Hussain
4. Dr. Shadab Alam
5. Prof. S.A. Siddiqui - (In Chair)

In the beginning the Chairperson welcomed the members of the Board of Studies and then the items of the agenda were discussed.

**Item No. 1**

The Minutes of the last meetings of Board of Studies held on 12.04.2012 (Meeting no.27) were confirmed.

**Item No. 2**

i. The teaching schedule for MBBS and BRIT was prepared in consultation with all the teachers involved and assigned accordingly. Practical classes for BRIT students are assigned to the Senior Radiographers.

ii. Training schedule (OPD, Ward, Brachytherapy, Planning) and Seminar schedule for MD, DMRT & BRIT students were prepared and accepted by all members.

**Item No. 3**

The chairperson informed the members that the BRIT course run by the faculty of Medicine conducted in the department of Radiotherapy is recognized by the Atomic Energy Regulatory Board, Govt. of India, Mumbai.

The following amendments were suggested by the members and unanimously agreed upon.

i. With the demand for the course and increased number of applicants every year the number of seats should be increased to 4(3+1): One seat being reserved for lateral entry in to the second year for Diploma holders in Radiology or Radiotherapy or equivalent. In the absence of candidates in this reserved category the seat will be filled by general category.
ii. The eligibility criteria for admission to the course should be modified in line with the other courses like MBBS/BDS & Paramedical Diploma as under:
-Senior Secondary school certificate from this University or Institution/Board recognized by the University or its equivalent with Physics, Chemistry, Biology with minimum of 50% marks in aggregate in P,C,B.

iii. The members also urged that multiple admission tests cause much inconvenience to the candidates as most of the aspirants for BRTT also appear for the admission test for MBBS/BDS and Common Entrance Test conducted by Centre for Professional Courses. So they requested the chairman to write to the controller of Exams to combine the Admission Test of BRTT with the MMBBS/BDS Admission Test and candidates should be allowed to give a third choice of BRTT. The members also requested the chairman to work out the modalities for the same.

iv. The following corrections need to be made in the application form.
- The course duration is 3 ½ yrs (including 6 months internship)
- The no. of seats should be advertised as 3+1* (*lateral entry for Diploma holders in Radiology/Radiotherapy or equivalent).
- Necessary correction in the application form to include a column to opt for lateral entry. Those candidates who wish to apply under lateral entry category should make their claim by submitting the Diploma Certificate/Course Completion Certificate /Course to be completed certificate from the institute attending the course. The candidates should have completed the diploma before the admission to the BRTT course, if selected.

Item No.4

The annual report of the department for the year 2011-2012 was read out to the members and all members approved it.

Any other Item

i. The syllabi for Admission Test (Departmental) for admission to BRTT is prepared and approved by the Board of Studies.

ii. The Chairperson of the Board of Studies informed the members that as per the Residency rules of the Ministry of H & FW (1992), the age limit for Senior Residency is 33 years and the term of appointment is for 3 years. But due to non-availability of the residents in some specialties, some State Governments have changed the rule and modified the age limit to 40 years and the appointment term extendable by 1 year (Total of 4 years) in order to cope up with the shortage and workload.

Other members also deliberated on the same and requested the chairman to take up the matter with the Dean, in the Faculty meeting to change the Residency rule.

(Prof. Shahnid Ali Siddiqui)
Chairman
Dept. of Radiotherapy
JNMC, AMU, Aligarh
Minutes
(Meeting no.32)

An Ordinary meeting of the Board of Studies of the department was held on 28.04.2014 at 12:30 p.m. in the Chamber of Chairman, Department of Radiotherapy.

The following Members attended the meeting:
1. Prof. S.A. Siddiqui – (In Chair)
2. Prof. L.M. Barier
3. Mr. M.A. Bilal Hussain
4. Dr. Md. Mamun Khan
5. Dr. Mohd. Khashif Razi
6. Dr. Mohsin Khan
7. Dr. Ahmad Masroor Karimi

Item No.1
The minutes of the last meeting of Board of Studies (Meeting No.31) of the department held on 21.12.2013 were confirmed.

Item No.2
Considered and recommended the allocation of Thesis topic, Supervisor & Co-Supervisors as follows:

Thesis Protocol – M.D. (Radiotherapy)

Name of Student : Dr. Nasmed Alam
Topic : "A Prospective Randomized Study to Compare Clinical Outcome of External Beam Radiotherapy (EBRT) and Interdigitated High Dose Rate Intracavitary Brachytherapy (HDRICBT) Versus Sequential EBRT and HDRICBT in Treatment of Locally Advanced Carcinoma Cervix"

Supervisor : Prof. Shahid Ali Siddiqui, MD
Co-Supervisor : 1. Prof. Islam Bano, MD, FICOG
2. Dr. M.A. Bilal Hussain

Item No.3
The Model Papers for M.D, DMRT, BRTT examinations were prepared and sent to Controller of Exams along with respective syllabus.

The meeting ended with a vote of thanks by the chairperson to the members of Board of Studies.

[Signature]
Chairman
(Prof. S.A. Siddiqui)
Chairman,
Dept. of Radiotherapy
JNMC, AMU, Aligarh
MINUTES

An Ordinary meeting (Meeting no.38) of the Board of Studies of the department was held on 27.08.2016 at 11:00 p.m. in the Chamber of Chairman, Department of Radiotherapy.

The following Members attended the meeting:
1. Prof. Shahid Ali Siddiqui (In Chair)
2. Prof. Aftab Anesu
3. Dr. Mohd. Akram
4. Mr. M.A. Bilal Hussain
5. Dr. Md. Shadab Alam
6. Dr. Mohsin Khan
7. Dr. Farrukh Arwar
8. Dr. Semraeen Zebaer
9. Dr. Naweed Ali

ITEM NO.1: The Minutes of the previous Board of Studies meeting held on 09.02.2016 were confirmed.

ITEM NO.2: The teaching Schedule of BRIT course is prepared and assigned to teachers.

ITEM NO.3: The teaching schedule of MBBS is prepared and assigned to teachers.

ITEM NO.4: The Seminar/Teaching schedule of MD(Radiotherapy) & DMRT were prepared and assigned to teachers.

Any other Item:
1. The members of the Board of Studies unanimously agreed to conduct the project study entitled "Structural & Functional Alterations in Hypochlorous Acid Modified Antithrombin" by the Ph.D candidate Dr. Parvez Ahmad from Jamia Millia Islamia and Chairman, Dept. of Radiotherapy was authorized to take necessary action.
2. The syllabus of BRIT (1st, 2nd & 3rd year) was revised and circulated to all teachers.

The meeting ended with a vote of thanks by the Chairperson to the members of Board of Studies.
MINUTES
(Meeting No. 43)

An ordinary meeting of the Board of Studies of the department was held on 07.10.2017 at 11:30 a.m. in the Chamber of Chairman, Department of Radiotherapy.

The following Members attended the meeting:

1. Prof. Shahid Ali Siddiqui (to Chair)
2. Prof. Seema Rashid
3. Dr. Mohd. Akram
4. Mr. M.A. Bilal Hussain
5. Dr. Shaaban Alam
6. Dr. Mohsin Khan
7. Dr. Sumeen Zaheer

ITEM NO.1

The minutes of the last meetings of Board of Studies were confirmed.

ITEM NO.2

Considered and recommended the allocation of thesis topic, Supervisor and Co-supervisor for 2 MD students admitted batch 2017 as follows:

<table>
<thead>
<tr>
<th>Candidate Name</th>
<th>Thesis Topic</th>
<th>Supervisor</th>
<th>Co-supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. Zarmina Alam, Comparative Evaluation of Hyperfractionated Concurrent</td>
<td>Prof. Shahid Ali</td>
<td>Dr. S.C. Sharma</td>
</tr>
<tr>
<td></td>
<td>Chemoradiation Versus Conventional Concurrent Chemoradiation in Squamous Cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cell Carcinoma of Head &amp; Neck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Nida Asif, The Impact of Prophylactic Concurrent Granulocyte Macrophage-</td>
<td>Dr. Mohd Akram</td>
<td>Prof. Shahid</td>
</tr>
<tr>
<td></td>
<td>Colony Stimulating Factor on Chemoradiation Induced Acute toxicity in Head</td>
<td></td>
<td>Ali Siddiqui</td>
</tr>
<tr>
<td></td>
<td>and Neck Cancer Patients</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ITEM NO.3

BRTT syllabus 2017-18 was reviewed and approved by members of the Board of Studies.

Any other Item-

As the term of present Co-opted and Assigned members is getting completed in the last week of Oct'17, following names were recommended to be approved as co-opted members and assigned members for the next term of board of studies

Co-opted Members-
1. Professor Madhup Rastogi
   Department of radiotherapy
   RML IMS, Lucknow
2. Professor Shalin Kumar
   Department of radiotherapy
   SGPGI IMS, Lucknow

Assigned Members-
1. Professor Anjum Pervez (department of Medicine)
2. Professor Mazhar Abbas (department of Orthopedics)
3. Professor Kamran (department of Paediatrics)
4. Professor Mohammad Shahid (department of Microbiology)
5. Professor Adeeb Alam (department of Ophthalmology)

The meeting ended with a vote of thanks by the Chairperson to the members of Board of Studies.

Chairman
Dr. Mohd. Akram
Consultant/Asso. Prof.
Dept. of Radiotherapy
J.N.M.C. A.M.U. Agra
Radiotherapy syllabus for Final MBBS


3. Radiobiology – 4 R’s, Dose of Radiation, Toxicity, acute & late effects


5. Radiation Hazards, Evaluation and Control – Sources and types of radiation, Background Radiation, Manmade radiation, Hazards involving diagnostic and therapeutic radiation –Prevention and control, ICRP, AERB recommendations of Maximum Permissible doses.

6. Principles of Chemotherapy – Cancers amenable to Cytotoxic Therapy

7. Common Cytotoxic Drugs- their handling and toxicity

8. Common cancers where RT plays important role
SYLLABI

OF

BACHELOR OF RADIATION THERAPY TECHNOLOGY
(BRTT)

AT

Department of Radiotherapy,
Jawaharlal Nehru Medical College,
Aligarh Muslim University
Aligarh, Uttar Pradesh

<table>
<thead>
<tr>
<th>Revision History</th>
<th>Rev No.</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>DocumentCreated</td>
<td>1.0</td>
<td>2011</td>
</tr>
<tr>
<td>First revision</td>
<td>1.1</td>
<td>2013</td>
</tr>
<tr>
<td>Second revision</td>
<td>1.2</td>
<td>2016</td>
</tr>
<tr>
<td>Last Revision</td>
<td>1.3</td>
<td>2017</td>
</tr>
</tbody>
</table>
Course Title : Anatomy and Physiology

Course Code : RT-101

Contact Hours : 3 : 2 : 1 Lecture / Tutorial / Demonstration

Course assessment : sessional test and/or home assignment 25%; Annual exam 75%

Course objective and outcome :

SYLLABUS

ANATOMY

Unit 1: Introduction to Anatomy & Histology, Structure of cell, epithelial tissue, muscular tissue, nervous tissue.
Unit 2: Skeletal System, Structure of bones, types of bones, Bones of cranium, face vertebral column, upper and lower limbs, fracture of bones, various movements of joints.
Unit 3: Muscular System, Structure and types of muscles in human body, important muscles and their group action.
Unit 4: Circulation System, Structure of heart, names and position of main blood vessels.
Unit 5: Lymphatic System, Lymph vessels, lymph nodes and lymphoid organs, their structure & functions.
Unit 6: Digestive systems. Parts of gastrointestinal tract and associated glands.
Unit 7: Respiratory System. Parts of Respiratory System.
Unit 8: Urinary System. Parts of Urinary System.
Unit 10: Reproductive System. Male & female Reproductive organs.
Unit 11: Skin and sense organs. Eye, Ear, Nose. Taste Buds
Unit 12: Nervous System. Parts of brain, spinal cord, peripheral nerves.
Unit 13: Surface markings and topographical relations; radiography anatomy.

PHYSIOLOGY

Unit 1: Blood. Composition and function of blood, haemopesis, blood coagulation. Blood groups, body fluid.
Unit 3: Respiratory system. Function of lungs, mechanism of breathing and exchange of gases in the lungs, regulation of respiration, Respiration disorder like anoxia, dyspnea, cyanosis etc. artificial respiration lung function tests.
Unit 4: Digestive Systems. Digestion of food in mouth, stomach & small intestines. Absorption of food, function of liver function tests.
Unit 5: Excretory Systems. Structure & function of kidney and urinary bladder. Mechanism of
<table>
<thead>
<tr>
<th>Unit 6</th>
<th>Endocrine Glands Functions of various endocrine glands and hormones secreted by them.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 7</td>
<td>Reproductive Systems. Physiology &amp; female reproductive organs.</td>
</tr>
<tr>
<td>Unit 8</td>
<td>Nervous System. Neurone &amp; its function, function of central nervous system,</td>
</tr>
<tr>
<td></td>
<td>Autonomous nervous system, physiology of vision, hearing &amp; olfaction.</td>
</tr>
</tbody>
</table>

**Reference Books**

**Anatomy**
1. William Davis (P) understanding Human Anatomy and Physiology MC Graw Hill
5. Anatomy and Physiology for Radiographers - C.A. Warrick
9. Essentials of Human Anatomy - Russel

**Physiology**
2. Chatterjee(CC) Human Physiology Latest Ed. Vol-1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book,
<table>
<thead>
<tr>
<th>Course Title :</th>
<th>Biochemistry, Pathology &amp; Microbiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code  :</td>
<td>RT-102</td>
</tr>
<tr>
<td>Contact Hours :</td>
<td>3 : 2 : 1 Lecture / Tutorial / Demonstration</td>
</tr>
<tr>
<td>Course assessment :</td>
<td>sessional test and/or home assignment 25%; Annual exam 75%</td>
</tr>
<tr>
<td>Course objective and outcome :</td>
<td></td>
</tr>
</tbody>
</table>

**SYLLABUS**

**Biochemistry**

**Unit 1 : Carbohydrates** : Glucose and Glycogen Metabolism

**Unit 2 : Proteins** : Classification of proteins and functions

**Unit 3 : Lipids** : Classification of lipids and functions

**Unit 4 : Enzymes** : Definition – Nomenclature – Classification – Factors affecting enzyme activity – Active site – Coenzyme – Enzyme Inhibition – Units of enzyme – Isoenzymes – Enzyme pattern in diseases.

**Unit 5 : Vitamins & Minerals** : Fat soluble vitamins(A,D,E,K) – Water soluble vitamins – B-complex vitamins- principal elements(Calcium, Phosphorus, Magnesium, Sodium, Potassium, Chlorine and sulphur)- Trace elements – Calorific value of foods – Basal metabolic rate(BMR) – respiratory quotient(RQ) Specific dynamic action(SDA) – Balanced diet.

**Unit 6 : Acids and bases** : Definition, pH, Henderson – Hasselbalch equation, Buffers, indicators, Normality, Molarity, Molality.

**Unit 7 : Distilled water** : Types of distilled water plants, preparation & storage, Analytical balance: Principal, Working & maintenance ; Preparation of reagents : Formulation and preparation

**Unit 8 : Standard solutions** : Various std. solutions used , their preparation ; storage of chemicals .

**Unit 9 : Units of measurements** : S.I units: Definitions, conversions; Measurement of volume : Strength , Normality.

**Unit 10 : Specimen collection** : Pre-analytical variables , Collection of blood , Collection of CSF & other fluids, Urine collection, Use of preservatives, Anticoagulants

**Pathology**


**Unit 2 : Acute And Chronic Inflammation** : Acute vascular changes. phagocytosis, Chemical mediators of inflammation. Definition and causes of chronic inflammation. Granulomatous inflammation, system manifestations of inflammation

**Unit 3 : Disorders Of Vascular Flow And Shock** : Oedema, hyperemia or congestion, thrombosis, embolism. Infarction shock, Ischemia, Over hydration, dehydration.

**Unit 4 : The Response To Infection** Categories of infectious agents, host barriers to infection,
how disease caused, inflammatory response to infectious agents

**Unit 5: The Haematopoietic And Lymphoid System:** Haemorrhage, various type of Anaemia, leakopenia, leukocytosis, bleeding disorders coagulation mechanism, maintenance of blood volume. Abnormalities of pH of blood.

**Microbiology**

**Unit 1: Introduction To Microbiology:** Discovery of micro organisms. Classification and general characteristics of microorganisms, nutritional requirements of Micro-organisms.

**Unit 2: Principles Of Microbial Control:** Sterilization, importance of sterilization in OT techniques various methods-physical UV radiation, alcohols and heavy metals, Autoclave structure functioning control and indicators.

**Unit 3: Immunology:** Antigen-antibody reaction anaphylaxis hypersensitivity

**Unit 4: Virology** Imp disease caused by different viruses of mode of infection

**Reference Books**

**Biochemistry**

1. Varley – Clinical chemistry
2. TEITZ – Clinical chemistry
3. Kaplan – Clinical chemistry
4. Ramakrishna(S) Prasanna(KG), Rajna ® Text book of Medical Biochemistry Latest Ed Orient longman Bombay – 1980
5. Vasudevan (DM) Sreekumari(S) Text book of Biochemistry for Medical students ,Latest Ed

**Pathology**

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss – cytology
4. Winifred greg – Diagnostic cytopathology
5. Orell – Cyto Pathology
6. Todd & Sanford Clinical Diagnosis by laboratory method
7. Dacie & Lewis – Practical Haematology

**Microbiology**

1. Anathanarayana & Panikar Medical Microbioloty
2. Roberty Cruckshank – Medical Microbiology – The Practice of Medical Microbiology
3. Chatterjee – Parasitology – Interpretation to Clinical medicine.
4. Rippon – Medical Mycology
5. Emmons – Medical mycology
6. Basic laboratory methods in Parasitology, 1st Ed, J P Bros, New Delhi – 199
7. Basic laboratory procedures in clinical bacteriology, 1st Ed, J P Brothers,New Delhi
8. Medical Parasitology – Ajit Damle
Course Title : BASIC RADIOLOGICAL PHYSICS & MEDICAL PHYSICS  
Course Code : RT-103  
Contact Hours : 3 : 2 : 1 Lecture / Tutorial / Demonstration  
Course assessment : sessional test and/or home assignment 25%; Annual exam 75%  
Course objective and outcome :  

<table>
<thead>
<tr>
<th>SYLLABUS</th>
</tr>
</thead>
</table>
| **Unit 1 : Basic concepts:**  
Units and measurements - Force, work, power and energy - Temperature and heat - SI units of above parameters. Atomic structure - atom model - Nucleus - electronic configuration - periodic table - Constituents of atoms, atomic and mass numbers, electron shells, atomic energy levels, Nuclear forces, Nuclear energy levels. Isotopes - Ionization – Excitation - Binding energy - electron volt |
| **Unit 2: Electricity and magnetism:**  
**Electricity:** Electric charges, Coulomb’s law, Unit of charge - Electric potential, unit of potential - resistance, ohm’s law - electric current, unit, electric power, heating effects of current, Joule’s law - capacitance and capacitors, series and parallel connection of resistors, capacitors and inductors.  
**Magnetism:** Magnetic induction - magnetic properties – classification of materials, Hysteresis - magnetic effect of current  
**Electrical instruments:** Galvanometer, Voltmeter, Ammeter. |
| **Unit 3 : Electromagnetic Induction:**  
Induced electro motive force, Faradays experiments, laws of electromagnetic induction, inductor coil, solenoid coil, Self and mutual induction. |
| **Unit 4 : Alternating current :**  
Peak and RMS values, AC circuits with resistance, capacitance and inductance, total resistance in a circuit, Impedance, Choke coil, eddy current. Transformer - theory, design, losses – types of transformers, auto transformer, high voltage transformer, electric power transmission, AC generator, commercial unit of electric energy consumption. |
| **Unit 5 : Electromagnetic radiation :**  
Quantum nature of radiation - mass energy equivalence- Fluorescence-electromagnetic spectrum, Energy quantization, Relationship between wavelengths, Frequency, Energy. |
| **Unit 5 : X-rays :**  
Thermionic Emission, History, Discovery of x-rays, properties - production, x-ray spectrum, bremsstrahlung and characteristic x-rays- X-ray tube; Coolidge tube, tube design, line focus principle, space charge effect, Modern x-ray tubes; stationary anode, rotating anode, grid controlled x-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality |
and intensity of x-rays, factors influencing them – measurement of kV, mA and time.

**Unit 6: X-ray generator circuits:**
Vacuum tube diodes, Rectifiers, Semi conductor diode, diode as rectifier, half and full wave, self rectification – X-ray generator; Electrical accessories for x-ray tubes, circuits and components, filament circuit- kilo voltage circuit-single phase generator-three phase generator - constant potential generator. Fuses, switches and interlocks-Exposure switching and timers-HT cables - earthing.

Half value layers, determination of HVL. Energy absorbed from x-rays, x-ray scattering, x-ray transmission through the medium, linear and mass attenuation coefficient, HVT and TVT.

**Unit 7: Radioactivity:**

**Unit 8: Non-Ionizing Radiation Physics:**
Role of Non-ionizing radiation in Medicine, Bioacoustics, Ultrasound – Principles, Production, properties and uses in medical diagnostics and therapy. Radiofrequency and Microwave radiation, Infra red and Ultraviolet radiations, lasers and its applications in medicine.

**Unit 9: General concepts of measurements:**
Fundamental definitions – accuracy and precision, repeatability and reliability of measurements – Different kinds of errors – internal and external estimation of errors in laboratory experiments.

**Reference books**
1. First year Physics for Radiographers - Hay & Hughes.
3. Fundamental of X-ray and Radium Physics - Joseph Selman
4. Basic Medical Radiation Physics - Stanton.
Course Title: Hospital Practice, Patient Care & Medical Ethics

Course Code: RT-104

Contact Hours: 3:2:1 Lecture / Tutorial / Demonstration

Course assessment: sessional test and/or home assignment 25%; Annual exam 75%

Course objective and outcome:
This section is intended to emphasize to the student technologist the importance of patient welfare. Many of the points included in this section may be considered during the teaching of other subjects also; but it is strongly urged that specific teaching and as much practical demonstration and instruction as possible should be given in this section.

Modern hospital treatment is based on team work, it is essential that the student should appreciate the technologist's role and that the importance of cooperation with OPD, wards and other departments. The students should be attached to wards or the accident and emergency department for a definite training period.

SYLLABUS

Unit 1: Hospital Procedure:
Hospital staffing and organization; records relating to patients and departmental statistics; Radiotherapy Department staffing and organization; professional attitude of the technologist to patients and other members of the staff; medico-legal aspects; accidents in the departments/organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.

Unit 2: Care of the Patient:
First contact with patients in the department; management of wheel chair and stretcher patients and aids for this; management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients (for example clean linen and receptacles, nursing care; temperature, pulse and respiration; essential care of the patient who has a tracheostomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.

Unit 3: First Aid:
Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints; bandaging; dressing, foreign bodies; poisons.

Unit 4: Infection:
Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis.

Unit 5: Principles of Asepsis:
Sterilization - methods of sterilization; use of central sterile supply department; care of
identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radiotherapy department

**Unit 6 : Drugs in the department :**

Storage : classification; labeling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti-hypertensive etc.

**Medical Ethics:**

**Unit 1 : Introduction to Medical Ethics:**

What is Ethics? What are the values & norms? Relationship between being ethical & human fulfillment. How to form a value system in one’s personal & professional life? Heteronomous Ethics & Autonomous Ethics. Freedom & personal Responsibility.

**Unit 2 : Definition of Medical Ethics:**

Difference between medical ethics & bio-ethics Major Principles of Medical Ethics Beneficence=fraternity, Justice=equality, Self determination(autonomy)=liberty

**Unit 3 : Perspective of Medical Ethics:**


**Unit 4 : Ethics of the individual:**


**Unit 5 : The Ethics of Human life:**


**Unit 6 : The Family & Society in Medical Ethics:**

The Ethics of human sexuality, FP perspectives, Prolongation of life, Advanced life directives-The Living Will, Euthanasia, Cancer & Terminal Care
**Unit 7: Death & Dying:**


**Unit 8: Professional Ethics:**


**Unit 9: Research Ethics:**

Animal & experimental research/humanness, Human experimentation, Human volunteer research-Informed Consent, Drug trials.

**Reference books**

2. Care of patient in diagnostic Radiography - Chesney & Chesney.
3. Chesney's Care of the patient in Diagnostic Radiography – Pauline J. Culmer.
4. Aid to Tray and Trolley Setting - Marjorie Hougton
5. First Aid - Haugher & Gardner
6. A guide to Oncology nursing (Livingstone) - Deeley
8. Capra : Care of the cancer patient
10. Sultan and Maurice : Cancer
Course Title : Physics of Radiotherapy & Imaging Techniques
Course Code : RT-201
Contact Hours : 3 : 2 : 1 Lecture / Tutorial / Demonstration
Course assessment : sessional test and/or home assignment 25%; Annual exam 75%
Course objective and outcome :

SYLLABUS

Unit 1 : Interaction of Radiation with matter
Radiation transmission through matter, Interaction of electromagnetic radiation with matter – Thomson scattering (coherent scattering), Photoelectric and Compton effects – Pair production – relative importance - energy absorption – attenuation co-efficients. law of exponential attenuation, half value layer, linear attenuation coefficient-Interaction of particle radiation with matter – neutrons, heavy ions, nuclear reactions – range and Bragg curve. Interactions of x and gamma rays in the body; fat-soft tissue-bone- contrast media-total attenuation coefficient-relative clinical importance

Unit 2 : Radiation and radioactivity units and quantities :
Flux, Fluence, Exposure, Activity, photon fluence, intensity, absorbed dose, KERMA, LET, SI units of radiation quantities.,
Radiation therapy – beam therapy – particle therapy, History & properties of Radium needles, tubes and its uses, Co-60 and Cs-137, Ir-192 seeds and wires.

Unit 3 : Basic Radiotherapy Physics
Historical developments in Radiotherapy, Physical components of Telecobalt Unit / Linear Accelerator Unit / Remote Afterloading Unit / Gamma Knife Unit / Simulator and their descriptions, Various types of sources used in Radiotherapy and their properties. Physics of Photons, electrons, protons and neutrons in radiotherapy, Build up and dose maximum, Physical parameters of dosimetry such as Percentage Depth Dose, Tissue-Air Ratio, Tissue Maximum Ratio, back scatter factor- Equivalent square field concept, Physics of Bolus and Phantom materials, Compensators, Wedges, Shielding Blocks, Patient immobilization devices. Use of PDD charts for isodose distribution- SSD and SAD technique - rotation technique--Time and dose calculations in SSD,SAD and rotation therapy. Worked examples for cobalt-60 and linac treatments.
Electron beam therapy - interactions - energy specification – characteristics of electron beams.

Unit 4 : Physics of Imaging :
Basic principles of radiation imaging techniques. Absorption characteristics of body tissues. Computerised Tomography (CT) – History, CT Generations, geometric generation of tomography – Image reconstruction – basic principles. - Ultrasound imaging – Doppler effect, Piezo Electric Effect, Scintillation detectors. - Basic principles of Magnetic Resonance Imaging (MRI) - Isotope imaging techniques – Nuclear Medicine – Rectilinear Scanners and Gamma Cameras – Positron Emission Tomography (PET) & SPECT. Isotopes used in Radioisotope imaging techniques. Isotopes used in Nuclear Medicine, Biological and Effective Half Life, Absorbed dose arising from Radionuclides within the body. Diagnostic and Therapeutic uses of colloidal Radioactive Isotopes. Digital Image processing – Grey scale, histogram, signal to noise ratio, digital filtering, Data acquisition, display devices, data storage devices.

**Unit 4 : Radiographic Film Processing :**

The X-ray Dark Room, lightproofing, ventilation, radiation protection. Film markers, pass through filters. Developer, Fixer solution, their chemical composition, preparation and process of developing a film. The radiographic image, effect of exposure factors on contrast and image qualities.

**Unit 5 : Radiation detection and measurements:**

Principle of radiation detection - Ionisation of gases, fluorescence and phosphorescence, effect on photographic emulsion. Ionization chamber-proportional counter-GM counters - scintillation detectors - semiconductor detector-Gamma ray spectrometer. free air ionization chamber-thimble ion chamber-condenser chamber - Victoreen electrometer-secondary standard dosimeter – photographic film dosimeter - calorimeter - chemical dosimeter - Thermoluminescent dosimeter, Radiation survey meter-zone monitor-contamination monitor, their function use and maintenance. Advantages and disadvantages of various detectors, appropriateness of different types of detectors for different types of radiation measurement.

**Reference books**

4. Joseph Selman – Part II Physics of radiotherapy explained
7. Radiographic Latent image processing - W.E.J. Mckinney
8. Photographic processing, quality control and evaluation of photographic material -J.E. Gray
9. Physical and photography principles of Medical Radiography -Seeman & Herman.
10. Avinash C. Kak, Principles of Computerised Tomographic Imaging. IEEE PRESS
12. Christensen's Physics of Diagnostic Radiology by Thomas S. Iii Curry, James E. Dowdey,


Course Title : Basic Radiotherapy Equipments And Process
Course Code : RT-202
Contact Hours : 3 : 2 : 1 Lecture / Tutorial / Demonstration
Course assessment : sessional test and/or home assignment 25%; Annual exam 75%
Course objective and outcome : The following syllabus is intended to be comprehensive in the range of subjects to be covered without being detailed. Candidates should possess a sound knowledge of the subjects and those of practical procedures which technologists might be called upon to undertake.

SYLLABUS


Unit 3 : Beam directing devices: Different types of collimators- penumbra trimmers-Front and back pointer-pin and arc. Tissue compensation-Field blocks-field shaping-multileaf collimator-IMRT concept-separation of adjacent fields.


Unit 5 : Radiotherapy simulators
Conventional simulators - CT simulators - cone beam CT simulators (CBCT) – comparison and quality assurance of simulators - different simulation techniques - Orthogonal, Semiorthogonal, Isocentric, Variable angle and Stereo-Shift.

Reference Books
4. Joseph Selman – Part II Physics of radiotherapy. explained
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Fletcher, Gilbert: Radiation therapy in the management of cancers</td>
</tr>
<tr>
<td>7.</td>
<td>Walter and Miller: Short text book of radiotherapy</td>
</tr>
<tr>
<td>8.</td>
<td>Moss: Radiation Oncology – Rationale, technique &amp; results</td>
</tr>
</tbody>
</table>
### Course Title:
**Principles and Practice of Radiotherapy**

### Course Code:
**RT-203**

### Contact Hours:
3 : 2 : 1 Lecture / Tutorial / Demonstration

### Course assessment:
Sessional test and/or home assignment 25%; Annual exam 75%

### Course objective and outcome:

#### SYLLABUS

**Unit 1: Introduction to Clinical Radiotherapy:**

**Unit 2: Basic Pathology & staging of malignant tumor:**

**Unit 3: Care of Cancer Patients**
General welfare of the patient during and after the treatment including the care any intercurrent disease (diabetic, tuberculosis, arthritis). Diet and fluid intake. The observation and reporting any change in the signs and symptoms of patients receiving treatment. The use of blood count in the control of certain treatment. The care of local and systemic reaction. Local reaction should include those in the ear, nose, throat and eye and those arising from treatments given to the pelvis. Care of cancer patients. (Mucositis, Dermatitis, Cystitis, proctitis)

### Reference books
1. Walter and Miller: Short text book of radiotherapy
2. Meredith W J (et al) Radiation dosage the Manchester system
3. Smith : Ivan H (et al) Cobalt 60 teletherapy
5. Wachsmann : Felise and Berth Gunther Moving field radiation therapy.
6. Murphy and Walter : Radiation Therapy
7. Sulton and Maurice : Cancer explained
8. Fletcher, Gilbert : Radiation therapy in the management of cancers
9. Moss William : Therapeutic radiology
Course Title: Radiobiology & Radiation Protection

Course Code: RT-204

Contact Hours: 3 : 2 : 1 Lecture / Tutorial / Demonstration

Course assessment: sessional test and/or home assignment 25%; Annual exam 75%

Course objective and outcome:

SYLLABUS

Unit 1: Biological effects of radiation

Unit 2: Radiation Protection
Philosophy of Radiation Protection, Effect of time, Distance and shielding, Calculation of workload, Calculation of weekly dose to the radiation worker and general public, good work practices in diagnostic radiology and radiotherapy practices. Equivalent Dose, Weighting Factors, Effective Dose, Natural Background Radiation, Occupational Exposure limits, Dose limits for public.

Unit 3: Planning of radiation installation

Unit 4: Personnel monitoring systems

Unit 5: Radiation emergencies

Unit 6: Safety code and work Practices
Built in safety specification for teletherapy and brachytherapy units-treatment room and control room safety-operational safety-radiation protection program-personnel requirements and responsibilities-regulatory controls Regulatory requirements : National regulatory body, responsibilities, organization, safety standards, codes and guides, responsibilities of licenses, registrants and employers and enforcement of regulatory requirements.

Demonstration :
Time, Distance and shielding, measurement of HVT & TVT. Familiarisation of radiation survey meters and their functional performance checks, Radiological Protection Survey of Radiotherapy, Simulator and CT Simulator installations, QA on X-ray, Simulator and Radiotherapy Equipments, Procedures followed for calibration of measuring and monitoring instruments.

Reference books
2. Radiation Protection in Hospitals. Richard F.Mould
3. Basic radiological physics: K.Thayalan Jaypee brothers pvt ltd, New Delhi
4. An Introduction to Radiation Protection. Allen Martin & Samuel
5. Radiation safety in Medical practice. M.M. Rehani.
6. Radiation Protection. Ronald L. Kathren
7. AERB safety code, Mumbai
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Practicals and Viva-voce -1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code</td>
<td>RT-2P1</td>
</tr>
<tr>
<td>Contact Hours</td>
<td>2 : 1 Practicals / Demonstration</td>
</tr>
<tr>
<td>Course assessment</td>
<td>Clinical Posting / home assignment 25%; Annual exam 75%</td>
</tr>
<tr>
<td>Course objective and outcome</td>
<td></td>
</tr>
</tbody>
</table>

**SYLLABUS**

1. To find out the Timer / Shutter error of cobalt teletherapy unit
2. To Find the Field Size Factors for Theratron-780C cobalt teletherapy unit
3. To find the Tray factor of the Perspex shielding tray using cobalt teletherapy unit
4. Radiation Survey of the Teletherapy installation
5. Radiation Survey of the Brachytherapy installation
6. Congruence between Light and Radiation field for Th-780C cobalt teletherapy unit.
7. To prove Inverse Square Law.
8. To verify Area/Perimeter method
9. To find the HVL / attenuation factors
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Advanced Radiotherapy Equipments &amp; Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code :</td>
<td>RT-301</td>
</tr>
<tr>
<td>Contact Hours :</td>
<td>3 : 2 : 1 Lecture / Tutorial / Demonstration</td>
</tr>
<tr>
<td>Course assessment :</td>
<td>sessional test and/or home assignment 25%; Annual exam 75%</td>
</tr>
<tr>
<td>Course objective and outcome :</td>
<td>The following paper is intended to be comprehensive in the range of subjects to be covered without being detailed. Candidates should possess a sound knowledge of the various modern radiotherapy equipments and those of practical procedures which technologists might be called upon to undertake.</td>
</tr>
</tbody>
</table>

**SYLLABUS**

**Unit 1 : Linear accelerators**

**Unit 2 : Conformal Radiotherapy With Multi Leaf Collimator**

**Unit 3 : Intensity Modulated & Image Guided Radiation Therapy**
Introduction to IMRT –Target and critical structure definitions for IMRT – Static MLC IMRT, Dynamic MLC IMRT, compensator based IMRT – comparison of IMRT delivery systems — Introduction to serial Tomotherapy and Helical Tomotherapy.

**Unit 4 : Stereotactic Radio Surgery And Radiotherapy**
Introduction to SRS and SRT – SRS with Co-60 sources; the Gamma knife – stereotactic multiple – arc radiotherapy with a Linac – Cyber knife - Dynamic SRS – Dynamic collimation for SRS with multiple arc - Intra operative radiation therapy.

**Unit 5 : QA in Radiotherapy :**
Accessories and tools used for QA tests in Radiotherapy such as Front Pointer, Back Pointer, Laser Alignment etc., Optical and radiation field congruence, Beam shaping blocks, Beam shaping jaws, Delineator/Diaphragm movements, Isocentre alignment, Patient support system, Beam on and off
mechanisms, Technician’s role in QA tests on telecobalt/ Linear Accelerator/Brachytherapy /Simulator/CT Simulator machines.

<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Linear Accelerators for Radiation Therapy (Peter C. Williams)</td>
</tr>
<tr>
<td>2. Radiotherapy: Principles to Practice (Griffith)/Basics of Radiotherapy, Technical Aspects of techniques</td>
</tr>
</tbody>
</table>
Course Title: Clinical Radiotherapy

Course Code: RT-302

Contact Hours: 3 : 2 : 1 Lecture / Tutorial / Demonstration

Course assessment: sessional test and/or home assignment 25%; Annual exam 75%

Course objective and outcome:

SYLLABUS

Unit -1: Principles of Radiotherapy & Chemotherapy
Tumours from different organs and organ systems. Basic Principles of Radiotherapy and different Radiotherapeutic technique. Basic Principles, Classification, mechanism of action, Indication & toxicity of Cancer Chemotherapy.

Unit -2: Patient Treatment setup

Beam Shielding blocks, preparation, HVL requirements, materials used, Critical organs, dose limits for organs, Styrofoam cutting, shadow trays, Electron filters. Bolus requirements, tissue compensating bolus, bolus materials,

Unit – 3: Principles of Professional Practice
Professional Aspects –, Appearance and Hygiene, Universal Precautions – History and role of radiotherapy in cancer, Human body with typical technical terminology, General Care of the patient, Setup reproducibility, Basic Nursing Procedures for patient care and emergency situations

Procedure in Radiotherapy department – First Visit to include Room Preparation, Equipment and Documentation and assistance with procedures / examinations, Professional development skills Treatment preparation, Treatment equipment, Treatment set-up and delivery, Patient care, Care of the Cancer Patient.

Unit – 4: Nutrition
Nutrition – It’s health aspect and importance in Oncology, Health education, Psychosocial aspect of Oncology, Knowledge of Occupational disease & health aspects of Industries & other Occupations.

Unit – 5: Environment Science And Health
Introduction to Environment and Health Sources, health hazards and control of environmental pollution, Water, The concept of safe and wholesome water. The requirements of sanitary sources of water. Understanding the methods of purification of water on small scale and large scale. Various
biological standards, including WHO guidelines for third world countries. Concept and methods for assessing quality of water. Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

<table>
<thead>
<tr>
<th>Reference books</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Walter and Miller: Short text book of radiotherapy</td>
</tr>
<tr>
<td>2. Meredith W J ( et al) Radiation dosage the Manchester system</td>
</tr>
<tr>
<td>7. Murphy and Walter : Radiation Therapy</td>
</tr>
<tr>
<td>8. Sulton and Maurice : Cancer explained</td>
</tr>
<tr>
<td>9. Fletcher, Gilbert : Radiation therapy in the management of cancers</td>
</tr>
<tr>
<td>10. Mos William : Therapeutic radiology</td>
</tr>
</tbody>
</table>
Course Title : Biostatistics, Computer Skills & Patient Data Maintenance

Course Code : RT-303

Contact Hours : 3 : 2 : 1 Lecture / Tutorial / Demonstration

Course assessment : sessional test and/or home assignment 25%; Annual exam 75%

Course objective and outcome :

SYLLABUS

Biostatistics:

Unit - 1 : Introduction to Biostatistics

Unit – 2 : Tabulation of Data
Data arrangement and presentation, formation of tables and charts. Raw data, the array, frequency distribution. Basic principles of graphical representation. Types of diagrams - histograms, frequency polygons, smooth frequency polygon, commulative frequency curve, Normal probability curve.

Unit - 3 : Measure of Central Tendency
Need for measures of central tendency, Definition and calculaton of mean - ungrouped and grouped Meaning, interpretation and calculation of median ungrouped and grouped. Meaning and calculation of mode. Comparison of the mean, and mode. Guidelines for the use of various measures of central tendency.

Unit - 4 : Measure of Variability
Need for measure of dispersion. The range, the average deviation. The variance and standard deviation. Calculation of variance and standard deviation ungrouped and grouped. Properties and uses of variance

Unit -5 : Probability and Standard Distributions.

Computer Skills :

Unit -1 : Introduction to computers
Introduction to computer – I/O devices – memories – RAM and ROM – kilobytes. MB, GB their conversions - Operating systems – DOS, Windows, Linux and Unix- Number system – Binary and decimal conversions — Networking – LAN, WAN.
Unit -2 : Wordprocessing

Unit -3 : Spreadsheets

Unit -4 : Slide/Powerpoint presentations

Unit – 5 : Internet and its uses
Introduction to Internet – Using search engine – Google search – Using Web Browsers – Uploading and Download of files and images – E-mail ID creation – Sending messages – Attaching files in E-mail – Introduction to Software languages – Components of Software languages - Different variables, declaration, usage – Constants – Sub programs – Interpreter & compiler.

Patient Data Management
Unit – 1 : Medical Records
Revision : Definition and history of medical record-Values, purposes and uses of medical record-Contents and components of medical record-Responsibilities of Radiotherapy technicians, hospital administrators, Doctors, nurses and allied health professionals in relation to medical records.

Unit – 2 : Management of medical records
Numbering, filing, storing and retrieving medical records-Maintenance of Registers- admission, discharge, MLC registers – Daily treatment/simulation/mouldroom Registers, Radiotherapy registration - Analysis of medical records - Medico legal aspects, Medical confidentiality-Consents – Types of consent (Informed, implied, express, etc.)

Unit – 3 : Use of computers for data management
Introduction to the design, maintenance and use of data management systems for the collection and analysis of research data, especially epidemiologic research data on humans. MS Access, MS Excel and other data management & Statistical packages are emphasized. Topics include: database development, data manipulation and cleaning, data summarization, and selected topics in statistical analysis programming.

Demonstration/Practicals
Indentification of various parts of the PC, Demonstration of dis-assembly and assembly of PC and interconnection of Input and Output devices to PC,
Familiarization with start menu, taskbar icons, windows explorer, Control panel of settings
MS-Word, Basics of Letter writing, templates, wizards, formatting documents
Creating Graphics, tables, etc. using MS-Word, Building a sample worksheet using MS-Excel
Formulas for calculations, sorting etc..

**Reference Books**
B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002,
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Practicals and Viva-voce - II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code</td>
<td>RT-3P1</td>
</tr>
<tr>
<td>Contact Hours</td>
<td>2 : 1 Practicals / Demonstration</td>
</tr>
<tr>
<td>Course assessment</td>
<td>Clinical posting 25%; Annual exam 75%</td>
</tr>
<tr>
<td>Course objective and outcome</td>
<td></td>
</tr>
</tbody>
</table>

**SYLLABUS**

1. Mould Room 1 : Thermoplastic Immobilisation cast preparation
2. Mould Room 2 : Build up bolus preparation
3. Mould Room 3 : Custom shielding block preparation
4. Teletherapy Simulation of patient using x-ray machine
5. Brachytherapy Simulation for ICRT patients
6. Teletherapy Planning : simple planning calculations
7. Brachytherapy Planning : simple planning calculations
8. Treatment Delivery : Teletherapy – simple parallel opposing fields
9. Treatment Delivery : Teletherapy – multiple fields (more than 2) setup
10. Treatment Delivery : Brachytherapy
<table>
<thead>
<tr>
<th>Number</th>
<th>COMPETENCY</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Suggested teaching method</th>
<th>Suggested assessment method</th>
<th>Number required to pass</th>
<th>Vertical Integration</th>
<th>Horizontal Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>RADIOTherAPY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Topic: Principles of Radiation Delivery (Radiotherapy)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of competencies: (15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of procedures that require certification: (NIL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT1.1</td>
<td>Describe and discuss definition of radiation, mechanism of action of radiation, types of radiation</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
<td>General Surgery, Anesthesiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT1.2</td>
<td>Describe and discuss interaction of radiation with matter &amp; measurement of radiation</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT1.3</td>
<td>Enumerate, describe and discuss classification and staging of cancer (AJCC, FIGO etc.)</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
<td>Pathology</td>
<td>General Surgery, General Medicine</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Topic: Radiation Protection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of competencies: (91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of procedures that require certification: (NIL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT2.1</td>
<td>Describe and discuss radiation protection and personal monitoring during radiation treatment</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Topic: Radiobiology &amp; Chemoradiation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of competencies: (92)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of procedures that require certification: (NIL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT3.1</td>
<td>Describe and discuss cell cycle and cell survival curve, variables of radiobiology</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT3.2</td>
<td>Describe and discuss synergism of radiation and chemotherapy</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Topic: Radiation Treatment Delivery &amp; outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of competencies: (99)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of procedures that require certification: (NIL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT4.1</td>
<td>Describe and divided teletherapy machine (Cyto/LINAC)</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>O&amp;I session</td>
<td>Written/ Viva voce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT4.2</td>
<td>Enumerate, describe and discuss types of treatment plan, basic workflow of 2DCRT/IMRT/1RT</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>O&amp;I session</td>
<td>Written/ Viva voce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>COMPETENCY</td>
<td>Dem/Alt</td>
<td>Level</td>
<td>Core</td>
<td>Y/N</td>
<td>Suggested teaching method</td>
<td>Suggested assessment method</td>
<td>Quantity required to carry out</td>
<td>Vertical Integration</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td>-----</td>
<td>--------------------------</td>
<td>----------------------------</td>
<td>-----------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>R14.3</td>
<td>Describe and discuss the therapy machine (tempo &amp; flow)</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP session</td>
<td>Written/ Viva voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14.4</td>
<td>Describe and discuss different radiotherapy techniques and their use in cancer patients</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14.5</td>
<td>Describe and discuss the use of radiation in management of common malignancies in head &amp; neck (region specific)</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Basic side effects</td>
<td>Written/ Viva voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14.6</td>
<td>Describe and discuss radiotherapy for benign disease</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14.7</td>
<td>Counsel patients undergoing acute and late effects of radiation and supportive care</td>
<td>K</td>
<td>KSH</td>
<td>Y</td>
<td>Basic side effects, group discussion</td>
<td>Written/ Viva voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14.8</td>
<td>Describe oncological emergencies at palliative care</td>
<td>K</td>
<td>KSH</td>
<td>Y</td>
<td>Lecture, Group discussion</td>
<td>Written/ Viva voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14.9</td>
<td>Display empathy in the care of patients with cancer</td>
<td>A</td>
<td>SH</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Topics:** Cancer Prevention & Registries

**Number of competencies:** (61)

**Number of procedures that require certification:** (36)

---

**Columns:**
- **A:** Knowledge, **B:** Skill, **C:** Attitude / Professionalism, **D:** Communication,
- **E:** K, **F:** KH, **G:** Knows, **H:** Knows How, **I:** Shows, **J:** Performed Independently,
- **P:** DOAP session, **Q:** Demonstration, **R:** Observation, **S:** Assess, **T:** Perform.

Columns **H:** if entry is **P:** indicate how many procedures must be done independently for certification/ graduation.
### Topic: Principles of Radiation Oncology

**Competency:** RT 1.1

<table>
<thead>
<tr>
<th>At the end of session a phase 3 student must be able to-</th>
<th>DOMAIN</th>
<th>LEVEL</th>
<th>CORE</th>
<th>TEACHING/LEARNING METHOD</th>
<th>ASSESSMENT METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define radiation</td>
<td>K</td>
<td>L</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Describe particulate radiation</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Describe electromagnetic radiation</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Discuss mechanism of action of radiation</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Classify radiation according to their mechanism of action</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Differentiate between directly and indirectly acting radiation</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
</tbody>
</table>

### Topic: Principles of Radiation Oncology

**Competency:** RT 1.3

<table>
<thead>
<tr>
<th>At the end of session a phase 3 student must be able to-</th>
<th>DOMAIN</th>
<th>LEVEL</th>
<th>CORE</th>
<th>TEACHING/LEARNING METHOD</th>
<th>ASSESSMENT METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enumerate the various staging systems used for cancer staging</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Define the AJCC- TNM staging classification</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Discuss the rules for staging under the AJCC- TNM staging classification</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Enumerate the sites where AJCC- TNM staging classification is utilized</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Discuss the FIGO staging classification</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Enumerate the sites where FIGO staging is utilised</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
</tbody>
</table>

### Topic: Radiation Protection

**Competency:** RT 2.1

<table>
<thead>
<tr>
<th>At the end of session a phase 3 student must be able to-</th>
<th>DOMAIN</th>
<th>LEVEL</th>
<th>CORE</th>
<th>TEACHING/LEARNING METHOD</th>
<th>ASSESSMENT METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classify the harmful effects of radiation</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Discuss the stochastic and non-stochastic effects of radiation</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Discuss the principle of ALARA</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Enumerate the occupational and public dose limits</td>
<td>K</td>
<td>K</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Topic: Radiobiology and Chemoradiation Competency: RT 3.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>At the end of session a phase 3 student must be able to:</strong></td>
<td><strong>DOMAIN</strong></td>
<td><strong>LEVEL</strong></td>
<td><strong>CORE</strong></td>
<td><strong>TEACHING/LEARNING METHOD</strong></td>
<td><strong>ASSESSMENT METHOD</strong></td>
</tr>
<tr>
<td>Discuss the structural shielding design</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
<tr>
<td>Discuss personnel monitoring during radiation treatment</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ viva voce</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: Radiobiology and Chemoradiation Competency: RT 3.2.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At the end of session a phase 3 student must be able to:</strong></td>
</tr>
<tr>
<td>Enumerate different classes of chemotherapeutic agents</td>
</tr>
<tr>
<td>Discuss in detail the interaction of chemotherapy and radiotherapy</td>
</tr>
<tr>
<td>Describe the molecular mechanism of interaction between chemotherapy and radiotherapy</td>
</tr>
<tr>
<td>Enumerate the toxicities resulting from concurrent use of chemotherapy and radiotherapy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: Radiation treatment delivery and outcome Competency: RT 4.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At the end of session a phase 3 student must be able to:</strong></td>
</tr>
<tr>
<td>List different types of radiation treatment plans</td>
</tr>
<tr>
<td>Define 2D radiation plan</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Describe the basic workflow of 2D treatment plan</td>
</tr>
<tr>
<td>Define 3D conformal radiotherapy</td>
</tr>
<tr>
<td>Describe the workflow of 3D treatment plan</td>
</tr>
<tr>
<td>Define intensity modulated radiation therapy (IMRT)</td>
</tr>
<tr>
<td>Describe the basic workflow of IMRT</td>
</tr>
<tr>
<td>Enumerate the clinical applications of IMRT</td>
</tr>
<tr>
<td>Define image guided radiation therapy (IGRT)</td>
</tr>
<tr>
<td>Discuss the various IGRT image guidance technologies</td>
</tr>
</tbody>
</table>

**RT 4.6 Describe and discuss radiotherapy for benign disease**

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss the Basic principles of radiotherapy for benign disease</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voice</td>
</tr>
<tr>
<td>Describe the management of common benign conditions in which radiotherapy is used</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voice</td>
</tr>
</tbody>
</table>

**RT 4.7 Counsel Patients regarding acute and late effects of radiation and supportive care**

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counsel Patients regarding acute effect of radiation</td>
<td>KA/S</td>
<td>K</td>
<td>Y</td>
<td>Bedside clinic</td>
<td>Written/ Viva voice</td>
</tr>
<tr>
<td>Counsel Patients regarding late effect of radiation</td>
<td>KA/S</td>
<td>K</td>
<td>Y</td>
<td>Bedside clinic</td>
<td>Written/ Viva voice</td>
</tr>
<tr>
<td>Counsel Patients regarding supportive care</td>
<td>KA/S</td>
<td>K</td>
<td>Y</td>
<td>Bedside clinic</td>
<td>Written/ Viva voice</td>
</tr>
</tbody>
</table>

**RT 4.8 Describe oncological emergencies and palliative care**

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe oncological emergencies</td>
<td>KA/S</td>
<td>K</td>
<td>Y</td>
<td>Group Discussion</td>
<td>Written/ Viva voice</td>
</tr>
<tr>
<td>Describe palliative care</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Group Discussion</td>
<td>Written/ Viva voice</td>
</tr>
</tbody>
</table>
### RTA 9: Display empathy in the care of patients with cancer

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display empathy in the care of patients with cancer</td>
<td>A</td>
<td>IIC</td>
<td>N</td>
<td>Bedside clinic AETCOM</td>
<td>AETCOM</td>
</tr>
</tbody>
</table>

### RTS 5.1: Describe and discuss cancer prevention, screening, vaccination, cancer registry

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss cancer prevention</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Group Discussion</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>Describe screening</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Group Discussion</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>Discuss vaccination</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Group Discussion</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>Describe cancer registry</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Group Discussion</td>
<td>Written/ Viva voce</td>
</tr>
</tbody>
</table>

### Competency: RT 1.2 – Describe and discuss Interaction of Radiation with Matter and Measurement of Radiation

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enumerate the types of radiation.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>Enlist Electromagnetic Radiation.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>Enlist Particulate Radiation.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>Enumerate the types of Interaction of Electromagnetic radiation with matter.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>5. Describe Coherent Scattering.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>6. Describe Photoelectric effect.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>7. Describe Compton effect.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>8. Describe Pair Production.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>10. Describe Interaction of Proton with matter.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
<tr>
<td>11. Describe Interaction of Neutron with matter.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written/ Viva voce</td>
</tr>
</tbody>
</table>
12. Enlist methods used for measuring Exposure of Ionising Radiation.  
   K     KH    Y    Lecture    Written / Viva voce

   K     KH    Y    Lecture    Written / Viva voce

14. Define Unit of Exposure.  
   K     KH    Y    Lecture    Written / Viva voce

15. Define Unit of Absorbed Dose.  
   K     KH    Y    Lecture    Written / Viva voce

   K     KH    Y    Lecture    Written / Viva voce

17. Differentiate various methods of interaction of Electromagnetic radiation with matter.  
   K     KH    Y    Lecture    Written / Viva voce

Competency: RT 4.1 – Describe and discuss Teletherapy Machines (Co60 / LINAC).

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe Co60 Radioisotope.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>2. Enlist Parts of Co60 Machine.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>3. Enumerate Different Shutter Mechanisms in Co60 Machine.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>4. Define Collimators.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>5. Enumerate the types of Collimators.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>6. Define Penumbra.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>7. Enumerate the types of Penumbra.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>8. Describe LINAC Machine.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>10. Describe Multi Leaf Collimator in LINAC.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>11. Enlist the Differences between Co60 and LINAC Machine.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voce</td>
</tr>
</tbody>
</table>

Competency: RT 4.3 – Describe and discuss Brachytherapy Machine (Remote After Loading).

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency: RT 4.4 - Describe and discuss different radioactive isotopes and their use in Cancer patients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td><strong>At the End of Session, a Phase 3 student must be able to</strong></td>
<td><strong>Domain</strong></td>
<td><strong>Level</strong></td>
<td><strong>Core</strong></td>
<td><strong>Teaching Learning Method</strong></td>
<td><strong>Assessment Method</strong></td>
</tr>
<tr>
<td>Enumerate the sources used in Brachytherapy.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate the systems used in Brachytherapy.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate the types of Brachytherapy Techniques.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Describe Pre Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate Disadvantages of Pre Loading Technique</td>
<td>KH</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe Manual After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate advantages of Manual After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate Disadvantages of Manual After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Describe Remote After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate Advantages of Remote After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate Disadvantages of Remote After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enlist parts of Remote After Loading Machine.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Differentiate between Preloading, Manual After loading and Remote After Loading Technique.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>DOAP Session</td>
<td>Written / Viva voice</td>
</tr>
<tr>
<td>Enumerate Advantages of Caesium.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---</td>
<td>----</td>
<td>---</td>
<td>---------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Enumerate Disadvantages of Caesium.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enlist characteristics of Cobalt Source.</td>
<td>K</td>
<td>KH</td>
<td>?</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enumerate Advantages of Cobalt.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enumerate Disadvantages of Cobalt.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enlist characteristics of Iridium Source.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enumerate Advantages of Iridium.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enumerate Disadvantages of Iridium.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the uses of Sealed sources in treatment of cancer patients.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the uses of Unsealed sources in treatment of cancer patients.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture</td>
<td>Written / Viva voce</td>
</tr>
</tbody>
</table>

Competency: RT 4.5 - Describe and discuss role of Radiation in Management of Common Malignancies in India (Region 5)

<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enlist the Common Malignancies in India (Region-wise).</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Define the various Modes of use of Radiation in Treatment of Cancer.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Define the various Techniques of Radiation in treatment of cancer.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Head &amp; Neck Cancers.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Gynaecological Cancers.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Breast Cancer.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Upper and Lower GI Cancers.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Male Genito-Urinary Cancers.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Brain Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the use of Radiation in treatment of Various Lung Cancers.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture &amp; Bedside Clinic</td>
<td>Written / Viva voce</td>
</tr>
</tbody>
</table>
Describe the use of Radiation in treatment of Various Bone and Soft Tissue Sarcomas

Describe the use of Radiation in Haematological Malignancies.

Describe the common Malignancies in India and their Treatment with Radiation.


<table>
<thead>
<tr>
<th>At the End of Session, a Phase 3 student must be able to</th>
<th>Domain</th>
<th>Level</th>
<th>Core</th>
<th>Teaching Learning Method</th>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enlist the Benign tumors of Bone.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Small Group Discussion.</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enlist the Malignant tumors of Bone.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Small Group Discussion.</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the Aetiology and Pathogenesis of Benign and Malignant tumors of Bone.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enumerate the Clinical features of Tumors of Bone.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Enlist the Investigations of Benign Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Small Group Discussion.</td>
<td>OSCE</td>
</tr>
<tr>
<td>Enlist the Investigations of Malignant Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Small Group Discussion.</td>
<td>OSCE</td>
</tr>
<tr>
<td>Describe the Principles of Management of Benign Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Describe the Principles of Management of Malignant Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce</td>
</tr>
<tr>
<td>Define the Role of Surgery in Management of Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce/OSCE</td>
</tr>
<tr>
<td>Define the Role of Radiotherapy in Management of Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce/OSCE</td>
</tr>
<tr>
<td>Define the Role of Chemotherapy in Management of Bone Tumors.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce/OSCE</td>
</tr>
<tr>
<td>Describe the Aetiology, Pathogenesis of Pathological Fractures.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce/OSCE</td>
</tr>
<tr>
<td>Define the Role of Surgery in Management of Pathological Fractures.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce/OSCE</td>
</tr>
<tr>
<td>Define the Role of Radiotherapy in Management of Pathological Fractures.</td>
<td>K</td>
<td>KH</td>
<td>Y</td>
<td>Lecture, Video Assisted Interactive Lecture.</td>
<td>Written / Viva voce/OSCE</td>
</tr>
<tr>
<td>Question</td>
<td>Time</td>
<td>Teaching Method</td>
<td>Assessment Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------</td>
<td>-------------------------</td>
<td>-------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>