MAHARASHRTA UNIVERSITY OF HEALTH SCIENCES, NASHIK.

Post- Graduate Syllabus

(Medical Faculty)

Sub:- Rediotheraphy

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Proposed Syllabus for
M.D (Doctor of Medicine) Course
in Radiotherapy & Oncology

Radiotherapy is a highly specialized and technical discipline in clinical medicine dedicated, as one of the major arms, in management and treatment of Cancer. With a view to update, by inclusion of newer topics, and to provide a uniform syllabus and course contents in universities and teaching medical institutions, it is proposed to frame the syllabus and course outline based on the recent developments in clinical medicine, radiobiology and medical physics.

Objectives:

At the end of the training, the candidate should have attained sufficient and in depth knowledge of

-Basic and radiologic physics of ionizing radiation;

- Etiology, pathology and epidemiology and cancer statistics in malignant diseases;

-Radiology and laboratory methods in radiotherapy;

-Investigations and practice of clinical oncology with special reference to radiotherapy and chemotherapy;

-Multi-disciplinary approach in the treatment of cancer with surgery, radiotherapy and chemotherapy;

-Prevention, early detection, management, and rehabilitation of cancer patients and their emotional problems.

Training Scheme

Duration of Training -3 years after internship (One-point Entry Programme) The subjects to be covered during the first year are .

- Medical Physics related to Radiotherapy
- Radiobiology
- Basic Sciences including general pathology, pathology of tumors applied anatomy and physiology.

The candidates should devote next two years in learning the science and art of practice of Radiotherapy and Oncology including chemotherapy alongwith knowledge of integration of other modalities in total management of cancer.

Teaching Methods –

- Theory lectures seminars in radiation physics, basic & clinical oncology, clinica1 radiation therapy & chemotherapy, radiation techniques and computer applications etc.
- Weekly case discussions, inter-departmental conferences, regional/national conferences, etc. - Posting in various divisions of the department-mould room, radium theatre. simulation room, teletherapy and Brach therapy facilities etc
- Posting in Radiotherapy OPD and ward, by rotation.
- Posting in departments/divisions of Surgery, Pathology, Cytology, Hematology, Gynecology, Imaging, cancer registry etc.
- Special lectures in other allied disciplines like Psychiatry; Experimental Medicine {with special stress on organisation of various research activities & trials in oncology), Community Medicine including preventive oncology, primary and secondary prevention of cancer, early detection and screening programmes in cancer, Planning of cancer control activities, rehabilitation and pain relief, etc.

Note : During the training programme each candidate should be required to engage himself in a project under the supervision of a faculty member for a thesis or a dissertation.

Scheme of Examinations ***(As per Direction No. 01/2008 dtd. 26/05/2008)***

The examinations should be conducted After 3Yrs of course

GUIDEUNES FOR THE TRAINING CENTRES/DEPARTMENTS

In the first place. the Department of Radiotherapy should be independent and should have faculty who are committed and have sole responsibility in the growth of the discipline and who can provide effective supervision in all the important aspects of Oncology and radiation therapy. radiation physics. radiation biology. radiation effects. medical oncology and medical statistics. etc.

The following are guidelines for the establishment of a department of radiotherapy. which must be an independent one in view of the vast and highly specialized nature of this subject and should be headed by the consultant (of the rank of Reader or Professor) having pure M.D. Radiotherapy qualifications.

1. staff

a) Consultants

i) In Radiotherapy: Professor/Reader/Assoc-Asstt. Professor/Lecturer

ii) In Medical Physics: Professor/Reader/Assoc-Asstt. Professor/ lecturer

b) Trainees

i) In Radiotherapy: Senior Residents/Registrars/PG. Students/House Surgeons

ii) In Medical Physics: Ph.D. Students/Trainee Technologists

c) Radiographers (Radiotherapy Technologists)

d) Other Para Medical Staff: Staff Nurses. .Social Workers. Medical Record Clerk. Mould Room Assistant. Radium Curator. Bio- Statistician and other Supportive Staff etc.

(i**) Professor of Radiotherapy**-One. He should be a postgraduate in Radiotherapy alone (not a combined degree) with a minimum of eight years. experience in an independent department of radiotherapy

(ii) **Associate-Assistant Professor/Reader/Lecturer**-The number of positions and nature of designations depend upon the work load. It is suggested that for about 500 new cancer cases, one additional position (other than the Head) is required.

(iii) **Professor/Reader/Assoc.-Asst. Professor/Lecturer in Medical Physics**-The candidate should be M.Sc. in Physics with Diploma in Radiologic Physics from a recognized university. Should have expert knowledge in radiation physics. radiobiology. mould room techniques and computer treatment planning system. Experience (for a faculty position). at least two years. experience in medical physics. in a department of Radiotherapy

Medical Physics Division should be an integral part of a Radiotherapy department. Minimum one post of Lecturer/Asstt. Professor in Medical Physics should exist in the beginning. More posts at various levels may be added as the total work load, equipments and specia1 techniques are added with expansion of the department.

{iv)**Trainees -**Registrar and residents-According to the workload. but minimum of one each should be the requirement.

{v) **Technologists**-Trained personnel with diploma and/or degree Two technologists per unit are essential. Additional staff would be required for Brach therapy and supportive equipment.

2. **Equipment :**

(i) Teletherapy equipments (Telecobalt 60, Linear Accelerator; Superficial X-.ray Therapy etc.). ;

It is suggested that an isocentric, rotational teletherapy equipment with a minimum of 80 cm SSD Cobalt.60 or Linear Accelerator should be the basic unit for any Radiotherapy department. The next unit should depend upon the number of cases. It is estimated that one unit can look after approximately 500-600 new cancer cases per year

(ii) Brach therapy facilities

This is a very essential part of the overall Radiation Treatment where sealed isotopes in the form of Caesium.137 or Cobalt-60 needles and tubes etc are used for treatment of carcinoma cervix, oral cavity and related diseases. The amount of sealed isotopes needed is according to the local requirements, but a minimum of the following is essential:

(a) Tow sets of intracavitary sources: :

Caesium 137 tubes	20 mg=4	This is designed according to
{Radium equivalent)	15 mg = 2	Manchester system. However,
	10 mg = 4	these can be I modified when manual after loading systems are used.
{b) Caesium-137 needles	3.0 mg with 5 cm active length = 4	
{Radium equivalent)	1.5 mg with 5 cm active length = 10	
	2.0 mg with 3 cm active length = 4	
	1.0 mg with 3 cm active length = 10	
	1.0 mg with 1 cm active length = 10	

{Radium tubes and needles are not recommended for any new department as this element is associated with radiation hazards).

It is also recommended that whenever possible the intracavitary application should be done with after loading techniques, whether manual or remote. The former is recommended when the number of cases is less than 2-4 per week (i.e., 100-200 applications/year) The centers where

intracavitary applications are more than 5 per week, should install remote after loading system especially with low dose rate radiation techniques. High dose rate technique with remote after loading system is recommended only for well established centers where enough experience and know-how are available for intracavitary therapy.

(iii) Supportive equipments

(a) Teletherapy Simulator-one.

A well designed therapy simulator is a useful addition in any department. This is now regarded as an essential equipment. The use of a simulator is in the reproduction of geometry of teletherapy beam in precision treatment.

(b) The computerized treatment planning system is a highly sophisticated supportive equipment for maintaining a uniform dosimetry and accurate treatment facilities in the teletherapy and Brach therapy. It is recommended that the funds be made available for this equipment.

(c) Mould room facilities for beam direction techniques and shielding blocks.

d) Measuring instruments like
Secondary standard dosimeter,
Pocket dosimeter, Phantoms, Surveymeters,
Film badge or TLD badge facilities etc and other monitoring instruments.

3**. Ward and Out-patient Facilities**

The Radiotherapy department should have separate facilities for outpatients as well as indoor wards for direct patient care. It is recommended that a minimum of 20 beds should be provided.

There is no doubt that a majority of the patients in radiotherapy can be treated on outpatient basis. However, the patients for Brach therapy have to be admitted. Some advanced cases and other patients, where investigations are needed for further diagnosis and to know the extent of disease, have to be provided indoor bed facilities.

Operation Theatre

The department should have facilities of an operation theatre either in the general operation wing or a separate theatre attached to the department for intracavitary and interstitial application. It is recommended that such facilities be provided along with the general operation theatre wing

Day care facility - for chemotherapy and patients who need extra care during radiotherapy treatment by external beam therapy.

RADIOTHERAPY PHYSICS

The following courses of study and the subjects are recommended for training in M.D. Radiotherapy and Oncology. It is essential that these topics be covered in detail for better understanding of the basics of Radiotherapy.

Medical Physics related to Radiotherapy

1. Atomic and Nuclear Structure

A. Atomic structure

1) Energy levels, binding energy

2. Transitions, characteristic radiations

B. Nuclear structure

1. Mass, atomic and neutron numbers

2. Nuclear binding energy

3. Fission, fusion

4. Nuclear reactors

2. Radioactive Decay

A. Modes of decay

1. N/P ratio, even-odd relationship
2. Beta decay
3. Positron decay and electron capture
4. Alpha decay
5. Isomeric transitions, gamma emission, internal conversion

B. Mathematics of Radioactive Decay

1. Units half life, graphing

2. Transient and secular equilibrium

3. Radionuclide generators

C. Natural Radioactivity

1. Naturally occurring isotopes

2. Decay series

D. Artificial Radioactivity

1. Production by neutron bombardment

2. Fission products

3. Production by charged particle bombardment

3. Production of X-rays

A. X-.ray tubes

1. Requirements for X-ray production
2. Historical development
3. Focal: spot size
4, Reflection and transmission targets
5. X-ray production efficiency

B. X-ray circuits

1. Primary circuits
2. Secondary circuit
3. Filament circuit
.4. Modes of rectification

4. High Energy Treatment Machines

A. Cobalt units
B. Van de graaff generators
C. Linear accelerators
D. Betatrons
E. Resonance transformers
f. Cyclotrons for neutron therapy

5. Interactions of x- and Gamma-rays

A. Attenuation of a beam of x- or gamma-rays
1 .Attenuation and absorption coefficients
2. Attentuation in the body

B. Modes of interaction
1 .photoelectric absorption
2. Compton scattering
3- Pair production
4. Photo-disintegration

6- Interactions of particulate Radiations

A. Types of interactions

1. Elastic, inelastic

2. Excitation, ionization

B. Properties of particulate radiations

1. Specific ionization

2. LET

C. Interactions of heavy charged particles and pions

1. Bragg's peak

2. Applications in radiation therapy

D. Interactions of electrons

1 .Interactions with electrons

2. Interactions with nuclei

3. Applications to radiation therapy

E. Neutron interactions

1. Slow neutron interactions

2. Fast neutron interactions

3. Applications to radiation therapy

F. Radioactive sources used in diagnosis and therapy-Production and properties

7. Measurement of Radiation Exposure

A. photon and energy flux density and fluence

B. The roentgen

C. Electronic equilibrium

D. Ionization chambers

1. Free-air chambers
2. Thimble chambers
3. Condenser chambers
4. Electrometers
5. Extrapolation chambers

E. Exposure calibration of an x. or gamma-ray beam

1. Selection of calibration variables
2. Selection of chamber
3. positioning of chamber
4. Corrections to readings

F. Quality assurance checks on radiation therapy units

8. Radiation Quality

A. Measures of quality

1. HVL and effective energy

B Factors influencing quality

1. Variations in quality across a beam
2. Filtration and acceleration potential

9. Measurement of Absorbed Dose

A. Units of radiation dose, dose equivalent, RBE.-dose

B. Calculation of dose from exposure

C. Measurement of absorbed dose with an ionization chamber

1 Bragg-Gray cavity theory

D: Direct measurement of absorbed dose

1. Film
2. TLD
3. Calorimetry
4. Chemical dosimetry

10. Calibration of High Energy photon and Electron Beams

A. Photons

1. Stopping power ratios and energy absorption coefficients
2. Acq
3. C

B. Electrons

1. C_E

11. Dose Distribution, External Beam Therapy

A. Dosimetric variables

1. Backscatter factor
2. Percent depth dose
3. Tissue-air ratio
4. Scatter-air ratio
5. Tissue-maximum and tissue-phantom ratios
6. Isodose distributions
7. Treatment time calculations
8. Fixed SSD and isocentric treatment techniques

B. Single and multiple field dose distributions

1. Corrections for wedges
2. Design of compensating filters
3. Corrections for surface obliquities
4. Corrections for heterogeneities
5. Dose perturbations at interfaces
6. Adjoining fields
7. Integral dose

C. Dose distribution for rotational therapy

D. Calculation of dose in large. irregular fields

12. Dose Distribution, Sealed Source Therapy

A. Handling of sealed radioactive sources

B. Dose distributions for sealed implant sources

C. Design of sealed source implants

D. Radium and its substitutes

E. Special techniques for ^{192}Ir and ^{125}Ir

F. Other sealed sources in therapy ...

13. Computerized Treatment Planning

A. External x. and gamma-.ray beams

1. Rectangular fields
2. Irregular fields

B. Electron beams

C. Implanted sources

1. Intracavitary implants

2. Interstitial implants

3. Surface mould

14. Radiation Protection from External Sources

A. Concepts and units

. 1. Quality factors

2. Dose equivalent

3. Protection regulations

B. Treatment room design

1. Primary radiation

2. Scatter

3. Leakage

4. Special problems with high energy photon and electron beam. Special problems with neutron, proton and meson

C. Sealed source storage

D. Protection surveys

E. Personnel monitoring

15. Radiation Protection from Internal Sources

A. Body burdens and critical organs

1. Effective half lives for uptake and elimination

B. Internal dose computations

1. Locally absorbed radiation

2. Penetrating radiation

C. Handling radionuclide therapy patients

D. Licensing procedure for using radionuclides

16. Planning of a Radiotherapy Department

A. Building designs

B. Choice of various equipments and sources

C. Acceptance and Calibration Tests

D. Various maintenance steps and procedures

RADIOBIOLOGY

Radiobiology and Laboratory Radiotherapy

1 .Mammalian Cell Radiosensitivity

A. Interphase and reproductive death

B. Cell survival curves in vitro

C. Characterization of cell survival curves

D. Critical sites and target theory

1. DNA
2. Membranes

E. Dose response curves in vivo

1. Skin clone
2. Surviving crypts
3. Bone marrow colonies growing in spleen. monolayer culture

F. Quantitative normal tissue reaction based on systems

1. Pig skin
2. Rodent skin
3. Lung
4. Esophagus
5. Kidney
6. CNS and spinal cord

2. Factors that Modify Radiation Response

A. The Oxygen effect

1. Effect of oxygen concentration
2. Time of action of oxygen
3. Mechanism of the oxygen effect
4. Implications for radiotherapy
5. Methods to overcome problems of hypoxic cells

B. The age response function

1. The cell cycle
2. Age response for cells cultured in vitro
3. Age response for tissues in vivo
4. Age response for neutrons

5. The oxygen eftect through the cell cycle

6. Implications for radiotherapy

C. Potentially lethal damage

1. Repair in vitro

2. Repair in vivo

3. Pill and high LET radiations

4. Implications in radiotherapy

D- Sublethal damage.

1. Split-dose experiments with cells in vitro

2- Sublethal damage repair in normal tissues

3. Sublethal damage repair in tumours

4. Sublethal damage and hypoxia

5. Sublethal damage and high LET radiations

6. Dq as a measure of repair

E. Dose-rate ;

1. Dose-rate effects in cells invitro

2. Dose-rate effect in normal tissues

3. Dose-rate effect tumours

4. Interstitial therapy

5. Beam therapy at low dose rate

F. Radiosensitizers

1- The halogenated pyrimidines

2- Hypoxic cell radiosensitizers

a. Structure and mode of action

b. Enhancement ratio

c. Metronidazole/misonidazole

d. Pharmokinetics in the human

e. Clinical limitations

3. Antibiotics

G. Radioprotectors ;

1. Free radical scavenger

3. Linear Energy Transfer

A. Definition

B. Track and energy average

C. LET for different types of radiation

D. OER as a function of LET

4. Relative Biological Effectiveness

A. Definition

B. RBE for different cells and tissues

C. RBE as a function of dose

D. RBE and fractionation

E- RBE as a function of LET

F. Q factor

5. Cell and Tissue Kinetics

A. The cell cycle.

B. Autoradiography

C. Constituent parts of the cell cycle

D. Percent labelled mitoses technique

E. Growth fraction

F. Cell loss factor

G. Growth kinetics of human tumours

6. Tissue Radiosensitivity

A. Classification based on radiation pathology

B. Types of cell populations

1. Self renewal
2. Conditional renewal
3. Stem cell
4. Differentiated

7- Time-Dose and Fractionations

A. The 4 R's of radiobiology

B. The basis of fractionation

C. The Strandquist's plot

D. Nominal standard dose

E Linear Quadrate equation

8- New Radiation Modalities

A. Protons

1- Production

2. Processes of absorption
3. Depth dose patterns
4. Advantage compared with x-rays
5. Facilities available

B. Neutrons

1. Production
2. Processes of absorption
3. Depth dose patterns
4. Advantages compared with x-rays
5. Facilities available

C. Pions

1. Production
2. Processes of absorption
3. Depth dose patterns
4. Advantages compared with x-rays
5. Facilities available

D. High energy heavy ions

1. Production
2. Processes of absorption
3. Depth Dose Patterns
4. Advantages compared with x-rays
5. Facilities available

9. Hyperthermia

A. Methods of heating

1. RF microwaves ,
2. Ultrasound
3. Water baths

B. Systematic hyperthermia
C. Localized heating
D. Cellular response to heat
E. Repair of thermal damage
F Thermotolerance
G. Hyperthermia combined with ionising radiations
H. Time sequence of heat and irradiation
I. Hypoxic cells and heat
J. Effect of pH on the response to hyperthermia
K. Response of transplanted tumours to heat
L. Response of spontaneous tumours to heat
M. Response of normal tissues to heat
N. Heat and the therapeutic gain factor
O. Hyperthermia and chemotherapy

10. Total Body Irradiation-Acute Effects

A. Prodromal radiation syndrome

B. Central nervous system/cerebrovascular syndrome

C. Gastrointestinal syndrome

D. Hematopoietic syndrome

E. Mean lethal dose: (LD_{50})

F: Treatment of radiation accidents

11 .Late Effects

A. Non-specific life shortening

1. Definition
2. In animals
3. In man

B. Carcinogenesis

1. The latent period
2. Dose response curve in animals
3. Leukemia
4. Breast cancer
5. Thyriod cancer
6. Bone cancer
7. Skin cancer
8. Lung cancer
9. Other tumours
10. Malignancies in prenatally exposed children

12. Mechanisms of Radiation Carcinogenesis

C. Genetics of irradiation

1. Point mutations.
2. Relationship to dose
3. Chromosome aberrations
4. Relationship to dose
5. Doubling dose
6. Genetically siginificant dose (GSD)
7. Genetic .effect in humans
8. Background radiation in relation to the GSD

13. Radiation Effects in the developing Embryo and Fetus

A. Intrauterine death
B. Congenital abnormalities including neonatal death
C. Growth retardation
D. Dependence of the above effects on dose, dose-rate and stage in gestation
E. Carcinogenesis following in utero exposure
F: Human experience of pregnant women exposed to therapeutic doses
G. Occupational exposure of potentially pregnant women
H. Elective booking or "10 day rule"
I. The "practical threshold" for therapeutic abortion

14. Radiophysiology of Human Tissues

A. Effects of irradiation of the skin

1. Clinical manifestations
2. Histological substratum of effects
3. Repair
4. Degree of sequelae
5. Injurious effects

B. Effects of irradiation of bone and cartilage

1. Effects on growing bones and cartilage
2. Effects on adult bones and cartilage
3. Clinical manifestations
4. Histological substratum of effects
5. Functional consequences and sequelae

C. Effects of irradiation of the kidney

1. Clinical manifestations
2. Histological substratum of effects
3. Acute and chronic functional repercussions
4. Permanent Sequelae

D. Effects of irradiation of the lung

1. Acute clinical effects
2. Ultimate effects
3. Histologic substratum of effects
4. Measures to reduce final effects
5. Sequelae

E. Effects of irradiation of nervous tissues

1. Effects on the brain
2. Effects on spinal cord
3. Effects on peripheral nerves
4. Clinical manifestations
5. Histological substratum
6. Sequelae

F. Effects of irradiation of the ovary

1. Clinical manifestations
2. Histological substratum
3. Reversibility of effects
4. Therapeutic implications

G. Effects of irradiation of the testis

1. Clinical consequences
2. Histological substratum
3. Reversibility
4. Protective measures

H. Effects of irradiation of the eye ,

1. Clinical consequences
2. Histological substratum
3. Protective measures
4. Time-dose connotations
5. Sequelae-therapy

I. Effects of irradiation of lymphoid tissues

1. Clinical manifestations
2. Histological manifestations
3. Reversibility

J. Effects of irradiation of the bone marrow

1. Clinical and laboratory manifestations
2. Chronology of effects
3- Histologic substratum
4. Recovery
5. Therapeutic applications

K. Effects of irradiation of the oral. pharyngolaryngeal and esophageal mucous membrane

1. Clinical manifestations
2. Histological manifestations
3. Repair
4. Sequelae

L. Effects of irradiation of the salivary glands

1. Acute manifestations
2. Histological substratum
3. Dental consequences
4. Prophylaxis

M. Radiation effects observable in clinical radiotherapy

1. Technological protection
2. Role of total dose
3. Role of fractionation
4. Measures of Prevention
5. Therapeutic measures

N. Effects of irradiation of human embryo

1. Role of age
2. Role of dose
3. Teratogenic effects
4. Measures of prevention

BASIC SCIENCES

1 . Pathology of Benign and Malignant Diseases

A. Principles and methods of definite diagnosis
Surgical biopsy.
Exfoliative cytology
Fine needles aspiration cytology and biopsy

B General histologic and cytologic features of malignancy

C Classification of benign and malignant tumours and their interpretation

D Methods of dissemination of cancer and its biolocgical behaviour

E. Degree of differentiation of cancer

F. Radiation pathology

2. Applied Anatomy and Physiology

A. Anatomy of oral cavity, larynx, pharynx, paranasal sinuses, CSF pathways salivary glands, middle ear; external orbit, breast, broncho-pulmonary segments, mediastinum, oesophagus, liver; spleen, small and large bowels. pelvic and genito-urinary organs (bladder; uterus, ovary testis rectum, anal canal etc.)

B. Lympahtic system and drainage

C. Relationship of vital structures

D. General principles of physiology of respiratory cardio vascular, nervous and biliary systems

3. Various Investigative and Imaging Procedures in Diagnosis, Staging, Management and Follow up of Cancer

CLINICAL ONCOLOGY

1. Clinical Practice of Radiotherapy and Oncology

A. Principles of Radiotherapy

1 .General -Radiosensitivity and Radiocureability

-Tumor lethal dose, Tissue Tolerance and Therapeutic Ratio (TR)

-Factors influencing TR

-Target Volume

-Choice of Time, dose fractionation and technique

2. Teletherapy

Radiation factors

Megavoltage therapy

Orthovoltage therapy

Electron therapy

Heavy particle therapy (Neutron, photon, pi-meson)

3. Brachytherapy

Radium and its substitutes

Practice of -surface, intracavitary and interstitial

Clinical application

Rules and techniques

a. Newer developments

b. after loading

c. Low and high dose rates

B. Techniques of Radiotherapy

Small field beam directed therapy

Extended and irregular field therapy

Single, double and multiple field therapy

Beam modification therapy (wedge filter/compensator etc.)

Rotation and Arc therapy

Techniques in Brach therapy

Intracavitary

Interstitial

Mould application

Modern development and afterloading devices

C. Clinical Practice

Radical (curative)

Palliative

Pre-operative

Post -operative

Supplementary

Combination (both Pre. & Post operative-Sandwitch techniques)

Nutritional care and local hygiene during and after therapy

D. Treatment Planning and Presentation

Mouldroom practices

Simulation

Computerised treatment planning system

Clinical dosimetry

Prescription and execution

2. Cancer Chemotherapy and Hormones

A. Chemotherapy

Principles and clinical practice

Classification of drugs

Clinical application of

a. Single drug therapy
b. Polychemotherapy and various combinations
c. Adjuvant therapy
d. Prophylactic therapy

B. Hormone Treatment in Cancer

General Principles

Role in cancers of the Breast, thyroid, prostate, kidney etc.

Complications and their management

3. Related Specialities

A. Principles and practice of general surgery, gynaecology and paediatric surgery as related to cancer

Surgical treatment decisions

Surgical diagnosis and staging of cancer

B. Clinical staging and TNM system

Staging procedures

Methods of clinical staging and TNM classification

C. Terminal care of cancer patients-principles and practice of control of pain

D. Cancer registry and epidemiology

E. Prevention and early detection in cancer

F. Cancer education and oncology organization

G. Statistical methods.

4. **Principles of Treatment and Management in tumors of**

   A. Skin

   B. Head and Neck (including Orbit and Eye ball)

   C. Nervous System

   D. Thorax and Mediastinum

   E. GIT

   F. Genitourinary

   G. Other Abdomen and Pelvic Structures

   H. Breast

   I. Blood and Reticulo-Endothelial System

   J. Bone and other connective tissues

   K. Endocrine Glands

   L. Paediatric tumours

   M. Metastatic tumours with occult primary

5. **Special Topics**

   A. Oncological Emergencies

   B. Causes of Treatment Failure and Retreatment

   C. Radiation Treatment of Benign Diseases and tumor like conditions

   D. TLI and TBI _ Role, Philosophy and Techniques

   E. Supportive care in Radiation treatment and Oncology.

   F. Infections, nutritional and other problems in cancer patients

   G. Preventive Oncology.

   H. Psychosocial aspects of cancer and Rehabilitation

   I. Hospice Programme

   J. Immunotherapy and Role of Monoclonal antibodies in diagnosis staging and management of cancer.

   K. Recent advances coming up in various fields as applicable to oncology.

   L. Care and Nursing of patients on Radiotherapy and chemotherapy.