PRAVARA INSTITUTE OF MEDICAL SCIENCES
(DEEMED TO BE UNIVERSITY)
Loni, Tal. Rahata, Dist. Ahmednagar 413736
NAAC Re-accrediated with 'A' Grade

SYLLABUS
PG Programme- DIPLOMA (RADIOTHERAPY) (DMRT)
(As per MCI Regulations Governing PG Programme 2000 Amended up to May, 2018)

Paper I: Basic Medical Sciences as applied to Radiotherapy

1. **Applied Anatomy and Physiology**

a) Anatomy of oral cavity , larynx ,pharynx ,paranasal sinuses, CSF pathways, salivary glands, middle ear, breast, broncho-pulmonary segments, mediastinum,oesophagus, liver, spleen, small and large bowls, pelvic and genito-urinary organs (bladder, uterus, ovary, testis, rectum anal canal etc)
b) Lymphatic systém and drainage
c) Relationship of vital structures
d) General principles of physiology of respiratory ,cardio-vascular ,nervous and biliary systems

2. **Pathology of Benign and Malignant diseases**

a) Principles and methods of definite diagnosis surgical biopsy
b) Exfoliative Cytology ,Fine needles aspiration Cytology and biopsy
c) General histological &cytologic features of malignancy.
d) Classification of benign and malignant tumours and their interpretation
e) Methods of dissemination of cancer and its biological behaviour
f) Degree of differentiation of cancer
g) Radiation Pathology

3. **Various investigation and Imaging procedures in Diagnosis ,Staging,Management and Follow up of different types of Cancer.**
4. **Recent Advances related to topic for Paper-I**

Paper II: Clinical Radiotherapy including Chemotherapy

1. **Clinical Practice of Radiotherapy and Oncology**

a) Principles of Radiotherapy
b) Techniques of Radiotherapy
c) Clinical Practice
d) Treatment Planning and Presentation

2. **Diagnosis and management of following cancers**

a) Central nervous systém,Occular and Adnexal tumour ,Ear tumours, head and neck tumors, Salivary gland, Thyroid
b) Endocrine systém, Breast cancer, Bronchus ,G.l. cancers ,Urogenital systém, Skin cancer, Bone tumours, Soft tissue tumours, Leukamia ,Lymphoma ,Cancer in childhood, Multiple Myeloma ,Aids-related cancer.
c) Total body & Hemi body irradiation.

3. Cancer Chemotherapy ,Hormones and Immunotherapy

a) Chemotherapy: Structure, mechanism of action, pharmacokinetic, indication, doses, schedules, side effects and interaction
b) Hormone therapy
c) Immunotherapy
d) Gene Therapy

4. Related Specialties

a) Principles and Practice of general surgery, gynaecology&paediatric surgery as related to cancer, Surgical treatment decisions ,Surgical diagnosis and staging of cancer, Clinical staging, Staging procedures, Methods of clinical staging and TNM classification
b) Terminal care of cancer patients, Principles and practice of control of pain.
c) Cancer registry and epidemiology
d) Prevention and early detection in cancer
e) Cancer education and oncology organization
f) Statistical methods.

5. Recent Advances related to topic for Paper II

Paper III: Physics as applied to Radiotherapy, Nuclear Medicine, Radiobiology and Recent Advances in Radiotherapy

1. Physics

a. Atomic and Nuclear Structure
b. Radioactive Decay including artificial & natural radioactivity
c. Production and properties of X-rays
d. Clinical Radiation Generators
e. Interactions of ionizing radiation with matter
f. Brachytherapy
g. Measurement of ionizing radiation: Dosimetric aspects
h. Radiation Quantities & Quality assurance
i. Calibration of High Energy Photon and electron Beams
j. Dose Distribution of External Beam Therapy
k. Sealed & unsealed source Therapy
l. TPS & Manual treatment planning
m. Radiation Protection & Hazards
n. Planning of New Radiotherapy Department and maintenance

2. Nuclear Medicine

a. Radioactive Isotopes in Clinical Medicine and Clinical diagnosis
b. Sealed and unsealed source
c. Types of diagnostic test
d. Organ scanning
e. Gamma Camera & Whole body counter
f. Calibration and standardization of Radioactive Isotopes
g. Internal therapeutic uses of Radioactive Isotopes and their dosimetry

3. Radiobiology

a. Mammalian Cell Radiosensitivity: Interphase and reproductive death, Cell Survival

curves in vitro, Characterization of cell survival curves, Critical sites and target theory, Dose response curves in vivo, Quantitative normal tissue reaction based on systems.

b. Factors that modify Radiation Response: The oxygen effect, The age response function, Potentially lethal damage, Sublethal damage, Dose Rate, Radiosensitizers, Radioprotectors.
c. Linear Energy Transfer (LET) and Relative Biological Effectiveness(RBE)
d. Cells and tissue Kinetics: The cell cycle, Autoradiography, Constituent parts of the cell cycle, Percent labelled mitoses technique, Growth fraction, Cell loss factor, Growth Kinetics of human tumours.
e. Tissue Radiosensitvity: Classification based on radiation pathology, Types of cell populations.
f. Time-dose and Fractionations: The 4 R's of radiobiology, The basis of Fractionations, The Strandquist's plot, Nominal standard dose, Linear Quadratic equation.
g. New Radiation Modalities: Protons, Neutrons, Pions, High energy heavy ions
h. Hyperthermia: Methods for heating, Systematic hyperthermia, Localised heating, Cellular response to heat, Repair of thermal damage, Thermotolerance, Hyperthermia combined with ionising radiation, Time sequence of heat and irradiation, Hypoxic cells and heat, Effect of pH on the response of Hypothermia, Response of transplanted tumours to heat, Response of spontaneous tumours to heat , Response of normal tissues to heat, heat and therapeutic gain factor, Hyperthermia and Chemotherapy.
i. Total body Irradiation and its acute effects: Prodromal radiation syndrome, Central nervous systém /cerebrovascular systém, Gastrointestinal syndrome, Hematopoetic syndrome, Mean Lethal dose, Treatment of radiation accidents
j. Total body Irradiation and itsLate Effects: Non-specific life shortening, Carcinogenesis.
k. Mechanism of Radiation Carcinogenesis and Genetics of irradiations
l. Radiation protection in the Developing Embryo and Fetus
m. Radiophysiology of human Tissues: Effects of irradiation of the skin, bone & cartilage, kidney, lung, nervous tissues, ovary, testis, eye, lymphoid tissues, bone marrow, oral, pharyngolaryngeal&esophgeal mucous membrane, salivary glands, human embryo and Radiation effects observable in clinical radiotherapy.

DMRT YEARLY COURSE DETAILS

<<<<<< FIRST YEAR >>>>>>

CLINICAL ONCOLOGY [Theory] – first year

1. Introduction to Oncology.
2. Principles of clinical and pathological staging of cancers
3. Basics of Radiation Therapy
4. Basics of cancer chemotherapy
5. Basics of cancers surgery
6. Decision making process in oncology
7. Combined modality of RT + Surgery
8. Combined modality of RT + Chemotherapy
9. Basics of Radiation treatment planing: Clinical aspects.

CLINICAL ONCOLOGY [PRACTICALS]- First year (Patient Evaluation, care & procedures)

1. communication with cancer patients and their relatives
2. Clinical examination method like gynecological, laryngeal, breast, neurological, and lymph node examination.
3. Obtaining informed consent for routine treatment.
4. Management of treatment complications like mucositis, dermatitis, proctitis, diarrhea, nausea, vomiting, xerostomia, lymphoedema, candidacies etc.
5. Management/ care of patients with fluid electrolyte imbalance, malnutrition, neutropaenic sepsis, raised intracranial pressure, seizures, paraplegia, bed sores, tracheotomy, NG tube or gastronomy, bleeding PV or SVC compression.
6. Cervical biopsy PAP smear FNAC Pleural and peritoneal paracentesis, bone marrow and lumbar puncture.
7. Insertion and maintenance of IV lines (butterfly and Venflontypes) for blood collection and giving fluids or cytotoxic agents.
8. Patient positioning and immobilization using ORFIT, ACRALYC, and POP Masks
9. simple Simulation techniques of e. g. Cervix 2 or 4 field, Bone Metastases, lung AP/PA Esophagus 3 field and head and neck Bilateral Fields.
10. CVS and intra uterine applications.
11. Giving simple chemotherapy drugs likes 5-FU, Bleomycin cyclophosphamide, low dose methotrexate (CMF) procarbazene, CCNU, Cisplatin, Adriamycin etc.
12. Interpreting simple Radiographs like chest x-rays, barium swallows, osseous metastases, bone scan etc.
13. Be Familiar and follow the established principles of bio-safety e.g. MRSA, Hepatitis B and C, HIV etc.

PHYSICS [Theory] -first year

1. Electromagnetic radiation and the atomic structure
2. Radioactivity
3. Radioactive sources use in radiotherapy
4. Production of X Rays: The basic X Ray tube
5. Interaction of X Rays With matter
6. Teletherapy machines: Telecobalt&linac
7. The Roentgen and its measurement
8. Machine calibration and acceptance test quality assurance
9. Principles of radiation protection
10. Beam modifying devices
11. ICRU guidelines : Teletherapy& Brachytherapy
12. Basics of treatment planning and Dosmetric physical aspects.
13. 3 dimensional conformal planning
14. Electronic portal imaging
15. Networking
16. Quality assurance tests in stereotactic radiotherapy

PHYSICS [Practicals] – First year

1. Parts and functions of various Teletherapy and brachytherapy machines
2. Radiation protection
3. Calculation of output from ^{60}Co machine
4. Treatment time calculation for simple fields (open regular)
5. Quality control and machine calibration

6. Isodose curves and manual treatment plans using isodose curves

RADIOBIOLOGY [Theory] – First year

1. Cell survival curve
2. cell tissue and tumor kinetics
3. Factors affecting radiosensitivity
4. LET, OER, and RBE
5. Radio-sensitizers
6. Radio- protectors
7. Hyperthermia
8. Acute and late effects of whole body irradiation
9. Radiation Carcinogenesis

CANCER BIOLOGY [Theory] - First year

1. Cellular structure and function
2. Cell membrane and Cytoplasm
3. Nucleus
4. Signal pathway
5. Cell cycle control and cancer
6. Hyperplasia, dysplasia and neoplasia
7. Oncogenes – Introduction
8. Multistage Carcinogenesis and metastatic cascade
9. Human Genome Project
10. Principles and practice of stereotactic radiotherapy
11. PET and SPECT
12. Dosimetric aspects of magna field therapy
13. Complex field arrangements and mixed beam, electrons arcs matching fields asymmetric fields.
14. Dose rate effect in Brachytherapy
15. How to compensate for missed treatment days?
16. Molecular basis of radiation sensitivity
17. Molecular basis of cytotoxic drug action and drug resistance
18. Immunological aspects of cancers and cancer vaccines
19. Gene therapy

<<<<<< SECOND YEAR >>>>>>

CLINICAL ONCOLOGY [Theory] – Second year

1. Nasopharyngeal & PNS cancers
2. Oral Cavity & Oropharyngeal cancers, Hypoparynx and larynx
3. Tumours of salivary glands, ear, orbit, and Thyroid
4. Management of CNS Tumours
5. Lung cancer and Mediastinal tumors
6. Principles of CT and MR imaging
7. Oesophageal and gastric
8. Pancreas, Bile duct and liver cancers, cancers of Colon, Rectum & Anal canal
9. Oncological emergencies
10. Management of Breast cancer
11. Cervical cancer, Cancers of the uterus, Ovary, Urethra etc.
12. Kidney, prostate, bladder, and penile cancers

13. Testicular tumours
14. Acute leukaemia, Chronic leukaemias and myeloma
15. Non Hodgkin's lymphoma, Hodgkin's disease and mycosis fungoides
16. Bone tumours, Soft tissue sarcoma and skin cancers
17. Management of paediatric solid tumours
18. Interstitial brachytherapy in Head and Neck cancers &Gynaecological Brachytherapy
19. Is Quality of life an important outcome measure of curative palliative treatment? Factors affecting the Quality of life.
20. Care of the dying patients and Hospice care & Medical ethics: A clinician's perspective
21. National cancer control programme & Screening for common cancers: Pragmatic approaches for our country
22. Rehabilitation of cancer patients
23. Chemotherapy in head and neck cancers

CLINICAL ONCOLOGY [Practicals] – Second year

1. Knowledge about treatment options and decision making for various cancers.
2. Discussing Randomized Trails with patients and obtaining their consent.
3. Management of patients with Renal failure G.I. obstruction, SVCO, TOF , Cord compression, severe vaginal bleeding neutropaenic sepsis, hypercalcaemia, necrosis, pathological fractures etc.
4. Management of patients in severe pain and of bying patients, palliative care.
5. Hospice care: use of morphine
6. Divergent blocks (Mantle, Inverted Y, Rectum, Brain etc.) Electron cuts outs.
7. Simulation Techniques e.g. Conservative Breast, Mantle, Inverted Y, Dog Leg, Pancreas, Nasopharynx, PNS, Vocal Cord, Brain, Planning CT Scans.
8. Hemi Body irradiation
9. Computer treatment planning: Parallel opposed, antero, lateral, 3 or 4-field beam arrangement with equal and unqual weightage. Intracavitary and simple interstitial brachytherapy plans of breast, template buccal mucosa.
10. Organizing and maintaining central lines (Hickmans), Parentral Nutrition, Cytotoxic drugs such as Doxorubicin, Vincristine, Mitoxantrone, Cisplatinum.
11. Assisting Interstitial Implants/ ILRT/ EBRT Procedures. Performing simple procedures like Intracavitary, CVS etc.
12. Retrieving information from medline, Internet etc.
13. Recent developments and future trend in RT planning and treatment delivery
14. Complex Simulation and treatment techniques e.g. asymmetric beam, TSET, Craniospinal Irradiation, Paediatricstumours, TBI.
15. Treatment planning of mixed beam, matching fields electrons, head and neck implants
16. Intracavitary ILRT, and simple implants
17. Preparing Surface Moulds
18. Assisting EBRT, Head/Neck Implants, Templates
19. Cytotoxic drugs e.g. Taxenes, BCNU, High Dose Methotrexate, Interferon, G-CSF, Leuprolide etc.

PHYSICS [Theory] - Second year

1. Evolution of brachytherapy dosage systems
2. Modern brachytherapy dosage calculation

3. Electron beam therapy
4. Remote afterloading LDR and HDR machine
5. Computer treatment planning systems
6. Use of unsealed sources for therapy
7. principles of CT and MR imaging

PHYSICS [Practical's] Second year

1. Manual localization of brachytherapy sources from orthogonal X-Rays and estimation of the Basal Dose Rate and Reference Dose Rate as per PARIS rules.
2. Complex field shapes and modified beams. computer treatment planning teletherapy (AP/PA; 3or 4 fields anterior/ lateral; weightage)
3. Computer treatment planning brachytherapy (CVS, Intracavitary (Selectron) breast, template buccal mucosa.)
4. Simple Conformal plans; Conformal blocks, CT planning
5. Functions of RSO
6. HRD & LDR Surface mould treatment execution.

RADIOBIOLOGY [Theory] – Second year

1. Acute and late responding tissue and dose response relationship
2. Time Dose Fractionation and the evolution of bioeffect models
3. linear Quadratic Model
4. Predictive assays of radiation response
5. Radiation effect on embryo &Foetus

RADIOBIOLOGY [practicals] – Second year

1. Calculation of Biological Effective Doses for tumour control, acute and late effects using the LQ model.
2. Use of Radio sensitizers or radio protectors (eg. Amifostine).

CANCER BIOLOGY [Theory] – Second year

1. Genetic predisposition to cancer
2. Proto Oncogenes and tumour suppressor genes
3. Basic principles of molecular biology techniques e.g. PCR, FCM, Electrophoresis, cloning etc.
4. Tissue culture techniques and clonogenic assays.

Practical Training is same as for DMRT candidate (For 02 years except thesis)