MD RADIOTHERAPY

CURRICULUM MAP

The duration of the course shall be three (3) academic years in total.

CLINICAL POSTINGS

Rotations Postings

1st Year

Clinical Oncology (In-patient ward and special clinics)
Radiation Physics
Pathology/Radiobiology
Diagnostic Radiology
Cancer Epidemiology and Statistics
Cancer Research and Laboratory methods

2nd Year

Clinical Oncology & Critical Care (In–patient ward & special clinics)
Radiation Physics
Palliative Care
Medical Oncology including Haemato-oncology
(In-patient ward and special clinics)
Simulator and Teletherapy machine posting

3rd Year

Radiation Oncology (Inpatient ward and special clinics)

Dissertation

The thesis/dissertation will be done under the direct guidelines of the candidates guide and the same has to be submitted at least six (6) months before the final examination.

Final Examination

COURSE CONTENT

Structure

1) Basic Sciences

a. anatomy
b. Pathology
c. Radiation Physics
d. Radiobiology
e. Statistical basis for planning & interpretation of clinical trials.

2) Clinical Radiotherapy
3) Clinical Cancer Chemotherapy
4) Other disciplines allied to Radiotherapy and Oncology
5) Preventive and community oncology
6) Palliative care
7) Training
8) Administration

BASIC SCIENCES

a) **ANATOMY**

Knowledge of surface anatomy pertaining to Oncology
Detailed knowledge of the all organs
Detailed knowledge of the lymphatic system of all organs-regions
Practical familiarity with the radiographic appearance of important regions (living anatomy)
Cross sectional anatomy

b) **PATHOLOGY**

Definitions of & distinction between different types of growth disorders (i.e; distinction between hyperplasia, hypertrophy, regeneration, malformations and neoplasia.
Malignant transformation:
Initiation and promotion stages of carcinogenesis.
Mode of origin – monoclonal, polyclonal, unifocal, multifocal structural and functional changes in cellular components.
Etiology of cancer including genetic predisposition & congenital syndromes chromosomal abnormalities & hereditary tumors, Protooncogenes, oncogenes, tumor suppressor genes & viruses in the causation of malignancy.
Multifactorial causation including Nutritional aspects in cancer causation and prevention,
Environmental causes of cancer, Biological – protozoal, bacterial, viral, Chemical – classes of carcinogenic chemicals, smoking, Physical – trauma, irradiation (UV rays, other electromagnetic radiation including, X-rays and gamma rays and particulate radiation), Common occupational cancers & experimental tumors in animals relationship to human mutagenicity. Etiology, mechanisms of carcinogenesis, known types of carcinogens & their effects upon the cell. The relative importance of different factors in the causation and spread of human cancer including rate of tumour growth, methods of measurement, factors affecting growth rate, mechanisms of spread, local effects of tumors, local & systemic reactions to tumors, effects of therapy on tumors & normal tissues. Criteria for tumor diagnosis-macroscopic, histological & cytological uses & value of biopsy material.
Classification of tumors – histogenic, histological, behavioral & immunological nomenclature – solid tumors, lymphoproliferative disorders
Structure & organization of tumors- vascular supply, stroma etc.
Systems of grading Endocrine aspects of malignancy:- Production of hormones by tumors, effect of hormones on tumors, paracrine effects of tumors Paraneoplastic syndromes. Tumor Immunology including organization & development of the immune system and the role response in disease, cellular basis of immunity & measurement of immune function, graft versus host reaction, tumor immunity, tolerance, enhancement, Immune surveillance hypothesis, Immunological markers in diagnosis & monitoring, the I ILA systems & molecular biology for diagnostic and therapeutic purposes.

c) RADIATION PHYSICS

The aim of this subject is to provide the future Clinical Oncologist with the knowledge of physics required in clinical practice.
An understanding of the principles of planning & carrying out treatment is a necessary prerequisite & will be enhanced by the study of this subject.
A familiarity with the physics of electromagnetic radiation and atomic structure will be required.
With respect to their implications for accurate dose delivery in clinical radiation therapy, applicability, limitations, advantages & disadvantages of the various devices & techniques should receive particular attention.
Candidates should be encouraged to observe & gain practical experience with the equipment & techniques used in radiotherapy in clinical oncology departments Structure of Matter: Constituents of atoms, Atomic and mass numbers, Atomic and mass energy units, Electron shells, Atomic energy levels, Nuclear forces, Nuclear energy levels, Electromagnetic radiation, Electromagnetic spectrum, Energy quantization, Relationship between Wavelength, Frequency, Energy Nuclear Transformations: Natural and artificial radioactivity, Decay constant, Activity, Physical, Biological and Effective half-lives, Mean life, Decay processes, Radioactive series, Radioactive equilibrium Production of X-rays : The X-ray tube, Physics of X-ray production, Continuous spectrum, Characteristic spectrum, Efficiency of X-ray production, Distribution of X-rays in space, Specifications of beam quality, Measurement of beam quality, Filters and filtration Interaction of radiation with matter: Attenuation, Scattering, Absorption, Transmission, Attenuation coefficient, Half Value Layer (HVL), Energy transfer, Absorption and their coefficients. Photoelectric effect, Compton Effect, Pair-production Relative importance of different attenuation processes at various photon energies Electron interactions with matter: Energy loss mechanisms – Collisional losses, Radioactive losses, Ionization, Excitation, Heat production, Delta rays, Polarization effects, Scattering, Stopping power, Absorbed dose, secondary electrons.
Interactions of charged particles: Ionization vs. Energy, Stopping Power, Linear Energy Transfer (LET), Bragg curve, Definition of particle range. Measurement of radiation: Radiation Detectors: Gas, Solid – state, Scintillation, Thermo luminescence, Visual Imaging (Film, Fluorescent screens), and their examples. Exposure, Dose, Kerma: Definitions, Units (Old, New), Inter-relationships between units, Variation with energy and material. Measurements of exposure (Free air chamber, Thimble chamber), Calibration of therapy beams: Concepts, Phantoms, Protocols (TG 21, IAEA TRS- 398, TG 51) Dose determinants in practice (brief outline only, details not required)
Radiotherapy Equipment: Grenz rays, Contact, Superficial, Orthovoltage or Deep therapy, Supervoltage, Megavoltage therapy. Therapy and diagnostic X-ray units – comparison. Filters, factors affecting output. Co-60 units : Comprehensive description of the unit, Safety mechanisms, Source capsule Linear accelerators, Source capsule Linear accelerators : History, Development, Detailed description of modern, dual mode linear accelerator, Linac head and its constituents , Safety mechanisms, Computer controlled linacs, Record and Verify systems. Relative merits and demerits of Co-60 and linac units. Simulators: Need for them, detailed description of a typical unit, simulator CT. Dose distributions, Beam modifications and shaping in Teletherapy beams. Characteristics of photon beams: Quality of beams, Difference between MV and MeV, Primary and scattered radiation.Percentage depth dose, Tissue-Air Ratio, Scatter Air Ratio, Tissue-Phantom Ratio, Tissue Maximum Ratio, Scatter Maximum Ratio, Back Scatter Factor, Peak Scatter Factor, Off-Axis Ratio, Variation

of these parameters with depth, filed size, source-skin distance, beam quality or energy, beam flattening filter, target material. Central axis depth dose profiles for various energies.
Equivalent square concept, Surface dose (entrance and exit), Skin sparing effect, Output factors. Practical applications: Co-60 calculations (SSD, and SAD technique), Accelerator calculations (SSD, and SAD technique) Beam profiles Isodose curves, Charts, Flatness, Symmetry, Penumbra (Geometric, Transmission, and Physical), Field size definition Body in homogenecities: Effects of patient contour, Bone, Lung cavities, Prosthesis on dose distribution. Dose within bone / lung cavities, Interface effects, Electronic disequilibrium. Wedge filters and their use, Wedge angle, Wedge Factors, Wedge systems (External, In built Universal, Dynamic / Virtual), Wedge Isodose curves
Other beams modifying and shaping devices: Methods of compensation for patient contour variation and / or tissue inhomogenicity – Bolus, Buildup material, Compensators, Merits, and Demerits. Shielding of dose limiting tissue : Non-divergent and divergent beam block, Independent jaws, Multifocal collimators, Merits and Demerits.
Principles of Treatment Planning
Treatment planning for photon beams: ICRU 50 an NCAP terminologies. Determination of body contour and localization: Plain film, Fluoroscopy, CT, MRI , Ultrasonography,
Simulator based. Methods of correction for beam's oblique incidence, and body inhomogeneties. SSD technique and isocentric (SAD) technique: Descriptions and advantages of SAD technique
Combination of fields: Methods of field addition, Parallel opposed fields, Patient thickness vs. Dose uniformity for different energies in a parallel opposed setup, Multiple fields (3 fields, 4 field box and other techniques). Examples of above arrangements of fields is SSD and SAD techniques, Integral Dose. Wedge field technique, Rotation Therapy (Arc, and Skip), Tangential fields. Beam balancing by weighting. Total and hemi-body irradiation. Field junctions. Limitations of manual planning. Description of a treatment planning system (TPS): 2D and 3D TPS. Beam data input, Patient data input (simple contour, CT, MR data, Advantages of transfer through media). Input devices Digitizer, floppies, DAT devices, Magneto-optical disks, direct link with CT, MR).
Beam selection and placement, Beam selection and placement, Beam's Eys View (BEV), Dose calculation and display (Point dose, Isodose curves, Isodose surfaces, Color wash). Plan optimization , Plan evaluation tools: Dose volume Histograms (Cumulative and Differential), Hard copy output, Storage and retrieval of plans.
Alignment and Immobilization : External and internal reference marks, Importance of
Immobilization methods (Plaster of Paris casts, Perspex casts, bite block, shells, head rests, neck roll, Alpha-Cradles. Thermoplastic materials, polyurethane foams), Methods of beam marks, and front / back pointers). Treatment execution : Light field, Cross hair, ODIs, Scales in treatment machines. Treatment verification : Port films, Electronic portal imaging devices, Invivo patient dosimetry (TLD, diode detectors, MOSFET, Film, etc) Changes in patient position, target volume , and critical volume during course of treatment. Electron Beam Therapy Production of electron beams : Production using accelerators, Characteristics of electrons. Surface dose, percentage depth dose, beam profiles, Isodose curves and charts, Flatness and Symmetry. Beam collimation, variation of percentage depth dose and output with filed size, and SSD, photon contamination. Energy spectrum , Energy specifications, variation of mean energy with depth. Suitability of measuring instruments for electron beam dosimetry Treatment planning : Energy and field size choice, air gaps, and obliquity, Tissue in homogeneity – lung, bone, air filled cavitites. Field junctions (with either electron or photon beam). External and internal shielding. Arc therapy, Use of bolus in electron beam. Total Skin Electron Irradiation, Intraoperative Radiation therapy. Physical Principles of Brachytherapy : Properties of an ideal brachytherapy source, Sources used in brachytherapy :

Ra-226, Cs-137, Ir-192, Au-198, Co-60, I-125, Sr-90, Yt-90, Ru-106, Ta-182 and other new radionuclides, their complete physical properties, Radium hazards. Source construction including filtration, comparative advantages of these radionuclides. Histological background. Radiation and Dose units : Activity used, Exposure, Absorbed dose, mg-hr, curie, milli-curie destroyed, milligram Radium equivalent , roentgen, rad, gray. Source strength specification, Brachytherapy Dose calibrator. Technique : Preloaded, After loading (manual and remote), Merits and Demerits. Surface, Interstitial , Intracavitary, Intraluminal, Intravascular brachytherapy , Low, Medium, Highand Pulsed dose rates. Remote after loading machines. Dosage Systems: Manchester System , Paris System Treatment Planning: Patient selection, Volume specification, Geometry of implant, Number, Strength and Distribution of radioactive sources, Source localization, Dose calculation, Dose rate specification, Record keeping ICRU 38. Radiation Safety: Planning of brachytherapy facility, Rooms and equipment, Storage and `Movement control, Source inventory, Disposal, Regulatory requirements Beta-ray brachytherapy including methods of use, inspection, storage and transport of sources, dose distribution Unsealed adionuclides: Concepts of uptake, distribution and elimination, Activities used in clinical practice, Estimation of dose to target tissues, and critical organs, Procedures for administering radionuclides to patients. Quality Assurance in radiotherapy.(QART) Overview of QART: Need for quality system in Radiotherapy, Quality system: Definition and practical advantages, Construction, Development and implementation of a Quality system Quality Assurance of simulator,Tips,Co-60,Linear Accelerator Acceptance testing of Simulator, TPS, Co-60,Linear Accelerator Radiation Protection and Regulatory Aspects: Statutory Framework – Principles underlying International Commission on Radiation Protection (ICRP) recommendations, ICRP and National radiation protection i.e; Atomic Energy Regulatory Board (AERB) standards. Effective dose limits (ICRP and AERB) Protection mechanisms: Time, Distance and shielding. Concept of “As low as Reasonably Achievable” (ALARA) Personnel and Area Monitoring; Need for personnel monitoring, Principles of film badge, TLD badge used for personnel monitoring. Pocket dosimeter. Need for area monitoring, Gamma Zone monitors, Survey meters Regulatory aspects: Procedural steps for installation and commissioning of a new radiotherapy facility (Teletherapy and Brachytherapy). Approval of Standing Committee on Radiotherapy Development Programme. Type approval of unit. Site plan, Layout of installation / Associated facility: Primary, Secondary barriers, leakage and scattered radiation. Regulatory requirement in procurement of teletherapy / brachytherapy source(s). Construction of building, Qualified staff, Procurement of instruments, and accessories, installation of unit and performance tests. Calibration of unit, RP & AD approval for clinical commissioning of the unit.

Other regulatory requirements:

Regulatory consent, NOCs, Periodical reports to AERB and Radiological Physics and Advisory Division (RP & AD) , Bhaba Atomic Research Centre (BARC)

Advancements in Radiation Oncology: Virtual Simulation: Principle, CT Simulation, TPS based virtual simulation, Differences, Merits and Demerits, Practical considerations

Conformal radiotherapy(CRT): Principles, Advantages over conventional methods, Essential requirements for conformal radiotherapy.

Various methods of CRT:

With customized field shaping using conventional coplanar beams.

Multiple non-coplanar MLC beams conforming to target shape.

Stereotactic radiotherapy

Principle of inverse planning and Intensity Modulated Radiation Therapy (IMRT)

-Using 3D compensator

-Static IMRT (Step and Shoot technique)

-Dynamic IMRT (sliding window technique)
-Dynamic arc IMRT
-Micro –MLC
-Tomotherapy methods
Time gated (4D) radiotherapy
Merits and demerits of IMRT
Stereotactic irradiation methods: Physics Principles, Techniques, Description of units (Gamma Knife and Linac based). Merits and demerits, Stereotactic Radiosurgery (SRS) and Stereotactic Radiotherapy (SRT), whole body stereotactic frame.
Networking in radiotherapy: Networking of planning and treatment units in radiotherapy department including Picture Archival Communication System (PACS), Advantages, Patient Data Management

d) **RADIOBIOLOGY**

Introduction to Radiation Biology
Radiation interaction with matter
Types of radiation, excitation and ionization.
Radiation chemistry: direct and indirect effects, free radicals, oxygen effect and free radical scavengers, LET and RBE theory, dual action theory, intracellular repair, general knowledge of repair models.
Introduction to factors influencing radiation response.
Physical factors: dose, dose quality, dose rate, temperature Chemical factors: Oxygen, radiosensitizers, radioprotectors
Biological factors: type of organism, cell type and stage, cell density and configuration, age, sex.
Host factors: Partial or whole body exposure.
Relevance of radiation biology to radiotherapy
Interaction of ionizing radiation on mammalian cells.
The cell: structure and function; relative radiosensitivity of nucleus and cytoplasm, mitosis, cell cycle, principles of DNA, RNA and protein synthesis, radiation effects on DNA, strand breakage and repair, common molecular biology techniques.
Cell injury by radiation: damage to cell organelle like chromatids, chromosomes; interphase death, apoptosis, mitotic death, micronucleus induction, SLD, PLD, Oxygen effect: mechanism, hypoxia, OER, reoxygenation in tumors, significance in radiotherapy. Dose rate. Brachytherapy sources including 252f. Radiobiology of low, high dose rate & pulsed brachytherapy, hyper fractionation, significance in radiotherapy. Effects of low LET and high LET radiation on cell. Cell survival curves. Effect of sensitizing and protective agent. Dose modifying factors and their determination. Variation of response with growth and the progression of cell through the phases of cell cycle. Physical factors influencing cell survival; relative biological effectiveness (RBE); its definition and determination, dependence upon linear energy transfer, dose, dose rate and fractionation.
Hyperthermic and photodynamic injury.
Biological hazards of irradiation. Hyperthermic and photodynamic injury.
Biological hazards of irradiation; dose protection and LET, effects on the embryo and the foetus, life shortening, leukemogenesis and carcinogenesis, genetic and somatic hazards for exposed individuals and population. Biological basis of radiological protection. Organ radiosensitivity and radioresponsiveness, concept of therapeutic index. Acute effects on Radiation, Concept of mean lethal dose, Radiation Syndromes: BM, GI, CNS, Cutaneous Suppression of immune System: mechanism, Consequences

Total Body irradiation Biological dosimetry: Blood counts, BM mitotic index. Chromosome aberrations in peripheral blood lymphocytes
Radiation accidents: typical examples
Radiation effects on major organs/tissues
Acute & late effects on all normal organs & tissues including connective tissue, bone marrow, bones, gonads, eye, skin, lung, heart, central nervous system tissues, peripheral nerves, oesophagus, intestine, kidney, liver & thyroid with special reference to treatment – induced sequelae after doses employed in radiotherapy.
Normal tissue tolerances
Late effects of radiation (somatic)
Sterility,cataracts and cancer
Carcinogenesis: mechanism in vitro and in vivo, oncogenes and antioncogenes Radiation induced cancer of occupational, medical or military origin.
Recent controversial results for lowlevel exposure, risk estimates
Late effects of Radiation (Genetic)
Mutations: definition, types, potential hazards.
Low level radiation: sources, potential hazards, stochastic and determicistic nonstochastic) effects, high background areas and cancer.
Effects of Radiation on Human Embryo & Fetus
Lethality, congenital abnormalities and late effects (Leukemia and childhood caner), severe mental retardation. Doses involved.
Biology and Radiation Responsse of Tumors
Tumors growth: Kinetics of tumor response. Growth fraction, cell loss factor.
Volume doubling times, potential volume doubling times, repopulation, and accelerated repopulation.
Radiocurability: definition, factors involved, tumor control probability curves
Factors determining tumor regression rates. Causes of failure to control tumors by radiation: tumor related, host related technical/mechanical errors.
Relationship between clonogen numbers and tumor control probability. Local tumor control and impact on survival.
Applied Radiobiology
Fractionation : rationate, factors involved (4 R's)
Time, Dose and fractionation relationship isoeffect curves, isoeffect relationships, e.g; NSD, CRE formalisms and their limitations, partial tolerance, means of summating partial tolerance, steepness of dose response curves. Multi-rarget, two component and linear quadratic model. A/b ratios for acute and late effects and means for deriving these values. Isoeffective formulae. Clinical applications of the L-Q model. Hyperfractionation, accelerated fractionation, hypofractionation, CHART, split dose treatments. Brachytherapy – low dose rate, high dose rate and pulsed treatments. Introduction to new techniques to optimize radio-curability; combination therapy (adjuvant surgery or chemotherapy), hyperthermia, hypoxic cell radio-sensitize, high LET radiation. Photodynamic therapy. The volume effect, general principles and current hypotheses.
Shrinking Field technique.
Combination Radiation-surgery
Pre , post and intra operative radiation.
Rationale, radiobiological factors, current clinical results.
Irradiation of sub-clinical disease, debulking surgery, importance of clonogen numbers.
Combination Radiation-Chemotherapy
Definitions of radiosensitiser, synergism, potentiation, antagonism, Radiosensitisers: types, mechanism.

Hyperthermia
Sources, rationale (historical examples), advantages and disadvantages, thermotolerance.
Cellular damage: comparison and contrast with radiation, thermal and non-thermal effects of ultrasound, microwaves, radiofrequency, etc. general host responses (immunology,metastases)
Use along with radiotherapy and chemotherapy: optimum sequencing of combined modalities.
Current limitations to the clinical use of hyperthermia.
High LET Radiation
Comparison and contrast with low LET radiation
Neutrons: Source (including 252 Cf) and boron neutron capture (outline only). Advantages and disadvantages of neutrons, RBE values, hazards of low dose and low energy neutron, use in radiotherapy, combination with low LET, current clinical results.
Other high LET particles: protons, mesons, high-energy heavy nuclei, application to radiotherapy, current clinical results.

e) **STASTISTICAL BASIS FOR PLANNING AND INTERPRETATION OF CLINICAL TRIALS**

Advantages & disadvantages
Retrospective & Prospective studies
Controlled & uncontrolled trials
Single blind & double blind studies
Phase I,II & III trials
Ethics (Helsinki declaration).
Planning a trial
Establishing objectives – short term and long term
Determining the appropriate criteria
Establishing grounds for inclusion and exclusion of patients
Determining how many treatment schedules are to be completed
Determining the treatment schedules and any appropriate modifications
Determining the method of allocation of treatment; the allocation ratio and the method and timing of randomization
Determining what measures are to be taken, how they will be taken, who will take them, at what times (s) and where they will be recorded.
Designing, the appropriate forms of documentation
Determining the proposed duration of the trial , either in terms of a fixed closing date, or the entry of a predetermined number of patients.
Establishing conditions under which the trial may be terminated earlier than planned & procedures for detecting these conditions.
Re-assessing the proposed trial in terms of ethics, appropriateness to the short & long terms objectives, feasibility & the availability of resources.
Writing the protocol
Running a pilot study

1. CLINICAL RADIOTHERAPY

Cancer Epidemiology & Etiology
Cancer Statistics- world-wide & India

Cancer Registries & National Cancer Control Programme
Analysis of data in cancer registries
Regional Cancer Centers
Cancer Screening & Prevention
Patient Care
Assessment & referral systems for radiotherapy
Diagnosis & workup
Staging
Care & evaluation during & after treatment
Emergencies in Oncology
Radiotherapeutic Management of different malignancies
Radiotherapy for non malignant conditions
Treatment Response & Result
Guidelines for treatment response assessment.
Complete Response, Partial Response, No response, Stable disease.
End points of treatment results. Loco-regional control recurrence, metastasis, survival quality of life.
Treatment related morbidity assessment
Radiation morbidity (early & late)
Morbidities of combined treatment
Grading of morbidity

2. CANCER CHEMOTHERAPY

Basic Principles of chemotherapy
Chemotherapy drugs
Newer chemotherapeutic agents
Basic for designing different chemotherapy schedules. Standard chemotherapy schedules.
Chemotherapy practice in various malignancies
Chemotherapy practice & results/toxicities in sequential & concomitant chemoradiotherapy.
Supportive care for chemotherapy.
The basic principles underlying the use of chemotherapeutic agents.
Classification and mode of action of cytotoxic drugs. The principles of cell kill by chemotherapeutic agents, drug resistance, phase specific and cycle specific action.
Drug administration. The general principles of pharmacokinetics; factors affecting drug concentration 'in vivo' including route and timing of administration, drug activation, plasma concentration, metabolism and clearance.
Principles of combinations of therapy, dose response curves, adjuvant and neo-adjuvant chemotherapy, sanctuary sites, high dose chemotherapy, and regional chemotherapy.
Toxicity of drugs. Early, intermediate and late genetic and somatic effects of common classes of anticancer drugs. Precautions in the safe handling of cytotoxic drugs.
Endocrine manipulation and biological response modifiers. An understanding of the mode of action and side effects of common hormonal preparations used in cancer therapy (including corticosteroids).
Use of the major biological response modifiers such as interferons, interleukins and growth factors and knowledge of their side effects.
Assessment of New Agents. Principles of phase I, II, and III studies.
Gene Therapy

3. OTHER DISCIPLINES ALLIED TO RADIOTHERAPY AND ONCOLOGY

Surgical Oncology

Basic principles of surgical oncology, biopsy, conservation surgery, radical surgery, palliative surgery.
Basics of surgical techniques – head & neck, breast, thorax, abdomen, gynecological, genitourinary, musculoskeletal, CNS.
Combined treatments: with radiotherapy, chemotherapy, and hormone therapy.

Diagnostic Radiology and Nuclear Medicine

Radiographic diagnosis of malignant and non malignant conditions
Radiological Procedures with reference to Radiotherapy practices
Study of Ultrasound, CT Scans, MRI Scans, PET scans, as applicable for management of cancer.
Other nuclear imaging and therapeutic modalities as applicable to management of cancer.

4. PREVENTIVE &COMMUNITHY ONCOLOGY

Cancer Epidemiology & Etiology
Cancer Statistics- world wide & India
Cancer Registries & National Cancer Control Programme
Analysis of data in cancer registries
Regional Cancer Centers
Cancer Screening & Prevention

5. PALLIATIVE CARE

Guidelines for palliative care
Symptoms of advanced cancer
Management of terminally ill patients.
Different pharmacologic & non-pharmacology methods
Pain control, WHO guidelines for adults & children
Palliative radiotherapy
Palliative chemotherapy
Home care
Hospice care
Physical, social, spiritual & other aspects

6. TRAINING AND ADMINISTRATION

Residency in Radiotherapy and Oncology
Theory, clinical & practical modes of training
Structured training: lectures, seminar, Journal club, Ward-round, Physics demonstration, Practical, Case Presentations (e.g. Long Case; short case)
Participation in various procedures, techniques (e.g. Brachytherapy, Radiotherapy Planning, Mould Room Procedures etc.)
Administration of chemotherapy and supervision of day care ward.

CME-conference, symposium, workshop, seminar (including CME)
Visiting other cancer centers & clinical oncology departments.

7. ADMINISTRATION

Clinical Oncologists role as an administrator
How to set up a Radiotherapy and Oncology department, planning of infrastructure, & equipments
Role in National Cancer Control Programme (NCCP)
Responsibilities towards safety & quality assurance

RECOMMENDED READING

BOOKS

1. Liebelm and Philips text book of radiation oncology 3rd Edition (2010) Richard T Hoppe MD, FACR, FASTRO, Theodore Locke Philips MD, FACR, FASTRO, Mack Roach III MD, FACR.
2. Perez and Brady's Principles and Practice of Radiation Oncology 5th Edition (2004) Edward C Halperin MD, MA, FACR, Carlos A Perez MD, Luther W Brady .
3. Cancer – Principles and Practice of Oncology 8th Edition, Vincent T De Vita, Jr. Theodore S, Lawarence, Steven A Rosenbergo, Stevven A.
4. Clinical Radiation Oncology (2007) Leonard L Gunderson, Joel E Tepper.
5. Bethesda Handbook of Clinical Oncology (2009) by Carmen J Allegra MD (Editor), Jame Abraham MD (Editor), James L Gulley MD (Editor).
6. Handbook of evidence based radiation Oncology 2nd Edition (2010) Dr. Eric K Hansen, Dr, Mack Roach III.
7. Moss's Radiation Oncology: Rational, Technique, Results (1994) William Thomas Moss, and James Daniel Cox.
8. Text Book of Radiotherapy, Gilbert H Fletcher.
9. Treatment planning in Radiation Oncology 2nd Edition (2007) Faiz M Khan.
10. Oxford Handbook of Oncology, Jim Cassidy, Donald Bissett, Roy A J Spence Obe.
11. The Physics of Radiation Therapy: Mechanisms, Diagnosis and Management 3rd Edition by Faiz M Khan.
12. The Physics of Radiology 4th Edition (1983) Haold Elford Johns, John Robert Cunningham.
13. Radiobiology for the Radiologist 6th Edition, Eric J Hall.
14. The Chemotherapy source Book 4th Edition, Michel C Perry.
15. Text Book of Medical Oncology 4th edition, Franco Cavalli, Stan B Kaye, Heine H Hansen, James O Armitage, Martine J.
16. Surgical Oncology: Contemporary principls and Practice, K. I. Bland, John M Daly, Constantine P Karakousis.

JOURNALS

1. International Journal of Radiation Oncology, Biology, Physics.
2. Annals of Oncology
3. British Journal for Cancer

4. CA-A Cancer Journal for clinicians
5. Cancer
6. Cancer of clinical Oncology
7. Journal of Clinical Oncology
8. Journal of Cancer Research and therapeutics
9. Medscape Oncology
10. Seminars in Oncology
11. Seminars in Radiation Oncology
12. The Lancet
13. The new England Journal of Medicine

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