STRUCTURE

1. Basic Sciences

(a) Anatomy

(b) Pathology

– General Pathology

– Systemic Pathology

(c) Radiotherapeutic physics

(d) Clinical Radiobiology

(e) Statistical basis for planning & interpretation of clinical trials.

2. Clinical Radiotherapy

3. Clinical Chemotherapy

4. Other disciplines allied to Radiotherapy and Oncology

5. Palliative care

6. Research, Training & Administration

1. BASIC SCIENCES

1.1. Anatomy

1.1.1. Knowledge of surface anatomy pertaining to Oncology

1.1.2. Detailed knowledge of the anatomy of all organs.

1.1.3. Detailed knowledge of the lymphatic system of all regions

1.1.4. Practical familiarity with the radiographic appearance of important regions

1.1.5. Cross sectional anatomy

1.2. Pathology

1.2.1 General Pathology

1.2.1.1. Definitions of & distinction between different types of growth disorders (i.e. distinction between hyperplasia, hypertrophy, regeneration, malformation & neoplasia)

1.2.1.2. Malignant transformation -

Initiation & promotion stages of carcinogenesis

Mode of origin - monoclonal, polyclonal, unifocal, multifocal

Structural & functional changes in the cellular components.

Etiology, mechanisms of carcinogenesis, known types of carcinogens & their effects upon the cell. The relative importance of different factors in the causation of human cancer.

1.2.1.3. Rate of 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.

1.2.1.4. Criteria for tumor diagnosis - macroscopic, histological & cytological uses & value of biopsy material

1.2.1.5. Classification of tumors - histogenic, histological, behavioral & immunological

1.2.1.6. Nomenclature - solid tumors, lymphomas, leukemias

1.2.1.7. Structure & organization of tumors - vascular supply, stroma etc

1.2.1.8. Systems of grading

1.2.1.9. Endocrine aspects of malignancy:- production of hormones by tumors, effect of hormones on tumours, paracrine effects of tumors

1.2.1.10. Paraneoplastic syndromes

1.2.1.11. Etiology of cancer

Genetic predisposition, congenital syndromes

Chromosomal abnormalities, hereditary tumours

Protooncogenes, oncogenes, tumor suppressor genes, viruses & malignancy

Multifactorial causation

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 radiations)

Common occupational cancers.

Experimental tumours in animals - relationship to human mutagenicity.

1.2.1.12. Tumor immunology

Organisation & development of the immune system & the role of immune 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

Experimental & clinical immunotherapy

The HLA systems.

1.3. Radiation Oncology 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 electricity, atomic structure & electromagnetic radiation*** *will also be required in order to understand parts of the syllabus.*

As they are studied they should be analyzed critically 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.

1.3.1 *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 quantisation, Relationship between Wavelength, Frequency, Energy

1.3.2 *Nuclear Transformations:* Natural and artificial radioactivity, Decay constant, Activity, Physical, Biological and Effective half-lives, Mean life, Decay processes, Radioactive series, Radioactive equilibrium

1.3.3 *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

1.3.4 *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, Radiative 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

1.3.5 *Measurement of radiation:* Radiation Detectors: Gas, Solid-state, Scintillation, Thermoluminescence, Visual Imaging (Film, Fluorescent screens), and their examples

Exposure, Dose, Kerma: Definitions, Units (Old, New), Inter-relationships between units, Variation with energy and material. Measurement of exposure (Free air chamber, Thimble chamber), Calibration of therapy beams: Concepts, Phantoms, Protocols (TG 21, IAEA TRS-277, TG 51) Dose determination in practice *(brief outline only, details not required)*

1.3.6 *Radiotherapy Equipment:* Grenz ray, Contact, Superficial, Orthovoltage or Deep therapy, Supervoltage, Megavoltage therapy. Therapy and diagnostic X-ray units – comparison. Filters, factors affecting output, principles of cooling. Betatrons.

Co-60 units: Comprehensive description of the unit, Safety mechanisms, Source capsule

Linear accelerators: History, Development, Detailed description of a 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

1.3.7 *Basic ratios, Factors, 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, field 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 inhomogeneities: 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 beam modifying and shaping devices: Methods of compensation for patient contour variation and / or tissue inhomogeneity - Bolus, Buildup material, Compensators, Merits and Demerits. Shielding of dose limiting tissue: Non-divergent and Divergent beam blocks, Independent jaws, Multileaf collimators, Merits and Demerits

1.3.8 *Principles of Treatment Planning - I*

Treatment planning for photon beams: ICRU 50 and NACP 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 inhomogeneities

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 in 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

1.3.9 *Principles of treatment planning – II*

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's Eye 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 in radiotherapy, Immobilization methods (Plaster of Paris casts, Perspex casts, bite block, shells, head rests, neck rolls, Alpha-Cradles, Thermoplastic materials, polyurethane foams), Methods of beam alignment (isocentric marks, laser marks, and front/back pointers).

Treatment execution: Light field, Cross hair, ODIs, Scales in treatment machines

Treatment verification: Port films, Electronic portal imaging devices, In-vivo patient dosimetry (TLD, diode detectors, MOSFET, Film, etc) Changes in patient position, target volume, and critical volume during course of treatment

1.3.10 *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 field size, and SSD, photon contamination. Energy spectrum, Energy specification, 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 inhomogeneity – lung, bone, air filled cavities. 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

1.3.11 *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

Historical 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

Techniques: Pre-loaded, Afterloading (manual and remote), Merits and Demerits. Surface, Interstitial, Intracavitary, Intraluminal, Intravascular brachytherapy. Low, Medium, High and Pulsed dose rates. Remote afterloading machines, Detailed description of any one unit

Dosage systems: Manchester System (outline only), Paris System (working knowledge)

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 radionuclides: 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

1.3.12 *Quality Assurance in radiotherapy (QART)*

Overview of ESTRO QART: Need for a quality system in Radiotherapy, Quality System: Definition and practical advantages, Construction, Development and Implementation of a Quality System

Quality Assurance of Simulator, TPS, Co-60, linear accelerator

Acceptance testing of Simulator, TPS, Co-60, linear accelerator

1.3.13 *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).

1.3.14 *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:

1. With customized field shaping using conventional coplanar beams
2. Multiple non-coplanar MLC beams conforming to target shape
3. Stereotactic radiotherapy
4. Principle of Inverse planning and Intensity Modulated Radiation Therapy (IMRT)
   - Using 3D compensators
   - Static IMRT (Step and shoot technique)
   - Dynamic IMRT (sliding window technique)
   - Dynamic arc IMRT
   - Micro-MLC
   - Tomotherapy methods
5. 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 a radiotherapy department including Picture Archival Communication System (PACS), Advantages, Patient Data Management

1.4. Radiobiology

1.4.1. Introduction to Radiation Biology

1.4.1.1. 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.

1.4.1.2. 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.

1.4.1.3. Relevance of radiation biology to radiotherapy

1.4.1.4. 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 252Cf. Radiobiology of low, high dose rate & pulsed brachytherapy, hyperfractionation, significance in radiotherapy.

Effects of low LET and high LET radiation on cell. Cell survival curves.

Effect of sensitizing and protective agents. 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; dose protection and LET, effects on the embryo and the fetus, life shortening, leukaemogenesis and carcinogenesis, genetic and somatic hazards for exposed individuals and population. Biological basis of radiological protection.

1.4.1.5. Organ radiosensitivity and radioresponsiveness, concept of therapeutic index.

1.4.1.6. 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

1.4.2. 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, esophagus, intestine, kidney, liver & thyroid with special reference to treatment-induced sequelae after doses employed in radiotherapy

Normal tissue tolerances

1.4.2.1. Late effects of radiation (somatic)

Sterility, cataracts and cancer

Carcinogenesis: mechanisms in vitro and in vivo, oncogenes and anti oncogenes

Radiation induced cancer of occupational, medical or military origin

Recent controversial results for low level exposure, risk estimates

1.4.2.2. Late Effects of Radiation (Genetic)

Mutations: definition, types, potential hazards.

Low level radiation: sources, potential hazards, stochastic and deterministic (non-stochastic) effects, high background areas and cancer.

1.4.2.3. Effects of Radiation on Human Embryo & Fetus

Lethality, congenital abnormalities and late effects (Leukemia and childhood cancer),

severe mental retardation. Doses involved.

1.4.2.4. Biology and Radiation Response of Tumors

Tumor 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.

1.4.3. Applied Radiobiology

Fractionation: rationale, 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-target, two component and linear quadratic model. a/b ratios for acute and late effects and means of deriving these values. Isoeffective formulae. Clinical applications of the L-Q model, hyperfractionation, accelerated fractionation, hypofractionation, CHART, split dose treatments.

Bracthytherapy - 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-sensitizes, 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.

1.4.4. 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.

1.5. Clinical trials - Statistical basis for planning & interpretation

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 treatments ; 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 time(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 pre-determined 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 term objectives, feasibility & the availability of resources.
- Writing the protocol
- Running a pilot study

2. CLINICAL RADIOTHERAPY

2.1. Cancer Epidemiology & Etiology

2.1.1. Cancer Statistics - world wide & India

2.1.2. Cancer Registries & National Cancer Control Programme.

2.1.3. Analysis of data in cancer registries.

2.1.4. Regional Cancer Centers

2.1.5. Cancer Screening & Prevention.

2.2. Patient Care

2.2.1. Assessment & referral systems for radiotherapy

2.2.2. Diagnosis & workup.

2.2.3. Staging

2.2.4. Care & evaluation during & after treatment

2.2.5. Emergencies in Oncology

2.2.6. Management of different malignancies

2.3. Treatment Response & Result

2.3.1. Guidelines for treatment response assessment - Complete Response, Partial Response, No Response, Stable disease.

2.3.2. End points of treatment results: Loco-regional control, recurrence, metastasis, survival, quality of life.

2.3.3. Treatment related morbidity assessment

(i) Radiation morbidity (early & late)

(ii) Morbidities of combined treatment

(iii) Grading Systems.

3. CLINICAL CHEMOTHERAPY

3.1. Basic principles of chemotherapy

3.1.1. Chemotherapy drugs .

3.1.2. Newer chemotherapeutic agents.

3.1.3. Basis for designing different chemotherapy schedules. Standard chemotherapy schedules.

3.1.4. Chemotherapy practice in various malignancies

3.1.5. Chemotherapy practice & results/ toxicities in sequential & concomitant chemoradiotherapy.

3.1.6. Supportive care for chemotherapy.

3.1.7. The basic principles underlying the use of chemotherapeutic agents.

(i) Classification and mode of action of cytotoxic drugs. The principles of cell kill by chemotherapeutic agents, drug resistance, phase specific and cycle specific action.

(ii) 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.

(iii) Principles of combinations of therapy, dose response curves, adjuvant and neo-

adjuvant chemotherapy, sanctuary sites, high dose chemotherapy, and regional chemotherapy.

(iv) 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.

(v) 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.

(vi) Assessment of New Agents. Principles of phase I, II, and III studies.

(vii) Gene Therapy

3.2. Other Disciplines Allied to Radiotherapy and Oncology

3.2.1. Surgical Oncology.

3.2.1.1. Basic principles of surgical oncology, biopsy, conservation surgery, radical surgery, palliative surgery.

3.2.1.2. Basics of surgical techniques - head & neck, breast, thorax, abdomen, gynecological, genitourinary, musculoskeletal, CNS.

3.2.1.3. Combined treatments: with radiotherapy, chemotherapy, and hormone therapy.

3..2.2. Preventive oncology

4. PALLIATIVE CARE

4.1. Guidelines for palliative care

4.2. Symptoms of advanced cancer

4.3. Management of terminally ill patients.

4.4. Different pharmacologic & non-pharmacologic methods

4.5. Pain control, WHO guidelines for adults & children.

4.6. Palliative radiotherapy

4.7. Palliative chemotherapy

4.8. Home care

4.9. Hospice care

4.10. Physical, social, spiritual & other aspects.

5. RESEARCH, TRAINING & ADMINISTRATION

5.1. Research in Oncology

5.1.1. How to conduct a research

5.1.2. Guidelines for biomedical research: Animal studies, drug studies, human trial.

5.1.3. Cancer clinical trials. Phase I/II, III

5.1.4. Ethics of clinical research

5.1.5. Evidence based medicine.

5.2. Training in Oncology

5.2.1 Residency in Radiotherapy and Oncology

5.2.2. Theory, clinical & practical modes of training

5.2.3. Structured training: lectures, seminar, Journal club, Ward-round, Physics demonstration, Practical, Case Presentations (e.g. Long Case; Short Case)

5.2.4. Participation in various procedures, techniques (e.g. Brachytherapy, Radiotherapy Planning, Mould Room Procedures etc.)

5.2.5. CME-conference, symposium, workshop, seminar

5.2.6 Visiting other cancer centers & radiotherapy departments

5.3. Administration in Radiotherapy and Oncology.

5.3.1 Clinical Oncologists' role as an administrator.

5.3.2. How to set up a Radiotherapy and Oncology department, planning of infrastructure, & equipments

5.3.3. Role in cancer control programme.

5.3.4. Responsibilities towards safety & quality assurance.

Administration aspects of training, academic, patient care & research.

PAPERWISE DISTRIBUTION OF SYLLABUS FOR PURPOSE OF MD (RADIOTHERAPY AND ONCOLOGY) EXAMINATION

Paper I- Radiation physics and radiobiology, basic sciences related to oncology

Paper II- Management of human neoplasms according to site

PaperIII- Chemotherapy

Paper IV- Recent Advances in Radiotherapy and Oncology

ORTHOPAEDICS — M S

COURSE GOAL & OBJECTIVES

Major Goal:

Patient care Ability: A postgraduate in orthopaedics surgery at the end of its 3 year course should develop proper clinical acumen to interpret diagnostic results and correlate them with symptoms from history taking and become capable to diagnose the common clinical conditions/ disease in the specialty and to manage them effectively with success without making any serious complications and sincerely to take such accurate decision, for the patient's best interest including making a referral to consultation with a more experienced colleague/professional friend while dealing with any patient with a difficult condition.

Teaching ability: He/she also should be able to teach an MBBS student about the commonly encountered conditions in orthopaedics pertaining to their diagnostic features, basic patholophysiological aspect and the general and basic management strategies.

Research Ability: He/she should also acquire elementary knowledge about research methodology, including record-keeping methods, and be able to conduct a research inquiry including making a proper analysis and writing a report on its findings.

Team work: He/she should be capable to work as a team member. He/she should develop general humane approach to patient care with communicating ability with the patient's relatives especially in emergency situation such as in causality department while dealing with cancer patients and victims of accident. He/she should also maintain human values with ethical consideration.

OBJECTIVES OF THE POST-GRADUATE COURSE

A postgraduate at the end of a 3-year P.G. degree course should acquire the following:

1. *Cognitive knowledge:* Describe embryology, applied anatomy, physiology, pathology, clinical features, diagnostic procedures and the therapeutics including preventive methods, (medical/surgical) pertaining to musculo-skeletal system.
2. *Clinical decision making ability & management expertise:* Diagnose conditions from history taking, clinical evaluation and investigations and develop expertise to manage medically as well as surgically the commonly encountered, disorders and disease in different areas as follows: