STATE COUNCIL OF ALLIED MEDICAL SCIENCES, ODISHA

B.Sc. IN MEDICAL RADIATION TECHNOLOGY

(BMRT)

Learning Objectives: At the completion of this course, the student should be -
1. Able to execute all routine radio therapeutic procedures as per prescription and direction of Radiation Oncologist.

2. Able to operate the radiotherapy equipment used in treatment of cancer patient independently and maintain the equipment under the guidance of Medical Physicist.

3. Able to demonstrate and apply adequate knowledge about the safe handling of medical radiation sources, keeping in mind the radiation protection of staff, patients and public.

4. Able to demonstrate patient management skills.

Expectation from the future graduate in the providing patient care.
1. The coursework is designed to train students to work in conjunction with radiation oncology team including radiation oncologist, medical physicists and other members, in the application of prescribed doses of ionizing radiation for the treatment of malignant or benign disease.

2. Course work includes physics, anatomy and physiology, dosimetry, clinical oncology and radiation safety. The student will be skilled in management, administration of prescribed radiation treatment, and provisions of patient support.

3. Employment opportunities can be found in hospitals in both private and public sectors as well as in independent cancer treating centers.
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5. RTT graduate is encouraged to pursue further qualification to attain senior position in the professional field, also to keep abreast with the advances and new technology, the professional should opt for continuous professional education credits offered by national and international institutes.

Plan of Classes & Examination Pattern for Degree course

- Total duration of each course is 3 years (6 Semesters).
- Each semester is of 6months duration.
- In each semester the classes will be of 5months duration & internal assessment will be conducted in the last month of each semester except 3rd & 6th semester .
- University examination will be conducted at the end of 3rd & 6th Semester.
- In each semester, the classes will be of 500 hours including theory and practical/clinical.
- **Distribution of classes**: There will be 5 hours of classes / day for 5 days in a week, 25 hours / week, 100 hours /month and 500 hours in each semester approximately.
- Of the 500 hours of classes, 200 hours will be dedicated for the theory classes; rest 300 hours will be practical / clinical.
- **Attendance in Class:** A Student will be eligible to appear in the semester and university examination if he/she has attended minimum75% theory classes and 85% practical classes.

EXAMINATION PATTERN

- **Internal assessment:** Internal assessment will be conducted in the last month of each semester except 3rd & 6th semester(where there will be University examination.)
- **Mark Distribution:** 50 marks per each subject (30 Theory and 20 practical/clinical).Minimum qualifying mark: 50 % in each theory and practical/clinical.
- **Question Pattern for Theory (Semester Examination):**
  i. Short questions of 2 marks each X 5 = 10
  ii. Multiple choice question1 mark each X 5 = 5
  iii. Fill in the blanks 1mark each X 5 = 5
  iv. Match the following 1 mark each X 5 = 5
  v. Long Question (Choice) 1 X 5 = 5

University Examination:

Candidate has to pass two university examinations to be conducted atthe end of 3rd Semester & 6th Semester, of 100 marks/ subject. A student will be eligible to appear in the university examination if he/she has secured 50% in internal assessment done at the end of 1st, 2nd, 4th & 5th semester.

University Examination.

A student will be eligible to appear in the university examination if he/she has secured 50% in

each internal assessment (both Theory and Practical) done at the end of semester. Each Paper is of 100 marks (Theory -50, Practical-30, Internal Assessment-20). The duration of the examination is 2 hours.

Question Pattern for Theory (University Examination):

i. Short questions of 2 marks each X 5 = 10

ii. Multiple choice question1 mark each X 5 = 5

iii. Fill in the blanks 1mark each X 5 = 5

iv. Match the following 1 mark each X 5 = 5

v. Long Question (Choice) 1 X 5 = 5

Degree: On successful completion of three years course, the candidate will be awarded with**"B.Sc. in Medical Radiation Technology (BMRT)"**

B.sc. in Medical Radiation Technology (BMRT)"

	FIRST SEMESTER		
	Sl. No.	Subjects	**Total no of hrs(The+Prac+ clinical posting)**
PAPER I	1	Foundation Course	50
	2	General Anatomy and Radiation Anatomy	60+60
	3	General Physiology	60+40
	4	Basic Biochemistry	60+40
	5	Radiation Quantities,Units,Detection and Measurement	40+20
	SECOND SEMESTER		
PAPER II	6	Basic Radiation Physics	60+40
	7	Fundamental Medical Imaging	60+40
	8	Principles of Radiation Therapy and Radiotherapy techniques	40+20
	9	Basic Medical Instrumentation & Technique	40+20
	10	RTT related Clinical Education I	0+120
	THIRD SEMESTER		
PAPER III	11	Applied Radiation Physics & Radiation Protection	40+20
	12	Radiographic Technique - 1	0+120
	13	Basic Equipment in Radiotherapy	50+50
	14	Patient care,positioning and immobilisation	40+20
	15	Mammography and Ultrasound	40+60
	16	RTT related Clinical Education II	0+120
	FOURTH SEMESTER		
PAPER IV	17	Applied Equipment of Radio Diagnosis	40+60
	18	Radiotherapy and Brachy Therapy in Malignant & Non-malignant Disease	40+60
	19	Radiographic Technique - 2	0+120
	20	Quality Assurance in Radiotherapy	30+50
	21	Biological effects of Radiation	10+5
	FIFTH SEMESTER		
PAPER V	22	Clinical Radiobiology	40+40

	23	Physics of CT & MRI	20+60
	24	RTT related Clinical Education III	0+280
	25	Interventional Radiology and Drug Diagnostic Radiology	20+40
	26	Computerized Tomography (CT Scanning) Method & Procedure	20+40
	SIXTH SEMESTER		
PAPER VI	27	Basic of Magnetic Resonance Imaging	20+40
	28	Image Interpretation of X-Ray Mammography, CT & MRI	20+60
	29	Operational issues in Radiotherapy	20+60
	30	Medical Law and Ethics	20
	31	Orientation in Clinical Sciences Course Contents	0+40
	32	RTT related Clinical Education(IV,V)	0+140
	PROJECT		
	INTERNSHIP minimum of 720 hours @8hrs per day for 90 working days in a semester		

FOUNDATION COURSE

Introduction to Health care Delivery Systemin India	Basic computers and informatio nScience	Communicat ionand soft skills	Introduction to Quality and Patient safety (including Basic emergency care and life support skills, Infection prevention andcontrol,	Medical Terminologyand Record keeping (including anatomicalterms)
Biomedical waste manageme nt	Disaster manageme nt and Antibiotic resistance)	Professionali smand values	Biostatistics & introduction toResearch methodology	Biostat Medical Law and Ethics methodo

GENERAL ANATOMY

Course Objectives:

- To obtain Knowledge about the general anatomy – the structure of different organs and position of the organ.
- To familiarize the student with the different anatomical terminology and positions of the body.
- To develop the students to identify the structural reinforcement of the anatomical structures of human body, which would help the student to develop 3D images of the organs.

Learning Outcomes:

- Can acquire knowledge about the general anatomy – the structure of different organs and position of the organ.

- The student get familiarize with the different anatomical terminology and positions of the body.
- One can technically identify the structural reinforcement of the anatomical structures of human body, which would help the student to develop 3D images of the organs.

Module -1 INTRODUCTION TO ANATOMY AND SKELETON

Introduction to Anatomy: Sub division of anatomy, terms and terminology, systems of the Body. Skeleton:
Bones: function of bones, classification of bones, parts of young bone, development of bone, ossification of bones, blood supply bone, cartilage, clinical anatomy

Module –2 MUSCLES &JOINTS

Muscle: types of muscles, structure of striated muscle, naming of muscle, fascicular architecture of muscle, actions of muscle, nerve supply.
Joints: Classification, structures of joints, movements, mechanism of lubrication, biomechanics, levers, blood supply, nerve supply, and applied anatomy.

Practice: - Identification of different joints and bones from Charts and Human Skeleton.

Module -3 CIRCULATOTY SYSTEM, LYMPHATIC SYSTEM & SKIN

Circulatory system: Types of circulation of blood, arteries, veins, capillaries, end arteries, appliedaspect.
Lymphatic system : components, lymph nodes, clinical anatomy

Skin: structure of skin, superficial facia, deep facia, clinical aspects

Module -4 UPPER LIMB &LOWER LIMB

(A) Upper extremity: Bony architecture Joints–structure, range of movement Muscles–origin, insertion, actions, nerve supply Major nerves – course, branches and implications of nerve injuries Development of limb bones, muscles and anomalies Radiographic identification of bone and joints Applied anatomy

(B) Lower extremity: Bony architecture Joints – structure, range of movement Muscles – origin, insertion, actions, nerve supply Major nerves – course, branches and implications of nerve injuries Development of limb bones, muscles and anomalies Radiographic identification of bone and jointsApplied anatomy

Module -5 THORAX, ABDOMEN & BACK MUSCLES

Thorax: skeleton of thorax, intercostal spaces, pleura, lung, mediastinum, heart: morphology, blood supply, interior of heart, general information about upper respiratory tract (trachea, esophagus, pharynx and larynx) clinical anatomy.

Abdomen: Anterior and posterior abdominal wall, general information about viscera: stomach, liver, pancreas, duodenum, kidney, ureter, urinary bladder, uterus and its adenexa.

PRACTICE: -identification of structure, position, and different parts of Lungs, Heart, Kidney from charts, Models.

Back muscles: Superficial layer, Deep muscles of back, their origin, insertion, action and nerve supply. Vertebral column – Structure & Development, Structure & Joints of vertebra Thoracic cage Radiographic identification of bone and joints Applied anatomy

PRACTICE: - Radiography identification of different architecture joins, structure and positionof Bones from Skeleton, Model or PPT.

Module -6 NERVOUS SYSTEM & SPECIAL SENSE ORGANS

Nervous system: parts of nervous system, neurons, peripheral nerves, spinal nerves, summary of cranialnerves, parasympathetic nervous system.

Special sense organs: Structure and function of Visual system, auditory system, gustatory system, olfactory system.

Module -7 HEAD AND NECK & CENTRAL NERVOUS SYSTEM

Head and neck: scalp, facial muscles, cranial skeleton , triangles of neck, parotid region,temporomandibular joint, muscles of mastication, applied.

Central nervous system: General idea about spinal cord, brainstem, cerebrum, cerebellum, ventricularsystem, diencephalon, blood supply of brain and its applied, meninges and cerebrospinal fluid.

PRACTICE

- Identification of structure and different parts of Central nervous system from chart.
- Identification of different blood supply in brain from PPT.
- Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominalviscera, face and brain).

PRACTICE

1. Identification and description of all anatomical structures.
2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts,etc.
3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominalviscera, face and brain).
4. Demonstration of skeleton- articulated and disarticulated.
5. During the training more emphasis will be given on the study of bones, muscles, joints, nervesupply of the limbs and arteries of limbs.
6. Surface anatomy: Surface land mark-bony, muscular and ligamentous. Surface anatomy of majornerves, arteries of the limbs. Points of palpation of nerves and arteries

GENERAL PHYSIOLOGY

Course Objectives:

- To obtain Knowledge about the general physiological systems and physiological terminology.
- To familiarize the student with the functionality of different physiological systems.
- To develop the technical skills in identifying the Bio potential and their recording and advanced systems.

Learning Outcomes:

- Can acquire knowledge about the general physiological systems and physiological terminology.
- The student get familiarize with the functionality of different physiological systems
- One can technically identify the Bio potential signals, their recording and advanced systems.

Module -1

Scope of physiology. Definition of various terms used in physiology. Structure of cell, function of its components with special reference to mitochondria and microsomes. Elementary tissues: Elementary tissues of the body, i.e. epithelial tissue, muscular tissue, connective tissue and nervous tissue.

Module -2

Cardiovascular System: Composition of blood, functions of blood elements. Blood group and coagulation of blood. Brief information regarding disorders of blood. Heart: myocardium– innervations– transmission of cardiac impulse- Events during cardiac cycle–cardiac output. Structure and functions of various parts of the heart.

Module-3

Circulation: General principles, Peripheral circulation: peripheral resistances–arterial blood pressure– measurements–factors, Regulation variations–capillary circulation–venous circulation. Special circulation: coronary cerebral–miscellaneous, Arterial and venous system with special reference to the names and positions of main arteries and veins. Brief information about cardiovascular disorders.

Module -4

Respiratory system: Various parts of respiratory system and their functions, physiology of respiration.Mechanics of respiration–pulmonary function tests–transport of respiratory gases-neural and chemical regulation of respiration–hypoxia, –asphyxia.

Module-5

Urinary System: Various parts of urinary system and their functions, structure and functions of kidney, structure of nephron– mechanism of urine formation, composition of the urine and abnormal constituents, urinary bladder & micturition.Patho-physiology of renal diseases and edema.

PRACTICE: - Examination of pulse, B.P, Respiratory rate, Heartbeat, impulses etc.

Identification of different artery and Venous supply from chart or PPT.

Module-6

Digestive System: names of various parts of digestive system and their functions. structure and functions of liver, physiology of digestion- functions and regulations of Salivary digestion, Gastric pancreatic digestion, Intestinal digestion and absorption.

Lymphatic system: Name and functions of lymph glands,Reticulo endothelial system: Spleen, lymphatic tissue, Thymus

Module-7

Nervous System: Neuron–Conduction of impulse– synapse–receptor.Sensory organization–pathwaysand perception, Reflexes–cerebral cortex– functions. Thalamus–Basal ganglia Cerebellum,hypothalamus. Autonomic nervous system– motor control of movements

Reproductive system. Structure and function of Male reproductive system–control & regulation, Female reproductive system– uterus–ovaries–menstrual cycle–regulation–pregnancy & delivery–breast– family planning

PRACTICE

1. Identification of different organs and systems from charts
2. Identification of different blood cell, their normal and abnormal morphology from slides.
3. Examination of pulse, B.P., Respiratory rate.
4. Reflexes
5. Spirometry to measure various lung capacities & volumes, Respiratory rate, Tidal volume, IRV,IC,
6. ERV, EC, residual volume on Spirometry.
7. Estimate of Hemoglobin, R.B.C., W.B.C., TLC, DLC, ESR count.
8. Blood indices, Blood grouping, Bleeding & Clotting time

BASIC BIOCHEMISTRY

Course Objectives:

- Biochemistry is the study of biological phenomena at the molecular level.
- Its aim is to understand the fundamental chemical principles that govern complex biological systems.
- The program is an interdepartmental major between biology and chemistry that emphasizes the importance of a solid foundation in the natural sciences.

- The major focuses, however, on disciplines within biology and chemistry, ranging from cell biology and molecular biology to analytical chemistry and physical chemistry.

Learning Outcomes:

- Biochemistry helps in clinical diagnosis, understanding pathology of diseases, treatment of diseases, designing of drugs and understanding their metabolism and manufacture of various biological products like amino acids, proteins, antibiotics, hormones, enzymes, nutrients, etc.
- It is expected that the students become conversant with the Fundamentals of Biochemistry which can be applied in clinical diagnosis of the metabolic disorders

Module-1

Enzymes - Introduction, definition, classification, coenzymes, isoenzymes, properties, factors affecting enzyme action, enzyme inhibition, diagnostic value of serum enzymes - Creatinine kinase, Alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc.

Module-2

Chemistry of carbohydrates & their related metabolism - Introduction, definition, classification,biomedical importance & properties.

Module-3

Brief outline of metabolism: Glycogenesis &glycogenolysis (in brief), Glycolysis, citric acid cycle & itssignificance, HMP shunt & Gluconeogenesis (in brief), regulation of blood glucose level.

Module-4

Amino acids - Definition, classification, essential & non-essential amino acids. Chemistry of Proteins &their related metabolism - Introduction, definition, classification, biomedical importance.

Module-5

Metabolism: Transformation, Decarboxylation, Ammonia formation & transport, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids especially Phenylalanine, Tyrosine & Tryptophan, Creatine, Creatinine, Proteinuria.

Module-6

Chemistry of Lipids & their related metabolism - Introduction, definition, classification, biomedical importance, essential fatty acids. Brief out line of metabolism: Beta oxidation of fatty acids, fatty liver, Ketosis, Cholesterol & it's clinical significance, Lipoproteins in the blood composition & their functionsin brief, Atherosclerosis.

Module-7

Diabetes mellitus - definition, types, features, gestation diabetes mellitus, glucose tolerance test,glycosuria, Hypoglycaemia& its causes

BIOCHEMISTRY PRACTICAL

Quantitative exercises:

- Detection of abnormal constituents in urine, sugar, proteins, ketones, blood and bile salts Bens Jones protein.

Phlebotomy equipments

- Identification of Blood Collection Tubes & Centrifugal Separation of Blood Plasma and Serum

Techniques:

- Colorimeter, blood chemistry analyzer.

Demonstration:

- ✓ Estimation of blood cholesterol
- ✓ Estimation of alkaline phosphate
- ✓ Salivary amylase test (effect of PH and Temperature)
- ✓ Estimation of Serum creatinine
- ✓ Estimation of Serum uric acid
- ✓ Estimation of total protein.

Radiographic Anatomy

Emphasis on plain and cross-sectional radiographic anatomy

1. Surface anatomy
2. Plain film / conventional radiographs
3. Mammography
4. Computed Tomography (CT)
5. Magnetic Resonance Imaging (MRI)
6. Ultrasound
7. Nuclear medicine
8. Digitally Reconstructed Radiographs (DRR)
9. Portal imaging

Radiation Quantities, Units and Detection/Measurement

In this paper the students will learn about the various radiation quantities, their measuring units and various types of survey meters/dosimeters.

1. Radioactivity, Flux, Fluence, Kerma, Exposure, Absorbed Dose, Equivalent Dose, Weighting Factors, Effective Dose, Natural Background Radiation, Occupational Exposure Limits, Dose limits to Public.

2. Detection and measurement of radiation - Ionisation of gases, Fluorescence and phosphorescence, Effect on photographic emulsion, Ionisation chambers, Proportional Counters, G.M. Counters, Scintillation Detectors, Liquid scintillator, Pocket Dosimeters, TL Dosimeters and their use in personnel monitoring badges. Advantages and disadvantages of various detectors, appropriateness of different types of detectors for different types of radiation measurement.

BASIC RADIATION PHYSICS

Course Objectives:

At the end of the course, the student should be able to comprehend the following:

1. Production of x rays
2. Quality and quantity of radiation and its application in radiology
3. Application of radiation in Imaging technology
4. Factors affecting the image quality.

Learning Outcomes:

- Through practical demonstrations, assignments, orals, presentations, practical examination by external faculty.
- Proper use of radiation monitoring devices.
- Performance of different techniques with minimal exposure.

Module-1
Modern Atomic Physics: Constituents of matters & atomic structure, orbits and orbital, binding energyand mass defect, isotopes, isotones and isobars, electromagnetic and particle radiations.

Module-2
X-ray tube and Generators: Features of X-ray tube, anode, cathode and filament, characteristics of targetmaterials, cooling system, insulation and tube housing, filters, rating of tubes, faults of X-ray tubes;

Module-3
Gas tube, Hot cathode tube, fixed anode and rotating anode tube, line-focus tube, dual focus tube, Mammography X-ray tube; X-ray generators, power supply: transformers, Half-wave and full-waverectifications, timer.

Module-4
Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation inboth stationary and rotating X-ray tubes).

Module-5
Heat Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k ofvarious material of interest in radiology, thermal expansion, Newton's law of cooling,

Module-6
Physical Principles of X-ray Diagnosis: Radiological images: Photon fluence, Unsharpness, resolution,Contrast, scattered radiation, grids, fluoroscopy. Portable x-ray & Mobile X-Ray machine.

Module-7
Radioactivity: Radioactivity decay, half-life & mean-life, decay series, modes of decay: alpha, beta and gamma radiation, electron capture, internal conversion, isomeric transition, production of radioisotopes.

Production of X-Rays: Discovery and origin of X-rays, Production of X-rays, Nature and properties of X- rays, Energy spectrum, characteristic radiations, Absorption, scattering and quality of X-rays, HVT and TVT, Angular distribution.

FUNDAMENTAL MEDICAL IMAGING

Course Objectives:
To enable the students to understand image processing & dark room techniques.
Should be able to

- Select the cassette size

- Insert image plate for processing
- Taking the images & doing post-processing

Learning Outcomes:
Through practical demonstrations, assignments, orals, presentations, practical examination by

Fundamentals of Medical Image Processing Page 2 of 5
external faculty.
Students perform listed tasks under the guidance of hospital supervisors
- Read the requisition slip
- Make entries in the register
- Understand the quality of the film
- Practice film processing

Module -1 : Photographic aspects in Radiography:
Light sensitivity salts of silver; photographic emulsion; Emulsion preparation, Formation of the latent image, x-ray film; construction of X-ray film; characteristics and control; screen films; non-screen film; dental films; occlusal film; duplicating films; single coated and double coated films; speed of the film; antiabrasive supercoating; Base material; substratum; coating; emulsion, Fogs; types of fogs

Module -2: Intensifying screens:

Fluorescence; application of fluorescence to radiography, construction of an intensifying screen; Intensifying factor; relative speeds of intensifying screen; factor affecting the speed of screens; Mounting, Un-sharpness relative to the speed of the screens, Identification; cleaning and general care of intensifying screens.

Module-3:X-ray cassette:
Basic construction and functional requirements, Types of cassettes, Identifying of cassettes; records necessary for cassettes; general care of cassettes and storage; testing a cassette for light leakage; Testing for film screen contact, Sensitometry; Principles of sensitometry, Characteristic curve; Measurements from the characteristic curve;

Module-4: The X-ray dark room:
Layout plan of a dark room for a small medium and big hospital; Size of darkroom; light proof entrances; cassette hatches, General construction of room to provide light-proofing, Chemical; Radiation; disposition of equipment; loading-bench-design; film hoppers; safe light types; test for safe light; hangers types Care of hangers; ventilation; darkroom illumination and colour schemes; testing safety of illumination; Darkroom procedure

Module-5: Chemistry of processing:
X-ray developers; basic constituents, types of developer for manual processing; automatic processing; rapid theatre processing, fine grain developer development; effects on development

of time; temperature agitation developer activity; x-ray fixers; basic constituents and function of fixer; inclusion of hardening and other agents; Fixing

Module-6: Silver recovery:
Methods of silver recovery; economic reasons

Module-7: LASER Printer:
Introduction, work and function of LASER Printer, LASER characteristics day light films, dry film and wet film processing steps, Scintillation detectors – scintillation crystal, photomultiplier tubes, Photo diodes, Photocell, photocathode.

PRINCIPLES OF RADIATION THERAPY

Course Objectives:

- Radiotherapy technology is one of the treatment lines for cancer.
- The process involves the deposition of energy in the targeted cells through ionizing radiation causing destruction of the cells and ceasing their growth.

Learning Outcomes:

- Students will learn with Radiotherapy that can be used as a primary treatment option for cancer before surgery to shrink cancerous tumors.
- It can also be used after surgery to stop the growth of any remaining cancer cells or in combination treatment with chemotherapy or to alleviate symptoms caused by cancer.

Module-1
Radiation sources of Different Frequencies, Micro wave frequency Generation Reflex Klystron. Magnetrons; Travelling Wave tube. Backward Wave Oscillator

Module-2 Radio Therapy
Radiation Dose, Measurements- Dosimetric Instruments, quantity of Radio activity, Radiation Sources. Modes of Administration, Gamma Radiations, Tele Therapy. Radio Surgery and treatment planning

Module-3
Principles of Treatment. Modes or treatment. Radio Biology, Breast Cancer, Techniques of Artificial Menopause or Ovarian Irradiation. Lung Cancer. Cancer of Lower Pharynx. Larynx and post cricoids, Head and neck Cancer. Tumors of Central nervous systems, Tumors of Eye. Tumors of Kidney, Cancer of Urinary Bladder, Skin Cancer, Carcinoma of the prostate.

Module-4
Generation and properties of X-Rays; Production of X-Rays. Characteristics of Radiation, X-Ray Tube. Basic circuit or X-Ray Generation, Tube Rating Charts, Types of tubes.

Module-5
Radiation, Detection and Measurement: Radiation Detection-Types of Detectors Practical Dosimeters, Area of monitoring, personal monitoring Cyclotron

. **Module-6**

Nuclear Medicine: Basic atomic and Nuclear Physics. Radioactive Decay, Radioactive Detection Nuclear Medicine Imaging System. Production of Radio Isotopes. Technetium -99M.Radio nuclide Scanning. Radio nuclide Agents used in Neuro Imaging

Module-7

Radiation Dosimetry: OSLD; Biological Dosimetry; Chemical Dosimetry. Dose Estimation, Computed Tomography Fluoroscopy, mammography. Interventional Radiology ,Angiography, Catheters, Stents, Embolus Therapy.

BASIC MEDICAL INSTRUMENTATION AND TECHNIQUES

Course Objects:

- To obtain Knowledge about the basic electronic sensor systems.
- To familiarize the student with the construction, working, and principles Biomedical instrumentation systems.
- To develop the technical skills in handling Biopotential records and advanced Medical instrumentation.

Learning Outcomes:

- Can acquire knowledge about the basic electronic sensor systems.
- One can technically know the functionality of the Biopotential records and advanced Medical instrumentation to work with the patient in real-time.

Module-1 (9 Hrs.): Biopotential Electrodes and Transducers: -

Introduction, Design of Medical Instruments, Components of the biomedical instrument system, Electrodes, Transducers

Module-2 (9 Hrs.): Biopotential Recorders: -

Introduction, Characteristics of the recording system, Electrocardiography (ECG), Electroencephalography (EEG), Electromyography (EMG), Electroretinography (ERG), Electrooculography (EOG)

Module-3 (7 Hrs.): **Physiological Assist Devices: -**

Introduction, Pacemakers, Pacemaker batteries, Artificial Heart Valves, Defibrillators, Nerve and Muscle Simulators, Heart-Lung Machine, Kidney Machine,

Module 4: (8 Hrs.)Operation Theatre Equipment: -

Introduction, Surgical diathermy, Microwave diathermy, Ultrasonic diathermy, Therapeutic effect of heat, Ventilators, Anaesthesia Machine, Blood Flow meters, Cardiac Output Measurements, Blood Gas Analysers, Oximeters,

Module 5: (6Hrs) Specialized Medical Equipment: -

Introduction, Blood Cell Counter, Electron Microscope, Radiation Detectors, Photometers and Colorimeters, Digital Thermometer, Audiometers, Radiography and Fluoroscopy, Angiography,

Module 6: (6 Hrs.) Safety Instrumentation: -

Introduction, Radiation safety instrumentation,
Physiological effects due to 50Hz current passage, Micro shock and Macro shock, Electrical Accidents in Hospitals

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Introduction, Radiation safety instrumentation,
Physiological effects due to 50Hz current passage, Micro shock and Macro shock, Electrical Accidents in Hospitals

Module 6: (6 Hrs.) Safety Instrumentation: -

Introduction, Radiation safety instrumentation,
Physiological effects due to 50Hz current passage, Micro shock and Macro shock, Electrical Accidents in Hospitals

Module 7: (14 Hrs.) Advances in Biomedical Instrumentation: -

Introduction, Computers in medicine, Cryogenic Surgery, Computer Tomography (CT), Thermography, Ultrasonic Imaging Systems, Magnetic Resonance Imaging (MRI), Biofeedback instrumentation, Biomaterials.

RTT Directed Clinical Education – part I (studentship)

Students will observe the basic operations of the radiation oncology clinic while interacting with the multidisciplinary team members involved in providing optimal care to cancer patients. The student will be introduced to oncology terminology, equipment, and techniques used for treatment.

APPLIED RADIATION PHYSICS & RADIATION PROTECTION

Course Objective:

- To understand the importance of the X Rays in medical field.
- To study the application of radiotherapy sources.
- To develop an understanding of radiation measurements.
- To understand how to follow radiation protection rules.

- To study the physical properties and application of x- ray machine techniques.

Learning outcomes:

- Know what it takes a career in physics in X – ray techniques.
- Understand the need to increase physics in radiology
- Know the radiation protection rules and measurements.
- Know the application of physical parts in x- ray machines.

RADIATION PHYSICS

Module -1

Effects of variation of tube voltage current, filtration, III waveform and target material on X-ray production lows of radioactivity and decay schemes of different alpha, Beta, gamma ray.

Module -2

Megatron and position emitters as used in medicine especially in radiotherapy. Artificial radionuclide generators employed in medicine in general and radiotherapy sources in particulars.

Module -3

Physical requirements of beam defining devices e.g. cones, diaphragm, collimators etc. Units of radiation measurements specification of quality and half- valve thickness (HLV) and its measurements, filters and filtration.

Module -4

Measurement of radiation and dosimetry procedures. Radiation detectors and their principles of working. Definition of Bragg-peak, percentage depth dose, peak scatter factor, tissue air-ratio, tissue maximum

ratio, scatter air ratio, isodose curves and radiation penumbra of different beams.

Module -5

Wedge filters, wedge angle, hinge angle. Compensator beams flattering filters, scattering foils. Physical properties of phantom materials, bolus and substitutes. Factor used for treatment dose calculations, Daily treatment time and monitor unit's calculation method physical aspects of electron and neutron therapy.

RADIATION PROTECTION

Module -6

Definition of radiation hazards maximum permissible dose and annual limit of intake (ALI) permissible dose levels on and around sealed source housing and installation principles of radiation protection and MPD of different ICRP rules, stochastic and non-stochastic effects.

Module -7

Importance of 'ALARA' physical principles of design and planning of installation safe work practice in teletherapy and brachytherapy. Shielding materials Radiation survey and personnel monitoring devices film badge, TLD badges pocket dosimeters.

RADIOGRAPHIC TECHNIQUE -1

Course Objectives:

To enable the students to understand different imaging techniques & procedures & to take X -rays of optimum quality as required by the radiologist.

Should be able to

- Develop/process x-ray film
- Change the position of the tube
- Give instructions to the patient
- Select the cassette size
- Insert image plate for processing
- Taking the images & do the post-processing
- Perform radiology procedure

Learning Outcomes:

Through practical demonstrations, assignments, orals, presentations, practical examination byexternal faculty.

Students perform listed tasks under the guidance of hospital supervisors

- Read the requisition slip
- Make entries in the register
- Position the tube
- Give instructions to the patient
- Assist radiologist in various procedures

Module -1: Skeletal System:

Upper Limb, Lower Limb, Shoulder girdle &thorax ,Vertebral column, Pelvic girdle and hip region, Skeletal survey, Skeletal survey, Skull

Module-2: Dental Radiography:

Technique for intra oral, Occlusal projections, Extra oral projections including orthopantomography, Supplementary techniques

Module-3: Cardiovascular system:

Routine projections for heart and vessels, (without the uses of contrast agent), Supplementary views for above.

Module-4: Upper respiratory system:

Technique for post nasal airways, Larynx, Trachea, thoracic inlet, valsalvamanoeuvre

Module-5: Lungs and Mediastinum:

Technique for routine projections – PA & Lateral,

Supplementary projections:

Antero-posterior, Obliques, apical projection use of penetrated, postero-anterior projection, Expiration technique, Technique for pleural fluid levels and adhesions.

Module-6: Abdominal viscera:

Technique for plain film examination supire& Erect, Technique for plain film examination supire& Erect, Projection for acute abdomen patients for ambulant & non ambulant patients, Decubitus view positioning and benefits, Technique to demonstrate: Foreign bodies, Imperforated anus

Module-7: Radiography using mobile X-ray equipment:
Radiography in the ward, Radiography in the specialized unit, such as: Intensive care unit, Intensive care unit, Coronary care, Neonatal unit, Radiography in the operating theatre, What all the precautions for radiation safety

BASIC EQUIPMENT IN RADIOTHERAPY

Module-1
Orthovoltage equipment with special reference to physical design equipment of tube and its accessories and interlocks

Module-2
Gamma ray sources used radiotherapy especially cobalt 60 source its construction and sourcehousing and handling mechanism

Module-3
Principles of isocentric Tele-isotope machines, megavoltage x-ray and electron beam accelerators and betatron.

Module-4
Salient features of components of Linear Accelerator like tube design, wake guide, target design, beam bending system.

Module-5
Radio-frequency generators like magnetron and klystron. Basic principle of remote after-loading system/ machines and sources used.

Practice: - Demonstration, handling and maintenance of Linear Accelerator .Demonstration , handling and maintenance of cyclotron, betatron. Demonstration, handling and maintenance of magnetron, klystron.

Module-6
Principles of simulators and vacuum forming machines for making casts. Sterofoam template cutting system

Module-7
Introduction to radio-surgery. Equipment and dosimetry equipment.

Practice: - Demonstration, handling and maintenance the instruments used in gamma ray production.

PATIENT CARE, POSITIONING AND IMMOBILIZATION

In this context, patient care refers to all non-radiotherapy related aspects of the work that the RTT does while interacting with patients. This ranges from communication to the identification and referral for radiation related toxicities to cardio-pulmonary resuscitation. The RTT must also be able to apply the principles of positioning to the preparation of the immobilization device. Consideration must be taken of the practical aspects of immobilization device preparation.

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

2. Care of the patient: First contact with patients in the department, management of chair and stretcher patients and aids for this , management of the unconscious patient, elementary hygiene, personal cleanliness, hygiene in relation to patients (for example clean linen and receptacles, nursing care, temperature pulse and respiration, essential care of the patient who has a tracheotomy, essential care of the patients who has a colostomy, bedpans and urinals, simple application of a sterile dressing. First aid, Infection (Bacteria, spread of infections, auto- infection etc.).

3. Drugs in the department: Storage: Classification; labelling and checking, regulations regarding dangerous and other drugs, unit of measurement, special drugs, anti-depressive, anti-hypertensive etc.

4. Principles of positioning and immobilization

a. Positioning aids-Breast boards, Lung boards, Belly boards, Head-and-neck fixation devices, Vacuum packs, Stereotactic systems

b. Internal organ motion control- Bite blocks, Gating systems, Active breathing control, Diaphragm compression, Prostate immobilization, Tracking systems. Laser/ positioning systems

c. Marking systems

d. Isocentre determination

e. Reference points

f. Treatment couch

g. Image acquisition for planning (and/or verification)

h. Modalities for image acquisition for planning

i. Simulation- Conventional Simulation, CT Simulation, Virtual Simulation

j. Image processing and archiving

k. Treatment verification

l. Protocols- Imaging protocols: development and implementation, Non-action levels (NAL), On-line/off-line corrections, Matching/co-registration procedures, Geometric uncertainties, Documentation, Adaptive radiotherapy,
Information management35

MAMMOGRAPHY AND ULTRASOUND

Course Objects:

- To obtain Knowledge about the preparation and positioning of the patient during the imaging.
- To familiarize the student with the requirements and principles of imaging of the breast using X-ray mammography.
- To develop the technical skills of ultrasound, and doppler techniques to bring good

quality images for better analysis.

Learning Outcomes:

- Can acquire knowledge to perform the positions of the patient during the imaging
- One can technically know the functionality of the mammography, Ultrasound, and Doppler techniques to work with the patient in real-time.

Module-1: Anatomy and Physiology:
a. Breast Margins b. Nipple c. Areola d. Montgomery's glands
Internal anatomy- a. Glandular tissue b. Parenchyma c. Connective tissue d. Pectoralis muscle

Module-2: Positioning:
Cranio-caudal, Medio-lateral oblique, 90-degree lateral, medio-lateral and latero-medial, Latero-medial oblique, Caudal-cranial. Exaggerated cranial-caudal, Spot compression, Cleavage, Tangential, Axillary tail

Module-3: Professional ethics and patient care:
Patient preparation, care of special patient populations: patient concerns, early detection, patient education, visual inspection- areas of interest (perimeter, nipples, lymph nodes);

Module-4: Technical aspects of mammography:
Breast composition; fundamental of image quality; methods of improving image quality, Image receptor, screen//film combination; cathode (purpose, effect on focal spot, orientation),focal spot size; anode/target (purpose, material, anode angle,, line focus principle, heel effect); window material, filtration, source-to-image distance; use of grids, magnification; compression (pressure settings,, hand versus foot pedal use)

Module-5: Ultrasound

Principle & history of Ultrasound, advantages and disadvantages of ultrasound, Types of Ultrasound, Equipment description, Indication and Clinical Application, Physics of ultrasound imaging, Physics of transducers, Physics of Doppler, Ultrasound tissue characterization, Potential for three-dimensional ultrasound, Artefacts in ultrasound, Comparison of ultrasound equipment Computerization of data, Image recording, Ultrasound jelly & Safety of ultrasound

Module-6: Abdomen and pelvis ultrasound & USG Contrast Media

Pathologies and indications, patient preparation, positioning and scanning technique. Types of Ultrasound Contrast media and its advantages

Module-7: Color Doppler imaging, The obstetric Ultrasound examination

Doppler effect, Doppler ultrasound applications; CWD, PWD, Color Doppler Method of gynecologic ultrasound examination, Assessment of Normal fetal growth, fetalbehavior states,

fetal breathing movements, fetal cardiac activity.

RTT Directed Clinical Education – part II (studentship)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel.

Students apply knowledge from previous clinical learning experience under the supervision of a registered radiation

therapist. Students are tested on intermediate clinical radiation therapy skills.

APPLIED EQUIPMENT OF RADIO DIAGNOSIS

Course Objectives:

- To enable the students to understand different imaging techniques & procedures to take X -rays, DEXA, USG & PET Scan of optimum quality as required by the radiologist.
- Should be able to: Preparation of patient, Preparation of contrast media, Give instructions to the patient, Perform radiology procedures

Learning Outcomes:

- Through practical demonstrations, assignments, orals, presentations, practical examination by external faculty.
- Students perform listed tasks under the guidance of hospital supervisors: Read the requisition slip,
- Make entries in the register, Give instructions to the patient, Assist radiologist in various procedures

Module-1

Preparation of patients for general radiological procedures:

Departmental instruction to out-patients or ward staff, use of aperients enemas and colonic irrigations, Flatulence and flatus causes and methods of relief

Module-2

Principles of catheterization and intubation, pre-medication, its uses and methods.

Module-3

DEXA Scan: History of DEXA, Bone mineral density, Preparation of patient, t-score, z-score, osteopenia, osteoporosis, Units of BMD, Standard deviation.

Module-4

Equipments and description, Color Doppler, Flow Imaging, Indication, Clinical Application

Module-5

CT SCAN-Advancement in CT, Spiral CT, Preparation opt Patient, Contrast Media, Indication and Contraindication, Technical Aspects of various procedures in CT

Module-6

Nuclear Medicines -Nuclear medicines,

a. Definition, **b.** Characteristic of Radio Nuclide, **c.** Commonly used Radio Nuclides

Module-7

PET Scan- PET scan and Mammography, Definition, Characteristic and Descriptionof Equipment.

RADIOTHERAPY &BRACHY -THERAPY TECHNOLOGY IN MALIGNANT AND NON-MALIGNANT DISEASES

Module-1

Orthovoltage techniques in skin tumors, and cancers of the breast Advantages and disadvantages of orthovoltage in radiotherapy.

Module-2

Tele isotope cobalt therapy techniques in skin and deep sealed tumors parallel opposed fields and small beam directed therapy and wedge field techniques in head and neck tumors especially cancers of larynx treatment techniques for cancer of maxillary antrum and pituitary tumors.

Module-3

Treatment techniques in cancer of breast by telecobalt and low energy megavoltage X-rays and electron beam. Tele and brachy-therapy techniques of treatment of different stages of carcinoma cervix uteri with special emphasis on HDR and LDR brachytherapy.

Module-4

Three field techniques in cancer of esophagus and bladder. Radiotherapy technique in meduloblastoma. Whole body and hemi body radiation techniques.

Module-5

Treatment techniques of malignant and non-malignant conditions in ovarian and kidney tumors. Radiation treatment techniques of lymphomas with special emphasis on mantle field irradiation radiotherapy techniques in head and neck cancer.

Module-6

Salient features of computers in radiotherapy and its application. Introduction to computer, Hardware and software component. Input and output data systems computerized treatment planning systems in tale, brachytherapy and documentations.

Module-7

Radiological protection- 1. Dose limits of occupational workers & Publics, **2**. Principle &Methodof Protection**, 3**. Monitoring devices.

RADIOGRAPHIC TECHNIQUE-2

Course Objectives:

- To enable the students to interpret the radiographic images & find out the abnormalities if any like fractures, tumors etc.
- To train and inform students about special investigative techniques in imaging because after completion of this course if they are working as CT/MRI/Cath Lab technologist.
- To upgrade students about all tools and techniques in these imaging modalities to competently assist the radiologist.

- To help students to produce better images and understand the images when produced.

Learning Outcomes:

At the end of course

- They will have basic knowledge of techniques & investigations available.
- Apply those in day to day activities.
- The students will be able to diagnose abnormalities, diseases, physiological and pathological conditions on X-Ray, C-Arm CT& MRI.

Module-1: Preparation of patients for general radiological procedures:

Departmental instructions to out-patients or ward staff; use of aperients, enemas and colonic irrigations, flatulence and flatus; methods of relief; principles of catheterization and intubations, pre medication;

Special conditions & Care: anaesthetized patients nursing, care before and after special x-ray examination, (for example in neurological, vascular and respiratory conditions, Diabetic patient's special attention to food; hazards of trauma

Module-2: Radiological Contrast agents:

General principles Opaque agents and gases, Relationship of x-ray transmission to density and atomic number of the elements of contrast medium. Types of Barium sulphate solutions, concentration and its particular uses, additional modifications activators, Routes, Dosage, Double contrast.

Module-3: Emergencies in the x-ray department and management

Emergency Equipment: Alarm system, oxygen cylinder, face mask, resuscitation set and their use. External defibrillation, internal defibrillation, direct cardiac massage, respiratory arrest, GI Bleed, local anaesthetic; reactions, treatment.

Module-4: Special procedures in diagnostic Radiology: GI Tract

Barium meal, Barium swallow, Small bowel enema, Barium enema,

Module-5: Special procedures in diagnostic Radiology:Renal Tract

Intravenous urography, Retrograde pyelography, Micturating cysto urethrography.

Module-6: Special procedures in diagnostic Radiology: Biliary system

Plain film radiography, Intravenous cholangiography Percutaneous cholangiography, post-operative cholangiography (T-tube Cholangiography)

Module-7: Special procedures in diagnostic Radiology: Gynecology

Hysterosalpingography, Central nervous system: Myelography, Other: Sialography

PHYSICS OF CT & MRI

Course Objects:

- To obtain Knowledge about the basic physical Principles of CT and MRI.
- To familiarize the student with the working principles and components involved in

construction of the equipment.
- To develop the technical skills in image reconstruction techniques and identifying artefacts.

Learning Outcomes:

- Can acquire knowledge about the basic physical Principles of CT and MRI.
- One can technically know the functionality,physical structure and componential alignments in the equipment.
- They can reconstruct the MRI images and good in identifying the artifacts.

Module-1:Introduction to CT & MRI:
History & Principles, Advantages & Disadvantages of CT & MRI, X-Ray vs CT, CT vs MRI.
Module-2: Physics of CT:
Tomography, Tomography moment and types, Types of CT beams, Detectors efficiency and Detector types, Scintillation Detector, Xenon Gas detectors, Collimators Generations of CT, Hounsfield Units, Grey Scale, Concept of Windowing, WW, WL, Concept of Voxel, Pixel
Module-3: Physics of MRI:
Basics of magnetism, Types of magnetism: Ferromagnetism, Para magnetism, Super para magnetism, Diamagnetism, Superconductivity, strength of external magnet, Tesla unit, Concept of proton unit, Larmour Frequency, Concept of resonance
Module-4: MRI Instrumentation:
Basic instrumentation of Coils Gradient Coils, RF Coils: Surface coil, Pair Saddle Coil, Helmholtz Pair Coil, Bird, Cage Coil.
Module-5: MRI Pulse sequences
T1, T2, Proton Density, Spin Echo, Inversion Recovery, Gradient echo.
Module-6: CT & MRI Image Reconstruction
Image Reconstruction, Back projection, Filter Back projection, Iterative method, Analytical method, CT-Number, Storage - Floppy, hard disc, magnetic tape, optical disc. Fourier transformation, Half-Fourier.
Module -7: Artefacts of CT & MRI
CT-Metal artefacts, Steak artefacts, Beam Hardening artefacts& Ring Artefacts

MRI-Aliasing, Chemical shift, Motion, Point , Gibbs , Magic Angle , Slice overlap , Zipper , Array Processing , Coil Selection ,Susceptibility

INTERVENTIONAL RADIOLOGY& DRUGS USED IN DIAGNOSTIC RADIOLOGY

Course Objectives
- Basic introduction to interventional radiology is to acquaint the students with

various interventional procedures, to important studies , knowledge about various interventional options.

- Interventional radiology not only includes diagnostics but also therapeutic aspects also so it's essential for students to learn theoretical as well as practical aspects of interventional radiology so that they can assist the radiologist properly in interventional procedures.

Learning Outcomes:

- Basic principles of Cath-Lab equipments
- Contrast media
- C-Arm
- Pressure injector
- Defibrillator
- IVUS
- Image quality
- Radiopharmaceutical and procedures

Module-1: Equipment:

Equipment in Cath lab units; C-Arm,Digital
Subtraction Angiographic Units, Pressure Injectors, Contrast media, Introduction to Stents, Endoscopes, pacemakers

Module -2: Access, Equipment's used in Access

Arterial and Venous access (Femoralapproach, Arm approach), Equipment and Instruments used for access (Catheters, Guide wires, Dilators, Balloons)Seldinger technique.

Module-3: Medications & Safety in Cath Lab:

Preparations, Contraindications, Risks and medication, Environmental safety and sterilization in cath lab

Module-4: Angiography:

Coronary angiography, Peripheral angiography, Carotid angiography, Renal angiography, Cerebral angiography,Selective Aortography, Catheter Embolization, CT Angiography, MR Angiography, Vertebroplasty

Module-5: Biopsy & Special Procedures:

CT Guided Biopsy, MR Guided Biopsy,US Guided Biopsy, Endogenous Ablation of Varicose veins, Transjugular Intrahepatic Portosystemic Shunts, Introduction to Vascular Ultrasound

Module-6: Anaesthesia in Diagnostic Radiology

Facilities regarding general Anesthesia in the X-ray Department.

Module-7

Anesthetic Problems associated with specific technique-

a. Vascular Studies, **b.** Venography,**d.**NMR

COMPUTERIZED TOMOGRAPHY (CT SCANNING) METHOD AND PROCEDURE

Course Objectives:

- The course should help the students have a basic working knowledge of the main

imaging modalities and also help them actually use it in practice.

- It should help them achieve a level so that they can function as technologists. In fact in this course physics of imaging modalities do not exist the course would have no meaning.
- This subject form the basics of the understanding of the course both intellectually as well as professionally. This subject gives an insight into the world of imaging modalities.
- It will help them to work as technologists and not only technicians. It should help them work with full confidence as compared to the other students taking other courses.

Learning Outcomes:

- At the end of this course students will have fair knowledge of imaging methods and techniques with their common appearances.
- Ability to operate and use all the techniques. While actually performing the studies on patients during the study they have actual working integrated into the system of learning.

Module-1

Introduction to CT scan, current and accurate information of patient about CT at the body and precaution of patient for CT scan, Counselling of the patient abdominal pain or difficulty breathing, current and accurate information for patient about CT Scan of the head, stroke, Perfusion techniques for brain

Module-2

CT Scan position of different organ abdominal and pelvic, head CT, Body CT, chest CT scan, KUB. Precaution of the patient, position, and counselling of the patients before scanning.

Prescription reading and guidelines of Dr. before scanning

Module-3

Introduction to CT Scan protocols, Basic of contrast enhancement CECT, Non-Enhanced CT(NE-CT), Early arterial phase, late arterial phase, late portal phase.

Module-4

Nephrogenic phase, delay phase, Timing of CECT, Amount of contrast, Injection rate, oral contrast, Rectal contrast, Trasent interruption of contrast, overview of CT protocols

Module-5

CT imaging quality and Dose management, Helical and spiral scanning, material and methods quality assurance and assessment. Image quality testes. Quality control of CT systems by automated monitoring of key performance indicators, material methods and position.

Module-6

Base difference between the CT scan and X-Ray, film developing, process difference between x-ray and CT scan.

Module-7

Radiation Hazards safety of CT Scan, Work management of Scan, Data analysis and reportingProcedure

BASIC OF MAGNETIC RESONANCE IMAGING

Course Objectives:

- On successful completion of this modules, a student will be expected to be able to:-
- The course should help the students have a basic working knowledge of the Imaging modality of MRI and also help them actually use it in practice.
- The knowledge of proper technical skills of MRI should help them work with full confidence in the MRI unit /department

Learning Outcomes:

- The subject techniques in MRI form the backbone of Radio diagnosis in the MRI modality of imaging sciences.
- The course is relevant in the context that it helps students to understand patient Positioning during the MRI procedure of different organ system to obtain well defined images for proper diagnosis of MRI films and images.

Module-1

Introduction to Magnetic Resonance imaging (MRI) strong magnetic fields and radio waves, MRI scanVs CT scan

Module-2

Indications for MRI, Contra Indications of MRI, Contrast media for MRI and quantity

Module-3

Counseling of patient for MRI, preparation of patient for MRI, prescription reading, Identification ofCoils, Operation of MRI, Selection of Protocols, Image Printing and presenting

Module-4

Physiologically controlled imaging: **Cardiac triggering, ECG signal, Triggered measurements, trackingSAT, Fat and water saturation**

Module-5

MRI Scan of different organ, MRI scan spine, MRI Scan Brain, Cardiac MRI, MRCP, MRI scan sideeffects, Precaution during MRI Scanning.

Module-6

MRI report format, data analysis, precaution for MRI film, quality engagement of MRI, coordination withRadiologist and team workers during MRI

Module-7

MR Angiography: Flow related Enhancement, Time of flight, Phase contrast MR Angiography, MRSpectroscopy, Magnetization Transfer Contrast, Functional MRI.

INTERPRETATION OF X-RAY MAMMOGRAPHY, CT & MRI

Course Objectives:

- Understanding the anatomy and pathology of different body parts.

- Identifying the anatomy and pathology of body parts in different planes and in different images like X ray, mammography,Ultrasound,CT and MRI.

Learning Outcomes:

- Identifying the Anatomy of body parts in X-ray, Mammography, Ultrasound, CT, and MRI images.
- Identifying Pathology of body parts in X-ray, Mammography, Ultrasound, CT, and MRI images.
- Identifying Anatomy and Pathology in different body parts in different planes.
- Radiological investigations

Module-1: Review of Anatomy & Skeletal System:

General anatomical terminology, surface anatomy, surface landmarks and topography in relation to the organs of the body for radiographic positioning, positioning terms, Anatomical terminology with regard to location.

All major bones and joints of skeleton i.e. extremities, skull, thorax and vertebral column and pathologies/diseases related to them and their radiographic appearance

Module-2: Heart and blood vessels & Respiratory System:

Structure, Function, Blood circulation and Purification, Blood supply to heart, major vessels of circulatory system and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it. Nasal passage, Accessory nasal sinuses,

Pharynx, Larynx, Trachea, Bronchus, Lungs, Pleura, the Blood supply to organs, Nature and function of respiration and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it.

Module-3: Alimentary System:

Function of mouth, tongue, teeth, salivary glands, pharynx and oesophagus, smooth muscle, small intestine, large intestine, liver and biliary tract, pancreas, digestion and absorption of food, metabolism and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it.

Module-4 : Urinary Tract:

Kidneys, Ureters, Bladder, urethra, Urinary secretion and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it.

Module-5:ReproductiveSystem:

Male and Female genitalia, Mammary glands, Menstruation, Pregnancy, Lactation and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it.

Module-6: Endocrine System & Nervous Systems

Anatomical location of pituitary, thyroid, parathyroid, adrenal, thymus, pancreas, gonads and

their function and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it.

Main subdivision, lobes of ventricles of brain, spinal cord, meninges and CSF and pathologies/diseases related to them and their radiographic appearance and names of radiological investigations related to it.

Module-7: Breast Imaging & Skill Development:

Normal, SOL, PreOp, Post Op

Deciding on quality of radiograph, Methods of troubleshooting for Image Quality Improvement, Recognizing and demarking bones and organs on a radiograph, Ability to detect major pathological changes and abnormalities Image Appreciation

RTT Directed Clinical Education – part III (studentship)

Students will improve their skills in clinical procedures. Progressive interaction with patients and professional personnel are monitored as students practice radiation therapy in a supervised setting. Additional areas include problem solving, identifying machine components and basic side effect management. Students will demonstrate competence in beginning, intermediate, and advanced procedures.

Clinical Radiobiology

In simplest terms, radiobiology is the study of the action of ionizing radiation on living structures and organisms. Radiobiology is the basic science behind radiotherapy and it can explain, and occasionally also predict responses of tumours and normal tissues to radiation.

Knowledge of the principles of radiobiology allows the RTT

1.to comprehend the effects of different types of radiation, fractionation schemes, the use of radio sensitizers and other interactions he/she observes on a daily basis.

2. cycle control mechanisms
3. Tumour biology
4. The five ‘R’s of radiobiology
5. Tissue structure and radiation effect
6. The Linear Quadratic (LQ) model
7. Tumour control probability (TCP), Normal Tissue Complications Probability (NTCP) models
8. Acute and late side effects
9. Sensitizers/protectors/side effect reduction
10. Fractionation
11. Treatment combinations
12. Treatment scheduling

ORIENTATION IN CLINICAL SCIENCES COURSE CONTENTS

Course Objectives:

- Orientation of Clinical Sciences is designed to present students with essential concepts of pathological processes and altered health states.

- The course looks in depth at a wide variety of common pathological conditions.
- Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs.
- The Candidates should be skilled and sufficiently qualified with theoretical knowledge and able to develop skills and abilities to diagnose a specific disorder.

Learning Outcomes:

- Students are expected to demonstrate proficiency in the area in order to apply knowledge of pathology's role in the diagnosis, staging, and management of disease.
- They will be able to classify diseases of various body systems and how they manifest clinically and histopathologically.
- They acquire the ability to relate these essential basic pathological processes to the pathogenesis of common and important diseases.

Module -1: Cardiovascular disorders

1. Pericarditis, 2. Valvular heart diseases 3.RHD 4. Heart failure for each disease etiology, clinical features, diagnosis, treatment.

Module- 2: Respiratory disorders

1. Chronic bronchitis, 2. Emphysema, 3. Pneumonia, 4. Tuberculosis, 5. Pulmonary effusion, 6. Spontaneous pneumothorax.

Module-3: Gastrointestinal disorders

1. Peptic ulcer disease, 2. Achalasia cardia, 3. Intestinal obstruction, 4. chron's disease 5. Ulcerative colitis, 6. Pancreatitis, 7. portal hypertension, 8. ascitis 9. Cirrhosis, 10. Cholecystitis

Module-4 :Renal disorders

1.Glomerulonephritis 2. Nephrotic syndrome 3. Urinary caliculus 4. Poly cystic kidney disease

Module-5: Central nervous system disorders

1. Cerebrovascular disorders 2. Meningitis 3. Encephalitis

Ob&G: 1. Diagnosis of Pregnancy 2. Normal Labour

Module-6: Orthopaedics

1. Fracture 2. Type Mechanism, Healing, Delayed Union, Non- complication 3. Injuries of the shoulder girdle, Dislocation of shoulder 4. Number of Humerus, Elbow Forearm 5. Number of Distal Radius & ulna 6. Injuries of the carpal 7. Dislocation of Hip 8. Femur, Tibia, Ankle, calcaneum 9. Acute & chronic osteo arthritis 10. Rheumatoid arthritis 11. Paget's Disease 12. Ankylosing spondylitis 13. Club foot 14. Bone Tumor-Benign Malignant

Module-7: Surgery

1. Incisions 2. Cholelithiasis 3. Peritonitis 4. Supraphrenic Abscess 5.Appendicitis 6. Benign Hypertrophy prostate 7. Sinusitis

OPERATIONAL ISSUES IN RADIOTHERAPY.

Course content is designed to focus on various radiation therapy operational issues. Accreditation, CQI development and assessment techniques will be presented. Human resource issues and regulations impacting the radiation therapist will be examined. Topics include the role of network information systems within the radiation oncology department.

RTT DIRECTED CLINICAL EDUCATION – PART IV,V (STUDENTSHIP)

This course is the final in a series of five directed clinical courses. The student will complete the clinical training by practicing all the skills learned in classroom and clinical instruction.

MEDICAL LAW AND ETHICS

Course Objective:

- The course provides an introduction to ethics generally and more specifically to medical ethics, examining in particular the principle of autonomy, which informs much of medical law.
- The course then considers the general part of medical law governing the legal relationship between medical practitioners and their patients. It considers the legal implications of the provision of medical advice, diagnosis and treatment.
- Selected medico-legal issues over a human life are also examined.

Learning outcomes:

- Apply local, state, and federal standards and regulations for the control and use of health information.
- Identify and discuss ethical issues in health care.
- Define general legal terms as they apply to the practice of medicine in ambulatory care settings
- Differentiate between sources and types of law.

Module-1

1. The Indian medical council act, 2. Medical council of India (functions),3. Functions of state medical councils, 4. The declaration of Geneva

Module-2

1. Duties of medical practioners 2. Regarding red cross emblem 3. Professional secrecy 4. Privileged communication.

Module-3

1. Professional negligence 2. Medical maloccurrence 3. Contributory negligence4.Criminal negligence

Module-4

1. Corporate negligence 2. Ethical negligence 3. Precautions against negligence 4. difference between professional negligence and infamous conduct.

Module-5

1. Malpractice litigation involving various specialities 2.Prevention of medical negligence

3.supreme court of India guidelines on medical negligence 3. The therapeutic misadventure 4. Vicarious liability

Module-6

1. Products liability 2. medical indemnity insurance 3. Medical records 4. Consent in medical practice

Module-7

1. Euthenesia 2.Deaths due to medical care 3.Malingering

INTERNSHIP THESIS GUIDELINE

This Guideline is designed to provide students the knowledge and practice of public health research activity, to enable them to carry out researches and solve research related problems and to help them in writing thesis and defend their work. Upon successful completion of the course, the students shall be able to:

1. Search relevant scientific literature
2. Develop a research proposal
3. Employ appropriate data collection techniques and tools
4. Manage collected data
5. Analyze data with appropriate statistical techniques
6. Write thesis
7. Defend the findings

Proposal Development:

At the ending of third year (Sixth Semester), students individually consultation with designated faculties and extensive literature survey will develop research proposal during the initial 6 months period.

Data Collection/ Thesis Writing:

Students will carry out data collection, data management, data analysis, and thesis writing during the remaining period (Six Semester).

The Dissertation should have following format:

1. Title
2. Introduction
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion

7. Recommendation
8. References
9. Appendix

Project work: -

Suggested Project title

1. A survey of radiation protection awareness in non-radiation workers.
2. An evaluation of accuracy of ultrasound in the detection of Hepatitis.
3. An assessment of depression among practicing radiographers in Andhra Pradesh.
4. Evaluation of radiation, protection, measure for female patients of child bearing age using information from nearby medical colleges .

Internship

1. Case record
2. Lab management and ethics
3. Evaluation -Guide(internal) -Industries guide(external) -University-project report/ Viva

SKILLS BASED OUTCOMES AND MONITORABLE INDICATORS

FORRADIOTHERAPY TECHNOLOGIST COMPETENCY

STATEMENTS

1. Demonstrate knowledge to interpret and evaluate a treatment prescription
2. Understands the place of treatment planning processes in RT and performs RTTs role in it(appropriate patient-set-up, immobilization and image scanning with relevant protocols).
3. Communicates relevant information to other members and completes accurate documentation
4. Demonstrates ability to prepare the shielding devices
5. Conducts the simulation and mark-up procedure for all standard treatment techniques
6. Demonstrates ability to carry out the daily organization of the treatment unit
7. Practices accurate treatment documentation
8. Demonstrates ability to interpret, apply and disseminate information as a member of theradiotherapy team
9. Demonstrates professional behavior
10. Demonstrates a sensitive and caring attitude towards the patient
11. Demonstrates ability to accurately and consistently set-up and treat the patient
12. Demonstrates ability to prepare the patient for their first treatment
13. Evaluates and monitors the patient performance status
14. Monitors, manages and records the patient's side effects throughout the course of treatment

15. Advises patient on appropriate nutrition, sexual function, rest, skin care, nausea and othersymptoms
16. Demonstrates skill to support and care for the patient during a brachytherapy procedure
17. Demonstrates ability to carry out the necessary data transfer checks
18. Acquires the initial verification images
19. Demonstrates ability to carry out treatment verification as per protocol/under supervision
20. Demonstrates ability to carry out corrective actions as per instructions

21. Follows health and safety procedures

22. Demonstrates ability to interpret, apply and disseminate information as a member of theradiotherapy team

23. Follows necessary radiation protection regulations as per instructions

24. Demonstrates knowledge and skills to carry out the daily patient related QA as per protocols.

25. Participates in research activities.