UNIT I - BASICS OF RADIOLOGICAL PHYSICS:


UNIT II - RADIATION THERAPY PHYSICS:

Radiotherapy with sealed and unsealed radionuclide – Mechanism of Telecobalt and linear accelerators (LINAC) – Physics of Modern radiotherapy machines - 3D CRT, IMRT, SRS & SRT, IGRT, cyber knife and Proton Beam therapy - Radiation Dosimetry protocol (TRS 398), Calibration of teletherapy equipments - Quality Assurance of Radiotherapy machines - Treatment Planning System (TPS) in radiation therapy & Quality assurance of TPS.

UNIT III - PHYSICS OF BRACHYTHERAPY:

Introduction to Brachytherapy radionuclide and their properties - Production and construction of sealed – LDR, MDR and HDR Brachytherapy sources, their specification & calibration - reference Exposure rate - reference air kerma rate and air kerma strength - source calibration using an In-air set-up and calibration using a well type ionization chamber - source calibration using solid phantoms- source dosimetry - Interstitial, Intracavitary, intraluminal and pulsed brachytherapy - Monte Carlo Based source dosimetry - Quality assurance of brachytherapy equipments.
UNIT IV - BIOLOGICAL EFFECTS OF RADIATION:

Physics of radiation absorption - Cancer biology - Cell survival curves - Fractionation in Radiation therapy - dose rate effect - Oxygen Enhancement Ratio (OER) - Relative Biological Effectiveness (RBE) – Linear Energy Transfer (LET) - Molecular mechanism of DNA & chromosomal damage and repair – 4 R’s of Radiobiology - Bioeffect models; Time Dose Fractionation (TDF) and Extrapolated Response Dose (ERD) - Hyperthermia - Radioprotectors - Effects of radiation on embryo and fetus - Acute radiation syndrome.

UNIT V - RADIATION HAZARD EVALUATION AND CONTROL:


UNIT VI - DIAGNOSTIC RADIATION PHYSICS:

UNIT VII - PHYSICS OF NUCLEAR MEDICINE:

Scintillation counters - Different types of collimators - Gamma camera - single head and dual head scanners - Emission tomography - Single photon emission computed tomography (SPECT) - Positron emission tomography (PET) - Production of radioisotopes for nuclear medicine procedure – Technetium generator – Radiopharmaceuticals and their clinical applications.

UNIT VIII - PHYSICS OF ULTRASOUND & IMAGING:

Production & properties of ultrasound - propagation of ultrasound through body tissue - Acoustic impedance and acoustical characteristics in human body - ultrasound dosimetry - piezoelectric transducers - ultrasound scanning modes - Ultrasound cardiography (UCG) – Doppler effect - Double doppler shift – doppler systems - ultrasonic tomography - applications of ultrasound in medicine.

UNIT IX - LASERS IN MEDICINE AND THERMOGRAPHY:

Theory and production of medical lasers - Laser Tissue interaction mechanism – Applications of lasers in Dermatology, Oncology, Ophthalmology - Application of ultrafast pulsed lasers in Medicine - laser blood flow meter. Hazards of lasers and their safety measures - Various types of electromagnetic radiations; UV, Visible, IR, their sources and detectors - Optical properties of tissues – Medical Applications of IR radiations in diagnosis and therapy.

UNIT X - MRI AND BIO MEDICAL INSTRUMENTATION: