Fundamentals of Radiology and Imaging BVORAD-103

**UNIT- 1**

Atomic and nuclear structure (protons, neutrons, electrons), Atomic number, atomic masses, nuclides and isotopes, early atomic models, the hydrogen spectra, difficulties with Rutherford’s model, Bohr’s model, limitations of Bohr’s model, the wave function of an electron, Quantum mechanics of hydrogen atom, Quantum numbers, Pauli exclusion principle, periodic table of element.Introduction, Maxwell’s equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere,Fundamental and derived quantity, SI unit, various physical/radiation quantity used in diagnostic radiology and its unit (for example, KvP, mA, mAS, Heat unit (HU), Radiation exposure, Absorbed dose, Equivalent dose, etc.). Measurements, significant figures/digits in calculation, uncertainty in measurement, Propagation of errors, kinetic and potential energy, conservation of energy, work done by constant forces, work done by variable forces. Elastic and inelastic collisions.

**UNIT -2**

X-Ray tube : historical aspects, construction of X-Ray tubes, requirements for X-Ray production (electron source, target and anode material), tube voltage, current, space charge, early X-Ray tubes (coolidge tubes, tube envelop and housing) cathode assembly, X-Ray production efficiency, advances in X-Ray tubes, anode angulation and rotating tubes. Common factors affecting thermionic emission, specialized types (metallic, biangular, fluoro, CT) grid controlled and high speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation). Interlocking and X-Ray tube overload protection. Heat dissipation methods, tube rating, heat units, operating conditions, maintenance and Q.A procedures.

**UNIT -3**

X-Ray films and film processing ,Image characteristics , Interaction of ionising radiation with matter , Detection of ionising radiation . Dosimetry , Biological effects of ionising radiation , Radiation protection (related to Phase-II topics) , Biological effects of non-ionizing radiation , Quality assurance , Presentation and viewing of radiographs , Basic Mammography , Xeroradiography, Introduction of Dental Radiography. Interaction of ionizing radiation with matter . Types of interactions of X- and gamma radiation, Photoelectric & Compton, Bremsstrahlung, pair production, annihilation radiation..Exponential attenuation (linear/mass attenuation coefficients), Half ValueThickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.. Radiation intensity and exposure, photon flux and energy flux density. . LET, range of energy relationship for alpha, beta particles and XRays,Characteristics X-Rays, factors affecting X-Ray emission spectra, X-Ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets

**UNIT -4**

Filament current and voltage, X-Ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types ofgenerators, 3 phase, 6 and 12 pulse circuits, falling load generators, capacitors discharge and grid control systems.Types of generators, 3 phase, 6 and 12 pulse circuits, falling load generators, capacitors discharge and grid control systems.