RAJASTHAN ILD SKILLS UNIVERSITY

(RISU)

167: Modern Physics

GE/THY 7P

Unit I

Postulates of special theory of relativity, Lorentz transformations of velocity and acceleration, time dilation and length contraction, Lorentz transformations as rotation in space-time, world line and Minkowski space, time-like and space-like vectors, Macro causality, Light cone and past, present and future

Unit II

Difficulties in classical mechanics to explain the black-body emission spectrum, Plank quanta concept and radiation law, Photoelectric effect and Einstein explanations, Compton effect, De-Broglie hypothesis. Uncertainty principle: position and momentum, angle and angular momentum, energy and time

Schrodinger wave equation: General equation of wave propagation, Schrodinger equation, wave function representation ψ, physical meaning of ψ, properties and conditions for ψ, postulates of wave mechanics, operators, probability current density, Time dependent Schrodinger equation, stationary state solution, one dimensional problem: particle in one dimensional box, eigen function and eigen values, discrete energy levels, generalization into three dimension and degeneracy of energy levels, concept of potential well and barrier, step potential, penetration through rectangular barrier, reflection and transmission coefficients, Quantum mechanical tunnelling.

Unit III

Properties of Nucleus: Discovery of nucleus, Rutherford scattering, Constituents of the nucleus, mass, charge, size, nuclear density, charge distribution, Hofstadter's experiment, Nuclear angular momentum, Nuclear magnetic Dipole moment, Electric quadrupole moment, Spin, Isospin, Wave mechanical properties: Parity and statistics, classification of nuclei, Mass defect and binding energy, Packing fraction, Mass spectrograph

Nuclear Forces: Properties of nuclear forces, Yukawa Meson theory, Nuclear potential

Nuclear models: Segre Chart, Liquid drop model, Semi Empirical Mass formula, Condition of stability, Fermi gas model

Unit-IV

Bonding in solids and crystal structure: Forces between atoms, ionic, covalent and metallic bonds, Hydrogen bonding, Vander Waal's force, periodicity in lattices, Basis, lattice points

and space lattice, Translation vectors, unit and primitive cell, Crystal systems, Packing fractions in Simple cubic (SC), Body cantered cubic (BCC), Face cantered cubic (FCC) and Hexagonal lattice structure, Bravais space lattice

Crystallography and Diffraction: Direction, plane and Miller indices in a crystal lattice, Reciprocal lattice and its significance, conversion of SC and FCC structures in reciprocal lattice frame, Concept of crystalline, polycrystalline and amorphous materials, X-ray diffraction by solids: Laue and Braggs equation, study of crystals by X-rays, FWHM, Scherrer formula and lattice constants (for Simple Cubic structure), Electron and neutron diffraction (only qualitative)