

CORE COURSE XII - ELEMENTS OF THEORETICAL PHYSICS

Unit I Lagrangian formalism.

Mechanics for a system of particle – Constraints – Generalized Co-ordinates – Transformation equations – Configuration space – Principle of virtual work – D'Alembert's principle – Applications of Lagrange's equations – Atwood's machine – Simple pendulum.

Unit II Hamiltonian formalism

Phase space – Generalized momentum – Cyclic co-ordinates – Conservation theorem for generalized momentum – Conservation theorem for energy

Unit III Dual Nature of Matter

De Broglie concept of matter waves – de Broglie wavelength – Wave velocity and group velocity for the de Broglie waves – Experimental study of matter waves – Davison and Germer experiment – G.P. Thomson's experiment for verifying de Broglie relation – Heisenberg's uncertainty Principle – Electron microscope – Gamma ray microscope.

Unit IV Schrödinger's wave Mechanics

Basic postulates of wave Mechanics – Development of Schrödinger wave equation – Time independent and dependent forms of equations – Properties of wave function – Orthogonal and normalized wave function Eigen function and eigen values – Applications of Schrödinger equation – particle in a box- Linear harmonic oscillator – The barrier penetration problem.

Unit V Photo electric and Compton effects

Photo electric effect – Lenard, Richardson and Compton experiments – laws of photoelectric emission – Einstein's photoelectric equation – Millikan's experiment- Determination of Planck's constant – photo emissive cell – photo – voltaic cell – photo conductive cell – photo multiplier – Compton effect – Theory – Experimental Verification.