

SYLLABUS

Unit I. Normalism of wave Mechanics :

- (i) Brief introduction to need and development of quantum mechanics, wave-particle duality (photon as particle, de-broglie hypothesis, particle diffraction, particle interference), wave packet, indeterminacy, complementarity.
- (ii) Schrodinger equation for a free particle, operator correspondence and equation for a particle subject to forces. Normalization and probability interpretation of wave function, superposition principle, expectation value, probability current and conservation of probability, Admissibility conditions on the wave function, Ehrenfest theorem.
- (iii) Fundamental postulates of wave mechanics, Eigenfunctions and eigenvalues, operator formalism, orthogonal systems, expansion in eigenfunctions, Hermitian operators, simultaneous eigenfunctions, equation of motion.
- (iv) Uncertainty of position and momentum, monochromatic waves, Gaussian wave packet.

Unit II :

Problems in One and three dimensions :

- (i) Time dependent Schrodinger equation. Application to stationary states for one dimension. Potential step, potential barrier, rectangular potential well, degeneracy orthogonality, linear harmonic oscillator.
- (ii) Schrodinger equation for spherically symmetric potential, spherical harmonics, hydrogen atom energy levels and eigenfunctions, degeneracy, angular momentum.

Unit III.

One Electron Atomic Spectra :

- (i) Interaction with radiation, transition probability, spontaneous transition, selection rules and life times.
- (ii) Spectrum of hydrogen atom, fine structure, normal Zeeman effect, electron spin Stern-Gerlach experiment, spin orbit coupling (electron magnetic moment, total angular momentum) Hyperfine structure, examples of one electron systems, Anomalous Zeeman effect, Lande-g factor (sodium D-lines).

Unit IV :

Many Electron System Spectra :

- (i) Exchange symmetry of wave functions, exclusion principle, shells, subshells in atoms, atomic spectra (Helium). LS coupling, JJ coupling selection rules, regularities in atomic spectra.
- (ii) X-ray spectra, Mostely law, absorption spectra, Auger effect.
- (iii) Molecular bonding, molecular spectra, selection rules, symmetric structures, Rational, vibrational electronic level and spectra of molecules, magnetic resonance experiments, Raman spectra.

Unit V : Spread over entire syllabus of unit of I to IV as above.