PPH103 QUANTUM MECHANICS

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand the basic subtleties of quantum mechanical ideas and use Schrodinger equation and various approximation methods to predict properties of simple and composite quantum systems.

Introduction to Quantum mechanics: Experimental background and inadequacy of classical Physics, Complimentary principle**.**

Schrödinger wave equation: Development of wave equation, Schrödinger's time dependent and independent wave equation, Interpretation and normalization of wave function, Probability current density, Expectation value and Ehrenfest theorem. Wave packet. Generalized uncertainty principle.

Solution of Schrödinger equation: Constant potential in one dimension: Potential Step, Rectangular Potential Barrier and tunneling, Linear Harmonic Oscillator, Rigid Rotator and Hydrogen atom.

Angular momentum in Quantum mechanics: General solution to the Eigen value problem of angular momentum J and the angular momentum matrices, Eigenvectors for spin ½ particles, Addition of two angular momenta, Clebsch-Gordan coefficient, System of identical particles, Indistinguishability principle, Symmetry of wave functions, Connection of symmetry with spin and statistics.

Perturbation theory: Time independent perturbation theory: (1) Non degenerate case: First order perturbation, second order perturbation, Perturbation of an oscillator. (2) Degenerate case: Removal of degeneracy in second order, Zeeman Effect without electron spin, first order Stark effect in Hydrogen.

Time dependent perturbation theory: The equation of motion in interaction picture, Transition probability And Fermi-Golden Rule, Selection Rules.

WKB Approximation: Method, The connection formule, Tunneling through a potential barrier**.**

Introduction to theory of Scattering: Total and Differential Scattering cross section, Partial wave and Phase shift, Optical Theorem, Born approximation and scattering by one dimensional Potential barrier, and Coulomb Field.

Course learningoutcomes: Students will have achieved the ability to:

1. explain the probabilistic and non-local nature of quantum world
2. calculate the physical properties (position/momenta/energies) of quantum systems using Schrodinger equation
3. apply different approximation methods for understanding complex quantum phenomena.

Recommended Books

1. *Schiff, L.I., Quantum Mechanics, McGraw Hill (2008).*

2. *Ghatak, A. and Loknathan, S., Quantum Mechanics, MacMillan (2004).*
3. *Thankapan, V.K., Quantum Mechanics, New Age International (2004).*
4. *Sakurai, J.J., Advanced Quantum Mechanics, Pearson Education (2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25