PH 403: QUANTUM MECHANICS-I (3-1-0:4)

Introduction
Empirical basis, wave-particle duality, electron diffraction, notion of state vector and its probability interpretation.

Structure of Quantum Mechanics
Operators and observables, significance of eigenfunctions and eigenvalues, commutation relations, uncertainty principle, measurement in quantum theory.

Quantum Dynamics
Time-dependent Schrödinger equation, stationary states and their significance, time-independent Schrödinger equation.

One-dimensional Schrödinger Equation
Free-particle solution, wave packets, particle in a square well potential, transmission through a potential barrier, simple harmonic oscillator by wave equation and operator methods, charged particle in a uniform magnetic field, coherent states.

Spherically Symmetric Potentials
Separation of variables in spherical polar coordinates, orbital angular momentum, parity, spherical harmonics, free particle in spherical polar coordinates, square well potential, hydrogen atom.

Angular Momentum and Identical Particles
Rotation operators, angular momentum algebra, eigenvalues of J2 and Jz, spinors and Pauli matrices, addition of angular momenta. Identical particles, indistinguishability, symmetric and antisymmetric wave functions, incorporation of spin, Slater determinants, Pauli exclusion principle.

Textbooks and References:

1. C. Cohen-Tannoudji, B. Diu, and F. Laloe, “Quantum Mechanics - Volume I”, Wiley VCH.
2. L. I. Schiff, “Quantum Mechanics”, Mcgraw-Hill College.
3. E. Merzbacher, “Quantum Mechanics”, John Wiley & Sons.
4. R. P. Feynman, “Feynman Lectures on Physics - Volume 3”, Narosa Book Distributors Pvt Ltd.
5. A. Messiah, “Quantum Mechanics -Volume I”, North Holland Publication.