**PH 403: Quantum Mechanics-I (3-1-0:4)**

**Quantum Theory**

Empirical basis, wave-particle duality, particle aspect of radiation, wave aspect of matter. **[2L]**

**Structure of Quantum Mechanics**

Notation of state vector and its probability interpretation, operators and observables, significance of eigenfunctions and eigenvalues, commutation relations, uncertainty principle, measurement in quantum theory. Unitary transformation. **[9L+3T]**

**Quantum Dynamics**

Time evolution and the Schrödinger equation, Schrodinger, Heisenberg and Interaction representation, position and momentum representation, Expectation values, time-independent Schrödinger equation.

**[6L+2T]**

**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. **[6L+2T]**

**Wave Mechanics in three dimensions**

Separation of variables in spherical polar coordinates, orbital angular momentum, parity, spherical harmonics, free particle in spherical polar coordinates, spherical potential, hydrogen atom, degeneracy and accidental degeneracy. **[6L+2T]**

**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. **[9L+3T]**

**Textbooks and References**

1. M. Beck, “Quantum Mechanics: Theory and Experiment”, 1st edition, Oxford University Press, USA, 2012.
2. N. Zettili, “Quantum Mechanics Concepts and Application”, 2nd edition, Wiley India Pvt. Ltd, 2016.
3. John S. Townsend, “A Modern Approach to Quantum Mechanics”, 2nd edition, University Science Books, California, 2012.
4. C. C. Tannoudji, B. Diu, and F. Laloe, Quantum Mechanics, Volume 1, 1st edition, Wiley VCH, 1997.
5. E. Merzbacher, “Quantum Mechanics”, 3rd edition, John Wiley & Sons, 2011.
6. W. Greiner, “Quantum Mechanics An Introduction”, 3rd edition, Springer, 1994.