

PHYSICS 305
QUANTUM MECHANICS I
(3.0 credits)

Contents:

1. Dirac formalism in Hilbert space, quantum state vector operators, amplitudes, probabilities, analysis of Stern-Gerlach experiment.
2. Rotation operators, projection operators, density operators, matrix representation of operators, similarity transformations of representation, photon polarization
3. Eigenstates and eigenvalues of angular momentum, uncertainty relation for angular momentum, spin-1/2 eigenvalue problem, Pauli matrices, spin-1 particles.
4. The Hamiltonian and the Schrödinger equation; spin-1/2 particles in a magnetic field, magnetic resonance, time dependence of expectation values.
5. Basis states of two spin-1/2 particles, addition of angular momentum of two spin-1/2 particles, hyperfine splitting of the ground state of hydrogen.
6. Position states, generator of translation, momentum space, general solution of the Schrödinger equation, tunnel effect.
7. One-dimensional harmonic oscillator
8. Path integrals, evaluation of transition amplitude, paths of least action.
9. Two-body problem, center of mass frame, rotational invariance, translational invariance, orbital angular momentum.
10. Radial wave equation, Coulomb potential and the hydrogen atom, three-dimensional oscillator and magnetic numbers, simple model of Deuteron.
11. Nondegenerate perturbation theory, degenerate perturbation theory, fine structure of the hydrogen atom.

References:

1. J.S. Townsend : “ Modern Approach to Quantum Mechanics “, Mc Graw Hill ,1992.
2. J. J. Sakurai : “ Modern Quantum Mechanics “, Addison Wesley ,1994.
3. W. Greiner : “ Quantum Mechanics “, Vol. I , Springer Verlag ,

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