SC332 (3-0-0-3): Introduction to Quantum Mechanics

DA-IICT, B.Tech Course,
Instructor: Gautam Dutta

Objective:
This course is for 3rd and 4th year B.Tech students. For students who wish to understand the basic foundations of Quantum Mechanics and the mathematical machinery used in developing the theory and its applications. Engineers in the field of Information, Communication and Computer Science who wish to have an exposure to the field of Quantum Information Theory, Quantum Communication and cryptography and Quantum Algorithms will benefit from this course. It is also for more practical oriented students who wish to catch up with the understanding of semiconductor devices based on Quantum Mechanics.

Prerequisite: Linear Algebra, Mechanics, Modern Physics

1. Motivation for quantum mechanics
   - Black body radiation
   - Photoelectric Effect
   - Wave-particle duality
   - Particle properties of waves
   - Wave properties of particles
   - De-Broigle wavelength
   - The uncertainty principle

2. Quantum Theory
   - Bohr model of the atom
   - Probability waves
   - Wave functions
   - Schrodinger’s equation
   - Operators, Eigenvalues and Expectationvalues

3. Applications
   - Particle in a box
   - Harmonic Oscillator
   - Hydrogen Atom

4. Angular Momentum
   - L and L\_z Quantization
   - Spin, Stern Gerlach Experiment
   - Spin Quantization (S and Sz)

5. Approximate Methods
   - Perturbation Theory

6. Two level Systems
• Time evolution of spin in magnetic field
• Addition of Spin Angular momentum
• Symmetric and antisymmetric states.
• Density Operators and Ensembles.

7. • Bohm Aharanov Effect
• Quantum Cryptography
• Quantum Computers.

Evaluation: Insemester Test 50 %, Endsemester Test 50 %

Books:

1. Perspectives of Modern Physics
   Arthur Beiser

2. Quantum mechanics
   L.I. Schiff

3. Modern Quantum Mechanics
   J. J. Sakurai

4. Feynmann Lectures in Physics Vol. 3
   Richard Feynmann

Attendance policy.
Students are expected to attend all the lectures. If attendance falls short by more than 20% of the lectures i.e 8 lectures then student may not be allowed to appear for endsem test.