

Course Title: Quantum Mechanics-(QI-802)

Credit Hrs: 3

Prerequisites: Modern Physics, Differential Equations, Linear Algebra

Course Description:

A concise introduction to the principles of quantum mechanics, covering Hilbert space methods, operators, Schrödinger equation, measurement theory, entanglement, and basic quantum information concepts.

Course Objectives:

- To provide a strong foundation in the **principles of quantum mechanics** and Hilbert space formalism.
- To develop the ability to **solve time-dependent and time-independent Schrödinger equations.**
- To understand **operators, eigenvalue problems, and the uncertainty principle.**
- To introduce **composite systems, entanglement, and quantum correlations.**
- To explain **quantum measurement, decoherence, and noise** in realistic systems.
- To prepare students for **applications in quantum information, qubits, and quantum gates.**

Course Learning Outcomes (CLOs)

- Formulate quantum systems using Hilbert spaces and operators.
- Solve time-dependent and time-independent Schrödinger equations.
- Explain uncertainty, superposition, and measurement postulates.
- Analyze entanglement, correlations, and decoherence.
- Apply quantum mechanics to qubits, gates, sensing, and communication.

Course Contents

Week	Contents
1	Postulates of Quantum Mechanics
2	Hilbert Spaces and Dirac Notation
3	Operators and Eigenvalue Problems
4	Uncertainty Principle
5	Composite Systems and Tensor Products
6	Density Operators and Mixed States
7	Midterm Exam
8	Time Evolution and Schrödinger Equation
9	Midterm Exam
10	Measurement Theory (Projective & POVMs)
11	Quantum Entanglement
12	Quantum Correlations & Nonlocality
13	Open Quantum Systems
14	Decoherence and Quantum Noise
15	Qubits, Bloch Sphere & Quantum Logic Gates
16	Final Exam

Textbooks / References:

- Sakurai & Napolitano – Modern Quantum Mechanics
- Nielsen & Chuang – Quantum Computation and Quantum Information
- Griffiths & Schroeter – Introduction to Quantum Mechanics

Assessments:

- Assignments: 10%
- Quizzes: 10%
- Midterm Exam: 30%
- Final Exam: 50%