Course Type	Course Code	Name of Course	L	T	P	Credit
DC	PHC205	INTRODUCTION TO QUANTUM MECHANICS	3	0	0	9

Course Objective
Course introduces the methods to do the mechanics of atomic and subatomic particles.
Learning Outcomes
Familiarizing students with the theoretical framework of non-relativistic quantum mechanics and its applications to simple problems.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction: Wave-particle duality, notion of state vector and its probability interpretation	3	This topic covers the introduction to quantum mechanics.
2	Structure of Quantum Mechanics: Operators and observables, significance of eigen functions and eigenvalues, commutation relations, uncertainty principle, measurement in quantum theory.	4	This unit will help to understand operators, eigen functions, eigenvalues, uncertainty principle, etc.
3	Schrödinger Equation: Time-dependent Schrödinger equation, stationary states and their significance, time-independent Schrödinger equation;	4	In this topic, students will learn about the time independent and dependent Schrödinger Equation.
4	Potential Problems: Free-particle solution, Potential Barrier and tunneling, simple harmonic oscillator	4	Application of quantum mechanics to few simple problems are dealt with in this unit.
5	Motion in a central potential: Separation of variables in spherical polar coordinates, spherical harmonics, hydrogen atom problem.	4	Helps understanding the physics of atoms.
6	Representation Theory: Linear vector space, Dirac notations of Bra - Ket, Matrix representation of Observables and states, operators and their properties; unitary transformation, Parity and parity operators	5	New technique learned to solve quantum problems
7	Theory of Angular Momentum: Relation between rotation and angular momentum, Rotation operators, angular momentum algebra: commutation rules, Matrix representations, addition of angular momenta, spinors and Pauli spin matrices.	8	Helps understanding angular momentum and spin of particles.
8	Approximation Methods: Time-independent Perturbation theory: (non-degenerate and degenerate) and applications to fine structure splitting, WKB approximation; Variational method; Time-dependent perturbation theory, transition probability calculations, Fermi golden rule.	8	In this topic student will learn to solve practical quantum mechanical problems.
9	Scattering Theory: Introduction, partial wave analysis, Born approximation.	5	Helps to calculate the outcomes from experiments following rules of quantum mechanics
	Total	**42**	

Textbooks:

1. Introduction of Quantum Mechanics, Griffiths, Pearson Education, 2010.
2. Principles of Quantum Mechanics, R. Shankar, Plenum Press, 1994.
3. Quantum Mechanics: Theory and Applications, 1st Edition, Ghatak & Lokanathan, Kluwer Academic Publishers; 2004

Reference Books:

1. A Textbook of Quantum Mechanics, 2nd Edition, Mathews &. Venkatesan, McGraw Higher Ed, 2010.
2. Introduction to Quantum Mechanics; Pauling and Wilson, Dover Publications 1985.
3. Quantum Mechanics, Thankappan, New Age International Pub, 1993.
4. Quantum Mechanics 2nd Edition, Bransden & Joachain, Pearson, 2000.
5. Quantum Mechanics, 3rd Edition, Merzbacher, John Wiley; 2005.
6. Modern Quantum Mechanics, 2 edition, J.J. Sakurai, Pearson Education India, 2013.