Course Code	Course Title	L	T	P	C
BPHY203L	Quantum Mechanics	3	0	0	3
Pre-requisite	BPHY202L	Syllabus version			
		1.0			

Course Objectives

1. Understand the origin and importance of quantum mechanics.
2. Realize the need of quantum mechanics in understanding various phenomena and their corresponding applications in the microscopic world.

Course Outcomes

1. Understand the foundations on which quantum mechanics is built.
2. Acquire knowledge about various aspects of waves and wave equations.
3. Gain knowledge about various basic principles in quantum mechanics.
4. Understand the significance of Schrodinger equation to analyze various conceptual and practical problems.
5. Realize the importance of quantum mechanics in real time applications.

Module:1	History of Quantum Mechanics	8 hours

Failures of classical physics - Energy, momentum and waves - Nature of light - Black body radiation - Planck's concept (hypothesis) - Wave particle duality - de Broglie hypothesis - Matter waves - Properties - Davisson Germer experiment - Wave packets and motion of wave packets - Group velocity and wave velocity - Heisenberg's uncertainty principle - Applications of uncertainty relation

Module:2	Operators	6 hours

Operators - position, linear momentum and energy operators - Eigen functions (Eigen vectors) - Eigen values - Matrices and Eigen values - Expectation values - Commutation relations - Hermitian operators - Pauli matrices - Hermitian Matrices - Unitary matrices - Eigenvalue Equations - Orbital angular momentum - formalism, commutation relations - Spin angular momentum

Module:3	Schrodinger equation	6 hours

Wave function - Physical significance - Schrodinger equation - Time dependent and independent wave equations - Bound state solution of the Schrodinger equation - Boundary and continuity conditions - Degeneracy - Orthogonality - Parity - Quantum harmonic oscillator - Eigen functions and Eigen values - Operator formulation

Module:4	Exactly solvable problems in One dimension - I	5 hours

Particle in a 1-D box - Eigen value - Eigen function- Energies and wavefunctions of ground and excited states - Ground state energy from uncertainty principle - Probability of existence

Module:5	Exactly solvable problems in One Dimension - II	7 hours

Potential barrier - Solution of the step potential problem with energy less than or greater than the step height - Reflection and transmission coefficients - Finite potential barrier – Barrier penetration - Tunnelling, Reflection and Transmission coefficients - Quantum mechanical tunnelling - Multiple potential well - Periodic potentials and energy bands - Simple harmonic oscillator (Differential equation method - Ladder operator methods)

Module:6	Three Dimensional problems	6 hours

Particle in a Central Potential - Spherical Harmonics Parity - Particle in a spherical well - Hydrogen Atom - Energy eigenvalues - Quantum Numbers Degeneracy - Explicit form of the ground state wavefunction - Probability density in the ground state		
Module:7	**Quantum Phenomena**	**5 hours**
Copenhagen interpretation - Superposition - Schrodinger's cat - Single and two qubit states - Single and two qubit operators - Bell states - Quantum teleportation - Quantum computing - Quantum theory to information technologies		
Module:8	**Contemporary Issues**	**2 hours**
Guest lecture from industry and R & D organisations		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	D. J. Griffiths, Introduction to Quantum Mechanics, 2018, 3rd Edition, Cambridge University Press, India.
2.	A. C. Philips, Introduction to Quantum Mechanics, 2014, Wiley India.
Reference Books	
1.	P.M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2017, 2nd Edition, McGraw Hill, India.
2.	Robert Eisberg and Robert Resnick, Quantum Physics, 2004, 2nd Edition, Wiley.
3.	Leonard I. Schiff and Jayendra Bandopadhyay, Quantum Mechanics, 2017, 4th Edition, Tata McGraw Hill, India.
4.	G. Aruldhas, Quantum Mechanics, 2008, 2nd Edition, PHI Learning of India.

Mode of Evaluation: CAT, Written Assignment, Quiz and FAT

Recommended by Board of Studies	20-06-2023		
Approved by Academic Council	No. 70	Date	24-06-2023