CURRICULUM DEVELOPMENT PLAN: Mr. Kapil Kumar
B.Sc. (H) PHYSICS, Final Year, Semester VIII,
(Even Semester, 2025-2026,)
No. of Theory Periods per week = 3

Name of Paper & Code	Allocation of Lectures	Month-wise schedule followed by the Department	Tutorial/assignment/ Presentation etc.
Advanced Quantum Mechanics -I			
Unit :1 Abstract formulation of Quantum Mechanics Motivation for developing a linear vector space formulation to describe quantum phenomena. Brief review of linear vector spaces with Dirac's ket notation, Inner product and norm, Schwarz Inequality. Dual space and Bra vectors. Orthonormal basis. Infinite dimensional (discrete) vector space. Hilbert Space of state vectors. Completeness. Dynamical observables as linear operators, Adjoint of a linear operator, Hermitian or self-adjoint operators, eigenvalues and eigenvectors. Projection operator and complete set of basis. Matrix representation of state vectors and operators. Unitary operators and change of basis. Postulates of quantum mechanics. Continuous basis, position and momentum representations. Degenerate eigenvalues and complete set of commuting observables. Generalized uncertainty principle.	18	January/February	• Syllabus Overview • Reference Books • Derivations • Problem solving • Assignments • Previous years Question Papers' problems • Students' difficulties
Unit :2 Quantum Dynamics Unitary time-evolution and Schrödinger equation in ket notation and correspondence with wave mechanics. Momentum as generator of translation in space and Hamiltonion as a	12	February/March	• Derivations • Problem solving • Assignments • Students' difficulties • Class Test

generator of translation in time. Schrödinger vs Heisenberg picture. Evolution of a system in Heisenberg picture with example of simple harmonic oscillator. Classical Limit. Density matrix Formalism Density operator and matrix, pure and mixed states, expectation value of an observable, time evolution of density matrix, Reduced density matrix for subsystems of a composite system with example of entangled spin-1/2 pair			• Previous years' Question Papers' problems
Unit :3 Angular Momentum: Abstract operator approach to angular momentum, Commutation Relations. Ladder operators, Matrix representation of angular momentum operators and ladder operators, Eigenvalues and eigenvectors. Pauli matrices and their properties. Matrix representation of Spin angular momentum operators. Eigenvalues, eigenvectors of S 2 and Sz for spin1/2 and spin 1 systems and General spin state for these systems. Addition of angular momentum: Clebsch-Gordan coefficients, C. G. coefficients of addition for j = (i) 1/2, 1/2; (ii)1/2, 1 and (iii) 1, 1 systems. Identical particles: Many-particle systems, Exchange degeneracy, concept of parity, symmetric and anti-symmetric wavefunctions. Pauli exclusion principle.	15	March-April	• Derivations • Related Problems • Students' difficulties • Previous years' Question Papers' problems • Revision session prior to Home Examinations