Sankalchand Patel University

Faculty of Science and Humanities

Master of Science (SEM-2)(Physics)

In Effect from Academic Year 2021-22

Subject Code:1SC2050202	**Subject Title:** Classical and Quantum Mechanics

COURSE OBJECTIVE:

Physics is a science to understand the nature. This course is designed to get basic understanding of the physical world.

LEARNING OUTCOMES:

Students can be learned about all concepts of Classical and Quantum mechanics.

Teaching scheme (hours) per week		**Credit**		**University Examination**		**Internal Examination**		**Total**
Theory	**Practical**	**Theory**	**Practical**	**Theory**	**Practical**	**Theory**	**Practical**	
4	**--**	**4**	**--**	**60**	**--**	**40**	**--**	**100**

Unit	**Content**	**Lectures**	**Weight (%)**
1	A brief review of Lagrange's & Hamilton's formalism-conservation theorem, Noether's theorem and symmetry properties, Lagrangian and Hamiltonian formulation of relativistic mechanics, Canonical transformations, Equations of Canonical transformations, Canonical transformations for the Harmonic Oscillator, Poisson brackets and canonical invariants, equations of motion, Infinitesimal CT and conservation theorems in the Poisson bracket formulation.	15	25
2	Hamilton Jacobi theory, Application to harmonic oscillator problem, Transition to quantum mechanics. Transition from a Discrete to a continuous system, Lagrangian formulation forContinuous system. Types of equilibrium, Theory of Small Oscillations, Secular equation, eigenvectors and eigenFrequencies, Orthogonality of eigenvectors; Normal coordinates; coupled Oscillation,; Linear triatomic molecule. Small oscillations of particles on string. Introduction to nonlinear oscillations.	15	25
3	Representation of state vectors.Dynamical variables as matrix operators.Product of operators. Self-adjointness and Hermiticity, diagonalization, Continuous basis, The Schrödinger Representation. Degeneracy-Labeling by commuting observables. Change ofbasis,Unitarytransformations. Unitary transformations induced by change of coordinate system-translations, Unitary transformation induced by rotation of coordinate system.The algebra ofrotation generators and the transformations of dynamical variables, concept of parity.	15	25
4	Quantum theory of angular momentum and its eigenvalue spectrum. Matrix representation of angular momentum operators, spin angular momentum, Pauli matrices and their properties, total wave function, non-relativistic Hamiltonian including spin. Addition of angular momenta, definition of Clebsch-Gordan coefficients, Phase convention, spin-wave function for a system of two spin-1/2 particles, Identical particles with spin, addition of spin and orbital angular momenta.	15	25

Basic Reference book:

1. Classical Mechanics – System of particles and Hamiltonian Dynamics, by Greiner : Springer International Ed. 2006

2. Classical Mechanics, 3rd Ed by Goldstein, Pole & Safko, Pearson Education, Pte. Ltd, Indian Branch, Delhi, India, 2002.

3. Classical Mechanics, by V. B. Bhatia; Narosa

4. Introduction to Classical Mechanics by R. G. Takwaleand P. S. Puranik; TMH

5. A text book of Quantum Mechanics, by P.M. Mathews and K. Venkatesan (TMH)

6. Introduction to Quantum Mechanics, by David J. Griffiths.

7. Quantum Mechanics by Ghatak&Loknathan; McMillan India Publication

8. Quantum Mechanics by G. Aruldas, Prentice-Hall India, Pvt., Ltd.