

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN PHYSICS
SYLLABUS WITH EFFECT FROM 2020-2021

BPS-CSC09

CORE-IX: QUANTUM MECHANICS

(Common to B.Sc.Physics with Computer Applications-VI Sem.)

Lecture: 60 Hours

Tutorial: 15 Hours

Credits:4

Course Objective:

To introduce to the undergraduate students the development and formulation of Quantum Mechanics, its underlying Mathematical and Physical principles through exactly solvable problems.

Learning Outcomes:

On completion of the course the students will be able to

- Know the inadequacies of classical mechanics in explaining microscopic phenomena
- Introduce with the concept of matter waves and their existence proved by experimental procedure and uncertainty principle in physical measurements
- Formulate quantum mechanics through Schrodinger equation and associated different operators
- Derive time dependent and independent Schrödinger equations
- Find eigen values and eigen functions of one dimensional and three-dimensional problems

UNIT I: ORIGIN OF QUANTUM MECHANICS

(12 Hours)

Limitations of Classical Physics- Black – Body Radiation Curve- Optical Spectra- Photoelectric Effect- Specific Heat of Solids – Planck’s Quantum Hypothesis - Compton Effect- Quantum Theory of Specific Heat-Bohr Atom Model of Hydrogen Atom- Franck and Hertz Experiment – Inadequacy of (Old) Quantum Theory

UNIT II: WAVE MECHANICS

(12 Hours)

Wave Nature of Particles – Matter Waves – Diffraction Experiment- Heisenberg’s Uncertainty Principle - Application of Uncertainty Relation – Principle of Super Position –Wave Packet - Time dependent Schrodinger Wave Equation- Interpretation of the Wave Function, Probability Interpretation, Probability Current Density and Equation of Continuity- Ehrenfest theorem-Time Independent Schrodinger Wave Equation-Stationary States, Admissibility Conditions

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN PHYSICS
SYLLABUS WITH EFFECT FROM 2020-2021

UNIT III: FORMALISM OF QUANTUM MECHANICS (12 Hours)

Linear Vector Space –Orthogonal Functions –Linear Operator -Eigen Functions and Eigenvalues- Hermitian Operator- Postulates of Quantum Mechanics – Simultaneous Measurability of Observables-Eigen Values of Angular Momentum Operators-Ladder Operators

UNIT IV: ONE DIMENSIONAL EIGEN VALUE PROBLEMS (12 Hours)

Square Well Potential: Rigid Walls, Finite Walls and Potential Barrier – Alpha Emission - Linear Harmonic Oscillator (Series Method) – Free Particle

UNIT V: THREE-DIMENSIONAL ENERGY EIGEN VALUE PROBLEMS (12 Hours)

Particle Moving in a Spherically Symmetric Potential – Radial and Angular Part of Schrodinger Equation - System of Two Interacting Particles -Rigid Rotator – Hydrogen Atom- Radial Equation –Solution to Radial Equation – Energy Eigen Values and Eigen Functions

Books for Study:

1. Quantum Mechanics, G Aruldhas, 2nded, PHI,(2013).

Books for Reference:

1. Quantum Mechanics, Leonard L. Schiff, 3rd edition, McGraw-Hill.
2. A Text book of Quantum Mechanics, PM Mathews & K Venkatesan, 2nded, Tata McGraw Hill, (2011).
3. Quantum Mechanics, V.Devanathan,Narosa Publications
4. Quantum Mechanics , Concepts and Applications, NouredineZettili, 2nded,Wiley(2009).
5. Introduction to QuantumMechanics, David Griffiths, 2nded,Pearson,(2015).
6. Introduction to modern physics ,H.S.Mani&G.K.Mehta, East West press
7. Concepts of Modern Physics,ArthurBeiser et al, 6thed, Tata McGrawHill, (2009).
8. <https://nptel.ac.in/courses/115101107/>
9. <https://nptel.ac.in/courses/122106034/>