

Module Code: MATH-424  
Module Title: **Quantum Mechanics - II**  
Module Rating: 3 Cr. Hours  
Pre-Requisite: Quantum Mechanics - I

### **Harmonic Oscillator and Problems in Three-Dimensions**

- The harmonic oscillator
- Eigenfunctions of the harmonic oscillator
- The harmonic oscillator in momentum space
- Motion in three dimensions
- Spherically symmetric potential and the hydrogen atom

### **Angular Momentum**

- Basic properties
- Eigenvalues of the angular momentum operators
- Eigenfunctions of the orbital angular momentum operators  $L^2$  and  $L_z$
- Commutation relations between components of angular momentum and their representation in spherical polar coordinates

### **Scattering Theory**

- The scattering cross-section
- Scattering amplitude
- Scattering equation
- Born approximation
- Partial wave analysis

### **Perturbation Theory**

- Time independent perturbation of non-degenerate and degenerate cases
- Time-dependent perturbations

### **Recommended Books**

1. R. L. Liboff, *Introductory Quantum Mechanics* (Addison-Wesley Publishing, 2003)
2. H. D. Dehmen, *The Picture Book of Quantum Mechanics* (Springer, 2001)
3. H. F. Hameka, *Quantum Mechanics: A Conceptual Approach* (Wiley-IEEE, 2004)
4. V. K. Thankappan, *Quantum Mechanics* (New Age Publishers, 1993).
5. D. R. Bès, *Quantum Mechanics: A Modern and Concise Introductory Course* (Springer, 2004)