# Quantum Mechanics 1

This course will cover the basics of quantum mechanics and its importance in Chemistry, solutions to model problems, introduction to electronic structure theory and dynamics.

The topics to be covered are as follows:

1. Introduction & necessity of quantum mechanics
   - 1.1. Review of classical mechanics
   - 1.2. Problems with classical mechanics
   - 1.3. Double-slit experiment
   - 1.4. Wave theory and parallels
   - 1.5. Matter waves
2. Overview of basic linear algebra & connections with quantum mechanics (Assignment 1)
   - 2.1. Vector spaces
   - 2.2. Dirac notation & duals
   - 2.3. Matrices as representation of linear operators
   - 2.4. Eigenvalue problem
   - 2.5. Functions as vectors
3. Postulates of Quantum Mechanics (Assignment 2)
   - 3.1. Time independent and Time dependent Schrodinger equation
   - 3.2. Heisenberg's uncertainty relations
4. Basic 1D problems (Assignments 3 & 4)
   - 4.1. Free particle
   - 4.2. Particle in a box
   - 4.3. Particle on a ring
   - 4.4. Harmonic oscillator
   - 4.5. Barrier tunneling problem
5. Systems with many particles
   - 5.1. Distinguishable particles
   - 5.2. Indistinguishable particles: Bosons and Fermions
6. Angular momentum and spin (Assignment 5)
   - 6.1. Addition of angular momenta
7. Electronic structure (Assignment 6)
   - 7.1. Hydrogen atom
   - 7.2. Brief introduction to wave-function theory: Slater determinants and Hartree-Fock
8. Time-independent perturbation theory (Assignment 7)

**Suggested text book:**

Shankar, R. Principles of Quantum Mechanics, 2nd ed.; Plenum Press: New York, 1994.

**Grading:**

Weekly / bi-weekly quizes (5%), homework assignments (20%), mid-term (25%), and end-term (50%). The weightages of the different components are approximate, and will be announced later.

**Lectures:**

Mondays 11:00 – 12:30
Wednesdays and Fridays 9:30 – 10:30

Office hours will be from 3pm – 4pm on the days of the lectures.

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