



PHYSICS

INTRODUCTORY QUANTUM MECHANICS

Instructor Name : PROF. MANOJ HARBOLA (IIT Kanpur - Others)

COURSE DURATION : Jan-Mar 2017 **CORE / ELECTIVE :** Elective **UG / PG:** UG

PRE-REQUISITES : Basic courses in Calculus, differential equations, Mechanics, Electromagnetism

INTENDED AUDIENCE : Physics, chemistry and engineering students

INDUSTRIES APPLICABLE TO : Nil

COURSE OUTLINE : This is the first course in Quantum Mechanics. The focus of the course is going to be the ideas behind quantum mechanics and its application to simple systems. The course is taught along the lines of development of quantum mechanics so that students get a good feeling about the subject.

ABOUT INSTRUCTOR : Dr. Manoj Kumar Harbola joined the Department in 2000. He obtained his doctoral degree at the City University of New York, USA, working under the supervision of Prof. Viraht Sahni. Subsequently he carried out postdoctoral research at the University of North Carolina, Chapel Hill, USA before joining the Centre for Advanced Technology, Indore as a Scientist. He is a theoretical physicist, whose chief interest lies in Electronic Structure of Atoms, Molecules and Solids using Density Functional Methods.

COURSE PLAN

Week 1: Black-body radiation and its spectral energy density; black body as a cavity, energy density inside a cavity, radiation pressure

Week 1: Stefan-Boltzmann law, Wien's displacement law, Wien's formula for spectral density

Week 1: Relation between energy density and average oscillator energy, quantum hypothesis for oscillators and resulting spectral density

Week 1: More on quantization concept – specific heat of insulators; photoelectric effect

Week 1: Spectrum of hydrogen atom and Bohr model

Week 1: Wilson-Sommerfeld quantization condition and application to particle in a box and harmonic oscillator

Week 2: Application of Wilson-Sommerfeld quantization conditions to atoms-I

Week 3: The correspondence principle and selection rules

Week 4: Introduction to waves and wave equation

Week 5: Equivalence of Heisenberg and Schrödinger formulation-I

Week 6: Examples of solution of one-dimensional Schrödinger equation – Particle in one and two delta function potentials

Week 7: Solution of Schrödinger equation for free particles and periodic boundary conditions

Week 8: Numerical solution for the radial component of wavefunction for spherically symmetric potentials