PHY204/PSO201 First Course Hand-out

Instructor: Soumik Mukhopadhyay (soumikm@iitk.ac.in)

This is designed to be the first introductory course on quantum physics. There will be two lectures per week and a tutorial. Regular assignments will be uploaded in the HelloIITK portal and selected problems will be discussed on Thursday's tutorials. Students are encouraged to use the HelloIITK portal as a forum for discussion and posting doubts.

Evaluation: There will be one quiz before mid-sem and another after mid-sem. There will be a mid-sem and an end-sem exam. The break-up of marks is as follows:

a) Quizzes: 20+20=40
b) Mid-sem: 60
c) End-sem: 100

It is highly probable that marks below **30%** could be given **F** grades.

Course contents:

The birth of quantum physics: Black body radiation, photoelectric effect, Compton Effect, de Broglie hypothesis.

Time independent and time dependent Schrodinger equation: Free particle wavefunctions and wave packets, Expectation values, uncertainty principle.

Solution of stationary state Schrodinger equation in simple cases: Particle in a box, particle in a finite well, etc.; step potential, application to phenomena like alpha decay; one dimensional harmonic oscillator.

Solution of stationary state Schrodinger equation: for the ground state of hydrogen, discussion of the excited states.

Stern-Gerlach experiment, Electron spin and Pauli's exclusion principle; two level systems.

Application of free particle wave functions in metals: Kronig Penny model and formation of bands in one dimension.

Variational principle for approximate solutions: Simple applications to problems like ground state energy of helium atom.

Interaction of light with matter: Einstein's phenomenological theory, lifetime of a state, LASERS

Policy: No make-up exam will be taken for mid-sem. Marks for mid-sem exam could be prorated based on end-sem exam only if appropriate documents approved by the authorities are produced. Marks will NOT be prorated for absence during quizzes. **Taking the end-sem exam is mandatory** for awarding of grades. **Attendance in the course is mandatory.**

Reference books:

No particular book will be followed. However the course material will be available in all standard introductory books on quantum mechanics. Some of them are listed below.

1) Quantum Physics by Robert Eisberg and Robert Resnick
2) Fundamentals of Physics II by R. Shankar
3) Introduction to Quantum Mechanics by David J. Griffiths
4) The Feynman Lectures on Physics, vol III by Feynman, Leighton and Sands