BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI-HYDERABAD CAMPUS
SECOND SEMESTER 2018-2019
COURSE HANDOUT- (QM I)

Date: 07.01.2019

Course No. **: PHY F242**
Course Title **: Quantum Mechanics I**
Instructor-in-Charge **: Subhash Karbelkar**
Instructor **: Subhash Karbelkar**

Course Description: Origin of the quantum theory - black body radiation, photoelectric effect, Compton scattering, electron diffraction, Bohr model of hydrogen atom, Frank-Hertz experiment, Bohr-Sommerfeld quantization condition; notion of wave function, statistical interpretation of the wave function, issues of normalization, the Heisenberg uncertainty relation; Schrodinger equation, stationary states and time independent Schrodinger equation, energy eigenvalues and eigen-functions, one-dimensional problems – potential wells, potential barriers, the harmonic oscillator; Hilbert space formalism – state vectors, Dirac's bra-ket notation, observables as Hermitian operators, eigenvalues and eigenstates of Hermitian operators, the measurement postulate, Three dimensional problems- Particle in a three-dimensional Box, The Schrodinger equation in spherical polar coordinates, Angular momentum and spherical harmonics, The hydrogen atom.

Scope & Objectives:

The course on QM I aims to

- provide a thorough basic understanding of the fundamental principles of quantum physics,
- furnish insight in the microscopic structure of matter and
- develop an ability to employ the principles of quantum mechanics to solve a variety of simple quantum systems

Text Book:

T1: Introduction to Quantum Mechanics (Second edition) by D J Griffiths, LPE, Pearson

Reference Books:

R1: Modern Quantum Mechanics by J J Sakurai, **R2:** Quantum Physics (2nd. Edition), Stephen Gasiorowicz, **R3:** Principles of Quantum Mechanics, R Shankar

Course Plan

Lecture Number	Learning Objectives	Topics to be covered	Text Book Section/s
1 - 4	The Schroedinger equation	The Schroedinger equation and statistical interpretation of wavefunction, probability and normalization	1.1 to 1.4
5-6	Uncertainty principle	Momentum and uncertainty principle	1.5-1.6

7-12	Time independent Schroedinger equation	Stationary states, Continuity (or otherwise) conditions, one dimensional piecewise constant potentials: infinite and finite square well potentials, delta function potential	2.1-2.6 (2.3 listed below)
13-16	The harmonic oscillator	The harmonic oscillator	2.3
17-20	Formalism	Hilbert space, observables, Hermitian operators	3.1-3.3
21-24	Generalized statistical interpretation	Generalized statistical interpretation, the uncertainty principle, Dirac notation	3.4-3.6
25-27	Spherically symmetric potentials	Schroedinger equation in spherical coordinates	4.1
28-30	The Hydrogen atom	The hydrogen atom	4.2
31-33	Angular momentum	Commutation relations, eigenvalues and eigen functions	4.3
34-36	Spin	Spin ½, Addition of angular momenta	4.4
37-40	Identical particles	Two particle systems	5.1
	What next?	(Obviously) quantum mechanics II	

Evaluation Scheme:

EC No.	***Evaluation scheme***	***Duration***	***Weightage (%)***	***Date, Time***	***Nature of component***
1	Tut tests		30		Closed book
2	Mid semester exam.	90	30	11/3 11.00 -12.30 PM	Closed book
3	Comprehensive Exam.	3 Hrs	40	01/05 AN	Open Book

- **Notices:** Notices for the course will be uploaded only on **CMS**.
- **Open book:** ***only the textbook, reference books and class notes allowed.***
- **Make-up Policy: Very strict** to **genuine cases only** i.e. No make up for tut tests.

  (i) Sickness leading to hospitalization. (No make up for stomach-ache, diarrhea, vomiting, head-ache unless seriousness is verified by medical test.)

  (ii) Out of station with **prior intimation** & **permission**.

  (iii) request for granting make up must reach me on or before the actual time of the concerned component; please send email snkarbelkar@gmail.com stating reason/s and the earliest date make up can be conducted. Attach pictures of documentary proof in support of such request.
- ***Award of NC grade:*** The senate may require instructors to specify the conditions an NC grade will be awarded. **For this course an NC grade may be recommended if the total**

score is less than or equal to 10% of the maximum course total for the course. For example, if the highest score is 80% then those scoring 8% or less may be recommended NC grade.

- **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-Charge

PHY F242