

**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI-HYDERABAD CAMPUS**  
**SECOND SEMESTER 2021-2022**  
**COURSE HANDOUT- (QM I)**

*Date: 15.01.2022*

**Course No.** : PHY F242  
**Course Title** : Quantum Mechanics I  
**Instructor-in-Charge** : K V S Shiv Chaitanya  
**Instructor** : K V S Shiv Chaitanya

**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 (2<sup>nd</sup>. Edition), Stephen Gasiorowicz, **R3:** A text book of Quantum Mechanics, Mathews Mathews, K. Venkatesan

**Course Plan**

Number	Learning Objectives	Topics to be covered	Chapter in the Text
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of lectures			Book
3	The Schroedinger equation	The Schroedinger equation and statistical interpretation of wavefunction,	1.1 to 1.2
3	continued	Probability and continuity equation for it	1.3-1.4
2	Uncertainty principle	Momentum and uncertainty principle	1.5-1.6
3	Time independent Schroedinger equation	Stationary states, Continuity (or otherwise) conditions, one dimensional piecewise constant potentials: delta function potential	2.1-2.6 (2.3 listed below)
3	continued	infinite and finite square well potentials,	2.6
4	The harmonic oscillator	The harmonic oscillator	2.3
5	Formalism	Hilbert space, observables, Hermitian operators	3.1-3.3
4	Generalized statistical interpretation	Generalized statistical interpretation, the uncertainty principle, Dirac notation	3.4-3.6
5	Spherically symmetric potentials	Schrodinger equation in spherical coordinates	4.1
3	The Hydrogen atom	The hydrogen atom	4.2
7	Angular momentum	Commutation relations, eigenvalues and eigen functions	4.3

#### Evaluation Scheme:

EC No	Evaluation scheme	Duration (minutes)	Weightage (%)	Date, Time
1	MidSem (closed)	90 min	30	12/03 11.00am to 12.30pm
4	QUIZZES/ASSIGNMENTS(open)		30	
5	Comprehensive examination(closed book)	120 min	40	11/05 AN

**\$:During scheduled class hour**

**First four listed components, with the exception of assignments if any, will be conducted during scheduled class hours.**

- **Notices:** Notices for the course will be uploaded only on **CMS**.
  - **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) 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 stating reason/s and the earliest date make up can be conducted. Attach pictures of documentary proof in support of such request.

● **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***