**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**

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**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:** A text book of Quantum Mechanics, Mathews Mathews, K. Venkatesan

**Course Plan**

|  |  |  |  |
| --- | --- | --- | --- |
| **Number of lectures** | Learning Objectives | Topics to be covered | **Chapter in the Text 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 to12.30pm |
| **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**