Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2022-2023
COURSE HANDOUT- QM II

Date: 29/08/2022

Course No. **: PHY F311**
Course Title **: Quantum Mechanics II**
Instructor-in-Charge **: Prasant Samantray**
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Course Description: Hilbert space formalism, operators and their matrix representations, Commuting and non-commuting observables, The generalized uncertainty relation, Operator method to Harmonic oscillator, The Time evolution operators and Schrodinger eq., Schrodinger-Heisenberg picture, Angular Momentum operators and their commutation relations, eigenvalues and eigenvectors of angular momentum, Spherically symmetric potentials, Hydrogen Atom ,Time independent perturbation theory, Time Independent Perturbation Theory, WKB approx., Variational method, Interaction of atom with classical radiation field , identical particles.

Scope & Objectives: The course on QM II is an extension of QM I, and is in some sense the formal development of the mathematical foundations of quantum mechanics. The objective of the course is to develop the necessary modern mathematical tools to understand, define and explore real quantum mechanical systems.

Text Book:
T: Principles of Quantum Mechanics, R. Shankar

Reference Books:
R1: Modern Quantum Mechanics by J J Sakurai
R2: Quantum Physics (2nd. Edition), Stephen Gasiorowicz
R3: Introductory Quantum Mechanics L. Liboff
R4: Quantum Mechanics (Vol1) , Cohen-Tanudji

Course Plan

Lecture Number	Learning Objectives	Topics to be covered	Chapter in the Text Book
1-6	To learn how to write matrix representations of operators. Derive the generalized uncertainty relation. Apply operator method to harmonic oscillator.	Operators and their matrix representations, commuting and non-commuting observables, the generalized uncertainty relation, operator method to harmonic oscillator,	T, R1, R3 Chapter1

7-9	Gain understanding of dynamics of a quantum system through Schrodinger and Heisenberg pictures.	The Time evolution operators and Schrodinger equation, Schrodinger picture, Heisenberg picture	T, R1, R3 Chapter1
10-16	To define angular momentum operators. Find eigenvalues and eigenvectors of angular momentum.	Angular Momentum operators and their commutation relations, eigenvalues and eigenvectors of angular momentum.	T, R1, R3 Chapter 3
17-24	To understand the quantum mechanics of Hydrogen atom.	Spherically symmetric potentials, Hydrogen atom	T, R3 Chapter 4
25-33	To learn the time independent perturbation theory technique to solve real quantum mechanical systems.	Time independent nondegenerate/ degenerate perturbation theory WKB approximation, Variational method	T, R1, R3 Chapter 6
34-36	To learn the time dependent perturbation theory technique to solve real quantum mechanical systems.	Time dependent perturbation theory	T, R1, R3 Chapter 7
37-39	To understand semi-classical radiation theory via interaction of atom with classical radiation field.	Interaction of atom with classical radiation field	T, R3 Chapter 7
40-42	Be able to define the concepts of identical particles and quantum statistics.	Indistinguishability of identical particles	T, R3 Chapter 8

Evaluation Scheme:

S. No.	***Evaluation scheme***	***Duration***	***Weightage (%)***	***Date, Time***	***Nature of component***
1	Mid semester Test	90 mins	35	03/11 1.30 - 3.00PM	Open Book
2	Quizzes	50 mins	20	TBA	Closed Book
3	Comprehensive Examination	180 mins	45	26/12 AN	Closed Book

***** Two quizzes will be conducted and the best performance will be considered. No make-up for missed quizzes.

Chamber Consultation Hour: To be announced in class.

Notices: Notices and solutions for examination's question papers will be displayed on the **physics department** notice board and/or on **CMS** website.

Make up Policy: Make up may be considered provided a **make-up application** (for a genuine health issue) forwarded by the **Chief Warden** is produced.

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.

Prasant Samantray
Instructor-in-Charge
PHY F311