Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021
COURSE HANDOUT- QM II

Date: 17.08.2020

Course No. **: PHY F311**
Course Title **: Quantum Mechanics II**
Instructor-in-Charge **: Asrarul Haque**
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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. This course aims to introduce theoretical constructs and mathematical techniques that are required to develop further understanding of the course on QM I. The objective of the course is to develop the necessary 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	Suggested Readings
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, R3
7-9	Gain understanding of non-uniqueness of the mathematical formulation of the dynamics of a quantum system through Schrodinger and Heisenberg pictures.	The Time evolution operators and Schrodinger equation, Schrodinger picture, Heisenberg picture	T, R3
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, R3
17-24	To understand the quantum mechanics of Hydrogen atom.	Spherically symmetric potentials, Hydrogen atom	T, R3
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, R3
34-36	To learn the time dependent perturbation theory technique to solve real quantum mechanical systems.	Time dependent perturbation theory	T, R3

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
40-42	Be able to define the concepts of identical particles and quantum statistics.	Indistinguishability of identical particles	T, R3

Evaluation Scheme:

EC No.	Evaluation Component.	Duration (Minutes)	Weightage (%)	Date, Time & Venue	Nature of Component
1	Test 1	30	15	September 10 – September 20 (During scheduled class hour)	Open Book
2	Test 2	30	15	October 09 –October 20 (During scheduled class hour)	Open Book
3	Test 3	30	15	November 10 – November 20 (During scheduled class hour)	Open Book
4	Quiz	-	20	Will be announced in the class	Open Book
5	Comprehensive Examination	120	35	TBA	Open Book

Chamber Consultation Hour: To be announced in the class.

Notices: Notices and solutions of the tests and comprehensive examination's question papers will be displayed only on the **CMS** website.

Make up Policy: Make up may be considered only for a genuine health issue on the ground of producing the evidentiary documents.

There will be **no makeup** for **Quizzes**.

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.

Asrarul Haque
Instructor-in-Charge
PHY F311