Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2023-2024

Course Handout Part II

Date: 09-01-2024

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : PHY F242
Course Title : Quantum Mechanics - I
Instructor-in-Charge : AravindaRaghavan

Scope and Objective of the Course: In this course, we travel to atomic scales from macroscopic scales where our intuition developed through observing macroscopic phenomenon explained through classical theories of particles and waves fail. The course has three (unequal) parts. The first part concerns the discovery of quantum mechanical ideas when all the attempts to explain the experimental results within the classical framework of mechanics, electrodynamics and thermodynamics failed. The second part develops the rudiments of Schrodinger's wave mechanics and apply the same to some simple systems (mostly 1-dimensional) that will help clarify the novelty of quantum mechanical concepts. The third and the final part introduces the formal structure of quantum mechanics thatwill lay the foundation for advanced courses.

Textbooks:

1. Principles of Quantum Mechanics, R. Shankar, Kluwer Publishers/ Plenum Press, Second Edition.
2. Introduction to Quantum Mechanics, D. J. Griffiths, and D. L. Schroeter, Cambridge University Press, Third Edition, 2018.

Reference books

1. The Feynman Lectures on Physics, Volume III, Feynman, Leighton and Sands, Pearson India, 2012.
2. Berkeley Physics Course, vol. 4: Quantum Physics, McGraw-Hill, New York, 1971.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	Introduction to Quantum behavior	A Gedanken experiment with bullets, waves and electrons	T1- Chapter 3, R1
2-5	Origin of *h*	Discovery of quantum of action through seminal experiments: blackbody radiation, photoelectric effect, atomic stability	R1
6	Link with classical mechanics	Path Integral	T1- Chapter 8
7-11	Quantum Theory: Photons and Matter waves	Photoelectric effect, Compton effect, de Broglie waves	R2- Chapter 4
12-15	The Bohr atom	Energy levels, Atomic spectra	T1-Chapter 13; R2

16-19	Electron orbital motion	Quantization of angular momentum, Zeeman effect	T1-Chapter 12; R2
20-22	Electron spin	Stern-Gerlach experiment	T1-Chapter 14; 2
23-28	Wave function	Introduction to wave mechanics – Probabilistic ideas, Schrodinger equation	T2 – Chapter
29-35	Time-independent Schrodinger	1-D problems: Potential well, potential barriers, Harmonic oscillators	T1-Chapter 5, 7; T2- Chapter 2
35-39	Hilbert space fornalism	State vectors, Dirac's bra-ket notation, observables as Hermitian operators, eigenvalues and eigenstates of Hermitian operators, the measurement postulate.	T2- Chapter 3
40	Conclusion		

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-semester	1.5 hours	30	14/03 - 4.00 - 5.30PM	CLOSED
Quizzes		30		OPEN
Comprehensive exam	3 hours	40	14/05 AN	CLOSED

Chamber Consultation Hour: Not yet decided.

Notices: Initial notices concerning CANVAS login information will be available in CMS. The course materials will be posted in CANVAS. Course evaluations may be conducted through CANVAS.

Make-up Policy: It is applicable to the following two cases and it is permissible on production of evidential documents:(i)Debilitating illness;(ii)Absent after obtaining prior permission from the Instructor.

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.

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INSTRUCTOR-IN-CHARGE