BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI-HYDERABAD CAMPUS
FIRST SEMESTER 2022-2023
COURSE HANDOUT- (QM I)

Date: 29.08.2022

Course No. **: PHY F345**
Course Title **: Quantum Mechanics for Engineers**
Instructor-in-Charge **: Subhash Karbelkar**
Instructor **: Subhash Karbelkar**

1. Scope and Objective:

The course mainly focuses on very essential concepts in Quantum mechanics that are required by engineers. It also covers few engineering applications. Throughout the course the problem-solving approach will be followed.

2. Course Description: The course covers the following topics: Wave particle duality; Schrödinger wave equation; probability and current densities; position and momentum operators; state space; expectation values of operators; commuting operators, Uncertainty relations; orthogonality and completeness of eigenfunctions; one dimensional potential problems; reflection and transmission; harmonic oscillator; time dependent Schrödinger equation; time evolution of stationary states; group velocity; crystals; one electron approximation; Bloch's theorem; density of states; effective mass; band structure calculations; nanostructures: quantum wire, quantum well, quantum dots

Text Book:

T1: Quantum Mechanics for Scientists and Engineers by David Miller, Cambridge University Press

Reference Books:

Much of the course content can be found in most books on quantum mechanics. Two quantum mechanics books, which should be accessible to all with prerequisites, are:

R1: Quantum Physics (2nd. Edition), Stephen Gasiorowicz,

R2: Introduction to Quantum Mechanics (Second edition) by D J Griffiths, LPE, Pearson

Course Plan

Number of lectures	Learning Objectives	Topics to be covered	Chapter in the Text Book
2	Introduction	Origins of quantum mechanics	CLASS NOTES
2	Wave particle duality		
4	Schroedinger wave equation	Probability and current densities	2.1-2.4
3		Eigen-functions, eigen-values, expectation values, normalization	2.7
2	Particle in a box	Infinite square well potential	2.6
3		Finite potential barriers and wells,	2.8

		reflection and transmission	
4	Harmonic oscillator	Eigen-values and eigen functions	2.10
2	Particle in linearly varying potential	Linear potentials without boundary, triangular potential well	2.11
3	Time evolution	Wave packets, group velocity, evolution of stationary states	3.1 -3.7
3	Operators and expectation values	Time evolution, Hamiltonian, position and momentum operators, Eigen-functions, eigen-values, expectation values,	3.8 -3.14
2	Electrons in crystals	One electron approximation, Bloch theorem,	8.1-8.3
3	Density of states and band structure	Density of states in k space, band structure	8.4-8.5
3	Effective mass theory	Effective mass approximation, density of states in energy, density of states in quantum well	8.6-8.8
2	Band structure	Kronig Penny model, k·p model, Fermi's golden rule	8.9-8.10
2	Nanostructures applications	Quantum wire, well and dots	Class notes

Evaluation Scheme:

EC No.	Evaluation Component	*Duration*	*Weightage* (%)	Date, Time	Nature of Component
1	Quiz-1	50 Min.	12.5	TBA	Open Book
2	Mid Sem Test	90 Min.	35	04/11 3.30 - 5.00PM	Closed Book
3	Quiz-2	50 min	12.5	TBA	Open Book
4	Comprehensive Exam	180 Min.	40	28/12 AN	Closed Book

Chamber Consultation Hour: Chanber A202; hour: To be announced later
Notices: Notices and solutions of Quizzes, Mid-Semester & Final Comprehensive Examination will be displayed on **CMS**.
Make-up Policy: In case of all pre-compre evaluation components, make up will be granted only on production of evidential documents with prior permission from the IC.
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 F345