Introduction to Modern Physics

Programme: B.Tech. (CSE/ECE/CCE/MME) Year: 1st Semester: 2nd Semester
Course : Core (MME)/Other Elective Credits : 3 Hours : 40 hours

Course Context and Overview (100 words):

Introduction to Modern Physics course covers only two fundamental areas of Physics:

Quantum mechanics: Concepts and techniques of quantum mechanics are essential in many areas of engineering and science such as semiconductor technology, materials science, nanotechnology, photonics, quantum computers and cryptography.

Optics: Knowledge of this topic has become very important to any engineer because of rapid progress in optical communication engineering as well as significant applications in optoelectronic devices.

This course gives the relevant base to appreciate those advanced technologies.

Prerequisites Courses:

(Math 1)

Course outcomes (COs):

On completion of this course, the students will have the understanding of the following:
CO1: The Failure of Classical concepts to explain experimental results and further requirement and development of quantum mechanics
C02 : The wave function and the uncertainty relations
C03: Solve Schrodinger equation for simple potentials and its application in the development of semiconductor physics
CO4: Basic concepts and fundamental principles underlying optical phenomena.

Course Topics:

Topics	Lecture Hours	
UNIT/Module - I **Quantum Mechanics**		
Failure of Classical concepts and origin of quantum mechanics (Double Slit Experiment) Wave particle duality, Photoelectric effect, Black body radiation, Stefan's law, Compton effect,	3	17
Phase and group velocities, Heisenberg uncertainty principle and its applications	1	
Dirac notation , Wave function and its physical interpretation, Probabilities, normalization, Expectation value, Operators, Eigen values, Eigen function,	3	
Time dependent and independent Schrödinger's equation and its applications (infinite quantum well/particles confinement in one dimension, potential step reflection and tunneling quantum, penetration of barrier, particle trapped in 3-D box, Harmonic Oscillator, Quantum confinement effects	8	

Hydrogen atom problem, Quantum numbers	2	
Application of Schrödinger equation in the development of semiconductor physics	3	3
UNIT/Module II: Optics		20
Basic Introduction and History of Optics	1	
Concept of Mechanical Waves	1	
Wave Equation	1	
Plane Waves	1	
Electromagnetic Waves	2	
Interference and Principle of Superposition	3	
Standing Waves	1	
Diffraction	2	
Grating	2	
Newton's Rings	2	
Lasers and its applications	4	

Textbook references:

Text Book: (UNIT – I)

- A. Beiser, Concepts of Modern Physics, Tata McGraw-Hill, New Delhi, 1995
- D. Neamen, Semiconductor Physics and Devices, Mcgraw Hill Education Private Limited New Delhi, 2012.

UNIT - II:

- Hecht – Optics.
- Ghatak - Optics.
- Pedrotti – Introduction to Optics.

References Books:

- R. P. Feynman, R. B. Leighton and M. Sands, The Feynman Lecture in Physics, Vol I, Narosa Publishing House, New Delhi, 1998.

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Item	Weightage (Unit/Module 1)	Weightage (Unit/Module 2)
Quizzes (may be surprised)/Attendance/ Assignments	10%	10%
Examination(Mid Term +End Term)	(40%)	(40%)

Prepared By: Dr. Manish Kumar Singh and Dr. Somnath Biswas
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