

Course Code: PHY137

Semester: I

FUNDAMENTALS OF PHYSICS

Course Objectives:

This course will help the learner to

1. Familiarize with the theories and fundamentals of harmonic oscillator, interference, diffraction, polarization, quantum physics, crystallography, semiconductors, Laser, optical fibre and Thermodynamics.
2. Understand various applications using basic concepts
3. Quantify the various physical quantities involved in a phenomena

UNIT - I

11 Periods

Oscillations and Interference: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion - vibration of simple springs mass system.

Interference- principle of superposition-young's experiment: Theory of interference fringes-types of interference-Fresnel's prism- Newton's rings- Diffraction - Types of diffraction--plane diffraction grating. Difference between interference and diffraction-

UNIT - II

10 Periods

Basic idea of Electromagnetisms: Gauss's law-Biot-Savart law- Ampere's circuital law- Faraday's law- Continuity equation for current densities, Maxwell's Equations in vacuum and non-conducting medium- Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane - elliptical and circularly polarized light - Brewster's law - double refraction.

UNIT - III

12 Periods

Quantum Mechanics: Introduction - Planck's quantum theory - Matter waves, de-Broglie wavelength - Heisenberg's Uncertainty principle - time independent and time dependent Schrödinger's wave equation - Physical significance of wave function - Particle in a one dimensional potential box - Heisenberg Picture.

Crystallography: Basic terms-types of crystal systems - Bravais lattices.

Semiconductor Physics: Basic concept of Band theory in Solids-Conductor, Semiconductor and Insulator- Hall Effect: Determination of Carrier Concentration & Mobility.

UNIT - IV

12 Periods

Laser: Properties of laser beams: mono-chromaticity - coherence - directionality and brightness- Temporal and Spatial Coherence- Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion - different types of lasers: Ruby Laser - CO₂ and Neodymium lasers; laser speckles - applications of lasers in engineering.

Fiber optics: Fundamentals of fiber optics-Types of optical fibres- Applications.

Thermodynamics: Zeroth law of thermodynamics - first law of thermodynamics - brief discussion on application of 1st law - second law of thermodynamics and concept of Engine - entropy - change in entropy in reversible and irreversible processes - third law of thermodynamics.

TEXTBOOKS

1. Beiser A. *Concepts of Modern Physics*, McGraw Hill International, Sixth Edition, 2003.
2. David Halliday, Robert Resnick, and Jearl Walker. *Fundamentals of Physics*, John Wiley & Sons, Inc, Ninth Edition, 2011.

REFERENCES

1. Ajoy Ghatak, *Optics*, Tata McGraw Hill, Fifth Edition, 2010.
2. Sears and Zemansky, *University Physics*, Addison-Wesley, Tenth Edition, 1999.
3. Jenkins and White, *Fundamentals of Optics*, McGraw-Hill, Fourth Edition, 2001.