PHYSICS – I (3 – 1 – 0)

This one semester Physics core course is divided into three parts. Part-1 covers oscillations, waves and wave optics. Part-II introduces some basic concepts in electromagnetism and Part-III includes introductory aspects of Quantum mechanics.

Module-I

Unit-I Oscillations and Waves

(a)Different type of Oscillations; Examples and applications of different types of oscillation; Resonance, Amplitude resonance, Velocity resonance, Sharpness of resonance

(b) Waves: wave equation, longitudinal and transverse waves, Progressive waves, Stationary waves, Nodes and Antinodes. Superposition of waves, Coherent and incoherent superposition of waves.

Unit-II (Interference)

In this unit some systems for production of observable interference pattern are covered.

a) Wave fronts and Huygen's principle, Superposition of waves, two beam superposition, coherent and incoherent superposition,

b) Two source interference pattern, Coherent sources of light, Conditions of interference, Young's double slit experiment, Fringe width and Intensity distribution.

c) Newton's Rings, Determination of wavelength of light and refractive index of liquid.

Unit-III (Diffraction)

Diffraction of light waves at some simple obstacles is to be covered in this unit.

a) Fresnel and Fraunhofer diffraction, Fresnel's half period zones : construction, Intensity at a point due to a plane wave front

b) Zone plate : Construction and Theory, similarities and dissimilarities with a convex lens.

c) Plane Diffraction grating – Diffraction spectra, Determination of wavelength of light, angular dispersion.

Unit-IV (Polarization)

The unit covers elementary features of polarization of light waves.

a) Polarization of transverse waves : plane, circular and elliptically polarized light. Pictorial representation.

b) Production of circular and elliptically polarized light, Polarization by reflection, Brewster's law.

Module-II

Unit-V (Electromagnetism)

Students will be familiarized with some basic terms used in vector calculus prior to development of Maxwell's electromagnetic wave equation. No proof of theorems and laws included in this unit is expected- statement and interpretation should suffice.

a) Vector Calculus : Gradient, Divergence, Curl of vector field, Gauss divergence theorem. Stoke's theorem, Green's theorem.

b) Gauss law of electrostatics in free space and in a medium, Electric displacement D, Magnetic induction B and magnetic intensity H. Amperes circuital law, displacement current. Faraday's law of electromagnetic induction.

c) Maxwell's electromagnetic equation in differential form and in integral form.

Unit-VI

Some aspects of propagation of EM waves are to be covered in this unit.

a) Electromagnetic energy density, Poynting theorem, vector potential and scalar potential.

b) Electromagnetic wave equations for E and B, transverse nature and speed of em waves, wave equation in terms of scalar and vector potentials.

Module-III

Unit-VII (Quantum Physics)

This unit deals with elementary concepts of Quantum Physics and basic formulation to deal with physical systems.

1. Need for Quantum Physics - Historical Overview

Particle Aspect of Radiation - Blackbody radiation,

Photo electric effect.

Compton Scattering, pair production

Wave Aspect of Particles - Matter waves:de. Broglie Hypothesis

Experimental evidence

Atomic Transition and Spectroscopy - Bohr Model of Hydrogen Atom.

Spectral lines

Heisenberg Uncertainty Principle - Statement, interpretation and examples.

2. Basic features of Quantum Mechanics- Transition from deterministic to probabilistic

States of a system - Wave functions Probability Density.

Superposition Principle. Observable

and operators. Expectation values.

Stationary states.

Schrodinger equation : Time dependant and time in-dependant wave packets.

Unit-VIII

Thus unit deals with application of quantum Mechanics to specific problems.

Application of quantum mechanics.

Solution of - One dimensional problems

Free Particles - Continuous States

Potential Steps - Boundary conditions, Reflection Transmission

Potential Barrier - Tunneling

Infinite deep potential well - Energy Eigen values, Eigen function

Text Books :

1. Physics-I - B.B.Swain & P.K.Jena – Kitab Mahal – Cuttack

Reference Books :

1. Optics – A.K.Ghatak

2. Geometrical and Physical Optics – P.K.Chakraborty

3. Ekectricty & Magnetism - D.C.Tayal, Himalaya Publishing House, New Delhi

4. Concepts of Modern Physics – A. Beiser

5. E.Merzbacher, Quantum Mechanics, 3rd Edition, John Wiley NY (1998)

6. A.Bohm,Quantum Mechanics : Foundations and Applications, 2nd Edition, Springer Verlag(1986)

7. N.Zettli, Quantum Mechanics : Concepts and Applications, John Wiley & Sons (2001)