PH 101 BS

ENGINEERING PHYSICS
B.E.1/4, I-SEMESTER
(Common for Mech., Civil & EEE)

Instruction	**:** (3L+1T) Hours/Week
Duration of SEE	**:** 3 Hours
SEE	**:** 70 Marks
CIE	**:** 30 Marks
Credits	**:** 4

Course Objectives:

i. To make student understand the basic concepts of waves and oscillations.
ii. To understand the different types of crystals and the analysis of crystal parameters to investigate crystal structures. To classify the type of the defect present in the crystal.
iii. To make student understand the formation of energy bands and classification of the solids based on the band theory. To understand the concept of semiconductors, ultrasonics and its wide applications.
iv. To study different types of dielectric polarizations and dielectric properties of materials. To know the significance of Maxwell's equations in engineering applications.
v. To make student understand the basic concepts of superconductivity and nanomaterials.

Course Outcomes:

At the end of this course, the student will be able to:

i. Solve engineering problems using the concepts of waves and oscillations.
ii. Explain the basic understandings of the matter, crystal structure and its fundamental properties including crystal systems and Miller indices.
iii. Show their understanding of the conductivity nature of metals and the classification of the solids learned from the Band Theory of Solids. Apply the basic concepts of ultrasonics for various applications.
iv. Demonstrate the knowledge in dielectric materials applications and its importance and explain the transportation of electromagnetic waves.
v. Apply the basic concepts of superconductivity and nanomaterials in engineering applications.

UNIT-I

Waves and Oscillations: Simple harmonic oscillators - Complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – Heavy, critical and light damping - Energy decay in a damped harmonic oscillator - Quality factor - Forced oscillators – Impeadance - Steady state motion of forced damped harmonic oscillator - Power absorbed by oscillator

UNIT- II

Crystallography: Introduction – Types of crystal systems - Bravais lattices – Lattice planes and Miller Indices (Cubic system) – Inter planar spacing (Cubic system) - Bragg's law - Powder diffraction method.

Crystal defects: Classification of point defects - Concentration of Schottky defects in metals and ionic crystals - Concentration of Frankel defects – Line defects – Screw and Edge dislocations – Burger's vector.

UNIT- III

Band Theory of Solids & Semiconductors: Classical free electron theory (qualitative) – Kronig-Penney model (qualitative treatment) - Energy band formation in solids - Intrinsic and Extrinsic semiconductors - Concept of a hole - Carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode and its I-V characteristics – Thermistor and its characteristics - Hall effect and its applications.

***Ultrasonics*:** Introduction to Ultrasonic waves – Production of ultrasonic waves by Piezoelectric method – Detection of ultrasonic waves : Piezoelectric detector – Properties of Ultrasonics – Wavelength of Ultrasonics by Debye-Sears method – Applications.

UNIT-IV

***Dielectric Materials*:** Dielectrics - Types of polarizations – Electronic, Ionic, Orientational and Space charge polarizations – Expression for Electronic polarizability - Frequency and temperature dependence of dielectric polarizations - Determination of dielectric constant by capacitance Bridge method - Ferro electricity - Barium titanate - Applications of Ferroelectrics.

Electromagnetic theory: Basic laws of electricity and magnetism - Maxwell's equations in integral and differential forms - Conduction and displacement current – Relation between D, E and P - Electromagnetic waves: Equation of plane wave in free space – Poynting theorem.

UNIT-V

Superconductivity: Introduction - General properties of super conductors - Meissner effect - Type I and Type II superconductors - BCS theory (qualitative) – Introduction to High T_c superconductors - Applications of superconductors.

Nanomaterials: Introduction - Properties of materials at reduced size - Surface to volume ratio at nano scale – Classification of nanomaterials - Preparation of nanomaterials: bottom–up methods (sol gel and CVD), Top-down methods (ball milling) - Basic ideas of carbon nanotubes – Applications nanomaterials and their health hazards.

Suggested Reading:

1) B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.
2) M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand & Co.
3) C. Kittel - Introduction to Solid State Physics, Wiley Eastern Ltd.
4) A.K Bhandhopadhya - Nano Materials, New Age International.
5) C.M. Srivastava and C. Srinivasan - Science of Engg. Materials, New Age International.