PHY109:ENGINEERING PHYSICS

L:3 T:1 P:0 Credits:4

Course Outcomes: Through this course students should be able to

CO1 :: understand the basics of electromagnetic theory and Maxwell’s equations for diverse engineering disciplines.

CO2 :: explain the principle and working of lasers and optical fiber for their wide applications.

CO3 :: articulate the evolution of quantum mechanics and discuss its practical applications in modern technology.

CO4 :: employ the physics of solids to understand the electrical conductivity of metals, semiconductors, and insulators.

CO5 :: classify the engineering materials into categories-magnetic materials, superconductors, and dielectrics based on their properties.

Unit I

Electromagnetic theory : scalar and vectors fields, concept of gradient, divergence and curl, Gauss theorem and Stokes theorem (qualitative), Poisson and Laplace equations, continuity equation, Maxwell electromagnetic equations (differential and integral forms), physical significance of Maxwell equations, Ampere Circuital Law, Maxwell displacement current and correction in Ampere Circuital Law

Unit II

Lasers and applications : fundamentals of laser- energy levels in atoms, radiation matter interaction, absorption of light, spontaneous emission of light, stimulated emission of light, population of energy levels, Einstein A and B coefficients, metastable state, population inversion, resonant cavity, excitation mechanisms, lasing action, properties of laser, Ruby laser, Nd - YAG, He-Ne Laser, Semiconductor Laser, applications of laser in engineering, holography

Unit III

Fiber optics : fiber optics introduction, optical fiber as a dielectric wave guide, total internal reflection, acceptance angle, numerical aperture, relative refractive index, V-number, step index and graded index fibers, losses associated with optical fibers, application of optical fibers

Unit IV

Quantum mechanics : need of quantum mechanics, Black body radiation: spectral distribution, photoelectric effect, concept of de Broglie matter waves, wavelength of matter waves in different forms, concept of phase velocity and group velocity (qualitative), Heisenberg uncertainty principle, wave function and its significance, Schrodinger time dependent and independent equation, particle in a box

Unit V

Solid state physics : free electron theory (Introduction), diffusion and drift current (qualitative)., fermi energy, fermi-dirac distribution function, density of states (qualitative), band theory of solids, semiconductors and insulators, fermi level for intrinsic and extrinsic semiconductors, direct and indirect band gap semiconductors, concept of effective mass - electrons and holes, Hall effect (with derivation)

Unit VI

Introduction to engineering materials : introduction to dielectric materials, dielectric constant, piezoelectric materials: direct and Inverse piezoelectric effect, application as production and detection of ultrasonic waves, magnetic materials: dia, para, ferromagnetic materials and application as magnetic data storage device (qualitative), superconducting materials: properties, applications, Meissner effect, type I & II superconductors, BCS theory (qualitative), nanomaterials: types and applications

Text Books:

1. ENGINEERING PHYSICS by HITENDRA K MALIK, A K SINGH, MC GRAW HILL

References:

1. ENGINEERING PHYSICS by B K PANDEY, S CHATURVEDI, CENGAGE LEARNING
2. ENGINEERING PHYSICS by D K BHATTACHARYA, POONAM TONDON, OXFORD UNIVERSITY PRESS