PHY110:ENGINEERING PHYSICS

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: recall the basic principles of physics to lay the foundation for various engineering courses.

CO2 :: understand the principle and working of lasers and optical fibres for their wide applications.

CO3 :: associate the knowledge of waves and their propagation.

CO4 :: articulate the physics of solids to understand their properties.

CO5 :: illustrate the development of quantum mechanics and its applications.

Unit I

Electromagnetic theory : scalar and vectors fields, concept of gradient, divergence and curl, dielectric constant, 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, application of em theory in resistive touch screen display, capacitive touch screen display, Imaging devices

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, Nd - YAG, He-Ne Laser, Semiconductor Laser, lasing action, properties of laser, applications of laser in engineering i.e. working mechanism of bar code scanner and laser pointer, 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 in computer networking and broadcasting

Unit IV

Quantum mechanics : need of quantum mechanics, photoelectric effect, concept of de Broglie matter waves, wavelength of matter waves in different forms, Heisenberg uncertainty principle, concept of phase velocity and group velocity (qualitative), wave function and its significance, Schrodinger time dependent and independent equation, particle in a box, tunneling effect (Qualitative idea), Application - Quantum computing

Unit V

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

Unit VI

Introduction to engineering materials : dielectric materials definition, dielectric breakdown, dielectric loss, internal field, Claussius Mossotti relation, magnetic materials: dia, para, ferromagnetic materials, magnetic data storage, piezoelectric materials: direct and inverse piezoelectric methods, materials and applications (ultrasonic sensors), superconducting materials: properties, Meissner effect, Type I & Type II superconductors, applications, nanomaterials: Introduction, synthesis of nano materials, top down and bottom-up approach

Text Books:

1. ENGINEERING PHYSICS by HITENDRA K MALIK, A K SINGH, Tata McGraw Hill, India

References:

1. FUNDAMENTAL OF PHYSICS by HALLIDAY D., RESNICK R., WALKER J., WILEY

2. ENGINEERING PHYSICS by B K PANDEY, S. CHATURVEDI, CENGAGE LEARNING

3. ENGINEERING PHYSICS by D K BHATTACHARYA, POONAM TONDON, OXFORD UNIVERSITY PRESS