With effect from the academic year 2018-2019

PH 201 BS

APPLIED PHYSICS
B.E.1/4, II-SEMSTER
(Common to CSE, ECE and BME)

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 wave mechanics and to know the significance of Maxwell's equations in engineering applications.
ii. To state the principle of optical fiber and to understand the design and applications of optical fibers. To explain the principles of laser and to demonstrate the applications of laser. To understand the concept of ultrasonics and its wide applications.
iii. To study different types of dielectric polarizations and dielectric properties of materials. To understand the concept of semiconductors and its wide applications.
iv. To make student understand the basic concepts of superconductivity. To know the significance of magnetic materials in normal life.
i. To study the preparation of thin films and their importance. To understand the basic concepts of nanomaterials.

Course Outcomes:

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

i. Solve engineering problems using the concepts of wave and particle nature of radiant energy. Explain the significance of electromagnetic waves.
ii. Compile the applications of laser and fiber optics in the field of industry, medical and telecommunication.
iii. Show their understanding about the conductivity nature of semiconductors and its wide applications. Demonstrate the knowledge in dielectric materials applications and its importance.
iv. Apply the basic concepts of superconductivity and magnetic materials in engineering applications.
v. Understand the widely used current technologies such as solar cells, fire alarms etc., which are based on thin films. Explain about the importance of nanomaterials.

UNIT-I

Wave mechanics: matter waves–de-Broglie wavelength, properties of wave function, Physical significance - Schrödinger time dependent and time in-dependent wave equation. Particle in a 1-D box.

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 – II

Fibre Optics: Introduction – Propagation of light through an optical fiber - Acceptance angle - Numerical aperture (NA)– Types of optical fibers and refractive index profiles – Fibre drawing process (double crucible method)- Application of optical fibers

Lasers: Characteristics of lasers - Spontaneous and stimulated emission of radiation - Einstein's coefficients - Population inversion - Ruby laser - Helium-Neon laser – Semiconductor laser – Applications of lasers.

***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- III

Semiconductors: 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.

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.

UNIT- IV

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.

Magnetic Materials: Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials – Weiss molecular field theory of ferromagnetism - Magnetic domains - Hysteresis curve - Soft and hard magnetic materials – Ferrites: Applications of ferrites.

UNIT-V

Thin films: Distinction between bulk and thin films - Thin film preparation techniques: Thermal evaporation methods, Electron beam evaporation – Construction and working of Solar cell – Applications.

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 2012
2) C. Kittel - Introduction to Solid State Physics, Wiley Eastern Ltd. 5th Edition, 1976
3) S.L. Gupta and V. Kumar - Solid State Physics, K. Nath & Co., 8th Edition, 1992.
4) A. Goswami - Thin Film Fundamentals, New Age International, 2007.
5) A.K Bhandhopadhya - Nano Materials, New Age International, Ist Edition, 2007.
6) M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand & Co., Ist Edition, 1992.
7) C.M.Srivastava and C.Srinivasan -Science of Engg. Materials,New Age International, 2002.