JAIN DEEMED-TO-BE UNIVERSITY
School of Engineering & Technology
Global Campus
Jakkasandra Post, Kanakapura Taluk, Ramanagara District - Pin Code: 562 112

PHYSICS

SYLLABUS (2018 onwards)

Subject Code: 18BSPH02 **Hours/week: 3:1:0**

Total Hours: 45 **Credits: 4**

Course Learning Objectives (CLO)

The objective of this course is to make students

- To learn the basic principles of physics using which they can analyze practical engineering problems effectively to obtain solutions.
- To build models and problem solving challenges with practical oriented skills.

UNIT-I: Electrostatics and Magnetostatics **(9 hrs)**

Electrostatics: Electrostatic field and potential of a dipole, dielectric constant, Bound charges due to electric polarization, electric displacement, dielectric slab in uniform electric field, relation between dielectric susceptibility (χ), dielectric constant and P, Electric polarization mechanisms -electronic, ionic, orientational, space charge polarization, Expression for internal field in one- dimensional solid dielectrics, numericals.

Magnetostatics: Biot Savart's law, divergence and curl of static magnetic field, Gauss divergence theorem sand stokes' theorem, Faraday's law in terms of EMF produced by changing magnetic flux, Magnetic field due to simple magnets like a bar magnet. Diamagnetic, paramagnetic and ferromagnetic materials (qualitative approach), concept of domains B-H curve in ferromagnetic materials, soft and hard magnetic materials, applications.

UNIT-II Modern physics **(9hrs)**

Dual nature of matter: Wave particle dualism. de-Broglie hypothesis, Davisson and Germer experiment, Matter waves and their characteristic properties. Phase velocity and group velocity, Relation between phase velocity and group velocity. Relation between group velocity and particle velocity. Problems on de-Broglie's wavelength.

Wave mechanics: Heisenberg's uncertainty principle, significance and its applications: non existence of electron inside the nucleus. Wave function, properties of wave function and physical significance. Probability density and Normalization of wave function, Schrodinger time independent wave equation in one dimension, Eigen values and Eigen functions. Applications of Schrödinger wave equation – Particle in one dimensional infinite potential well. Numericals.

UNIT-III: Introduction to solids **(9hrs)**

Review of classical free electron theory, Quantum free electron theory, Fermi energy and Fermi factor in metals, Variation of Fermi factor with energy and temperature, Fermi-Dirac statistics, Derivation of density of states, Band theory of solids (qualitative approach) Intrinsic semiconductors, concept of effective mass (qualitative) Intrinsic carrier density, Fermi level in intrinsic semiconductors, Extrinsic semiconductors- types, variation of carrier concentration with temperature, variation of Fermi level with temperature, Numericals.

UNIT-IV: Crystal physics **(9 hrs)**

Space lattice, Basis vectors, Unit cell, lattice parameters. Bravais lattice and crystal systems, Estimation of directions and planes in a crystal lattice, Miller indices and expression for interplanar spacing in terms of Miller indices. Expression for lattice constant for a cubic lattice, Co-ordination number, Atomic packing factor-Atomic packing factor for sc, bcc and fcc structures. Crystal structures of NaCl and diamond, Diffraction of X-rays –derivation of Bragg's law, Determination of crystal structure by Bragg's X-ray Spectrometer, problems on Bragg's law.

UNIT-V: Lasers and optical fibers: **(9hrs)**

Lasers- Interaction between radiation and matter (induced absorption, spontaneous and stimulated emission). Expression for energy density at thermal equilibrium in terms of Einstein's coefficients. Characteristics of laser light, Conditions for laser action- population inversion and Meta stable state, Requisites of laser system, Construction and working of Carbon Dioxide (CO_2) laser & Nd-YAg laser. Applications of lasers, Numericals.

Optical fibers- Construction and light propagation mechanism in optical fibers (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Expression for numerical aperture in terms of refractive indices of core and cladding, Condition for wave propagation in optical fiber, V-number and Modes of propagation, Types of optical fibers, Attenuation; absorption, scattering and radiation loss, Point to point communication systems, Numericals.

Reference books:

1. Fundamentals of Physics - Halliday and Resnick, 10th Edition, 2012, Wiley, UK
2. Introduction to Mechanics – M. K. Verma, 2008, CRC Press, Taylor and Francis.
3. Quantum Mechanics - D. J. Griffiths, 2013, Pearson Prentice Hall, New Jercy.
4. Lasers and Nonlinear Optics - B. B Laud, 2011, New Age International, New Delhi.
5. Solid State Electronics Devices - B. G. Streetman, 7th Edition, 2014, Pearson Prentice Hall, New Jersey.
6. Concept of Modern Physics - Arthur Beiser, 2009, MacGraw Hill, New Delhi.