



GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING PHYSICS

Course Code: GR15A1007
I Year I Semester

L:2 T:1 P:0 C:3

Prerequisites: Fundamentals in Physics and Mathematics.

Course Objectives: This is EP (Engineering Physics) subject is common to BME, CSE, IT, ECE and EEE branches of UG Engineering. At the end of the course the student is expected to

- Know the nature and origin of properties (Mechanical, Electrical, Magnetic etc.) of various materials.
- Know the concepts of latest developments in fiber optics and nanotechnology.

Course Outcomes

- Student will learn the fundamentals and origin of different types of materials and their applications.
- Get familiarized with the latest developments and applications like Fiber optics and Nano-technology in physics.

Unit-I

Crystal Structures: Lattice points, Space lattice, Basis, Bravais lattice, unit cell and lattice parameters, Seven Crystal Systems with 14 Bravais lattices, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Miller Indices, Inter planar spacing of Cubic crystal system.

Defects in Crystals: Classification of defects, Point Defects: Vacancies, Substitution, Interstitial, Concentration of Vacancies, Frenkel and Schottky Defects, Edge and Screw Dislocations (Qualitative treatment), Burger's Vector.

Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis, Matter Waves, Davisson and Germer's Experiment, Heisenberg's Uncertainty Principle, Schrodinger's Time Independent Wave Equation-Physical Significance of the wave Function-Particle in One Dimensional Potential Box.

Unit-II

Electron Theory of Metals: Classical free electron theory, Derivation of Ohm's law, Mean free path, Relaxation time and Drift velocity, Failures of Classical free



electron theory, Quantum free electron theory, Fermi-Dirac distribution, Fermi energy, Failures of Quantum free electron theory.

Band Theory of Solids: Electron in a periodic potential, Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), origin of Energy Band Formation in Solids, Classification of Materials into Conductors, Semi Conductors & Insulators, Effective mass of an Electron.

Semiconductor Physics: Intrinsic Semiconductors and Carrier Concentration, Extrinsic Semiconductors and Carrier Concentration, Fermi Level in Intrinsic and Extrinsic Semiconductors, Hall Effect and Applications.

Unit-III

Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Types of polarization: Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities (Electronic & Ionic) - Internal Fields in Solids, Clausius - Mossotti Equation, Piezo-electricity and Ferro- electricity.

Magnetic Properties: Magnetic Permeability, Magnetic Field Intensity, Magnetic Field Induction, Intensity of Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Hysteresis Curve on the basis of Domain Theory of Ferro Magnetism, Soft and Hard Magnetic Materials, Ferrites and their Applications.

Unit-IV

Lasers: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Fiber Optics: Structure and Principle of Optical Fiber, Acceptance Angle, Numerical Aperture, Types of Optical Fibers (SMSI, MMSI, MMGI), Attenuation in Optical Fibers, Application of Optical Fibers, Optical fiber Communication Link with block diagram.

Unit-V

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Bottom-up Fabrication: Sol-gel Process; Top-down Fabrication: Chemical Vapor Deposition, Physical, Chemical and Optical properties of Nano materials, Characterization (SEM, EDAX), Applications.



Teaching Methodologies

1. Power Point Presentation.
2. Assignments uploaded in website.

Text Books

1. **Engineering Physics:** P.K.Palanisamy, Scitech Publishers.
2. **Engineering Physics:** S.O.Pillai, New age International.
3. **Applied Physics:** T.Bhima Sankaram, G Prasad, BS Publications

Reference Books

1. **Solid State Physics:** Charles Kittel, Wiley & Sons (Asia) Pte Ltd.
2. **Fundamentals of physics:** Halliday, Resnick, Walker.
3. **Optical Electronics:** A.J Ghatak and K.Thyagarajan, Cambridge University Press.