

ELECTIVE -I EE-5005 (2) ELECTRICAL AND ELECTRONICS MATERIALS

COURSE OBJECTIVE

The primary objective of the course is to introduce concepts about the properties, characteristics, applications and limitations of Electrical & Electronics engineering materials.

Course contents :

Unit I : Crystal structure of materials, crystal systems, unit cells and space lattices and defects, Classes of Engineering Materials - Metals & alloys, ferrous and non-ferrous alloys, low alloy steels, aluminium alloys, copper alloys, stainless steels, cast iron, ceramics, organic polymers and composite material. Classification of solids from electrical engineering point of view. Conducting material - properties of conductors, characteristics of good conductor material, commonly used conducting materials, conductor materials for overhead lines, types of conductors, conductor for underground cables, conductor materials used in electrical machines, resistor materials, types of resistors, materials for bus bar.

Unit II : Dielectric Materials: Dielectric strength, factors affecting dielectric strength, dielectric loss, dissipation factor, factors affecting dielectric loss, permittivity & polarization, charging and discharging of dielectric, conduction through dielectric. Application of dielectric, different types of capacitors and materials used for them. Insulating materials, their- thermal and chemical, mechanical & electrical property. Insulating materials like ceramic, mica, glass, rubber, resins, wax varnishes, Class of insulator. Transformer oils & their testing. Piezoelectricity & Ferro electricity.

Unit III : Concept of energy band diagram for materials - conductors, semiconductors and insulators Applications of semi conductor materials: type of semi conductors, working and applications of semiconductors, Temperature sensitive elements, photoconductive cells, photo voltaic cells; Varistor, Hall effect generator, LCD, Light dependent resistors, LEDs, piezo - electric materials, semiconductor laser and its characteristics, photo conductors - photo diodes, avalanche photo diode, photo transistors.

Unit IV : Classification of magnetic materials: Dia-magnetism, Para magnetism, Ferro-magnetism, magnetization curve, hysteresis loop, Magnetostriction, Factors affecting permeability and hysteresis, Anti - ferromagnetism, Ferromagnetism, Magnetic resonance, B-H curve for different magnetic materials, loss of magnetism, impurities in ferromagnetic materials, soft and hard magnetic materials, ferrites

Unit V: Superconductivity & it's application. Materials of MHD generator, Thermoelectric generators, Thermionic conductors, Physical properties &Electrical properties of SF₆, Specification of SF₆ gas for GIS application, Advantages and Applications of SF₆, Nanomaterials, Ultra Light materials and metallic foams.

Course outcome :

Student after successful completion of course is expected to possess an understanding of basic of Electrical & Electronics engineering materials.

References:

1. A.J. Dekker; Electrical Engineering Materials; PHI.
2. William F Smith, Javad Hashemi, Ravi Prakash 'Material science and engineering', McGraw Hill.
3. James F. Shackelford, Madanapalli K. Muralidhara 'Introduction to Materials Science for Engineers', Pearson
4. Ian P. Jones ' Materials Science for Electrical and Electronics Engineers' Oxford university press
5. C. S. Indulkar and S. Thruvengadam; Electrical Engineering Materials; S. Chand.
6. TTTI Madras; Electrical Engineering Materials; TMH.
7. John Allison; Electrical Engineering Material s & Devices; TMH.
8. Kasap; Electronic Materials and devices; TMH
9. V. Raghvan; Material Science & Engineering; PHI.
10. S.P. Seth & P.V. Gupta; Electrical Engineering Materials; Dhanpat Rai.