ELECTRICAL ENGINEERING MATERIALS

Course Code:13EE1122

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Pre requisites: Basics of Materials

Course Educational Objectives:

To introduce the student with different materials and their characteristics used in manufacturing various electrical equipment.

Course Outcomes:

On completion of the course the student will be able to:

- Analyze the characteristics of different types of materials viz. conductors, insulators, semiconductors and magnetic materials etc.
- Select a suitable material for manufacturing electrical equipment

UNIT-I (12 Lectures)

CONDUCTING MATERIALS:

Introduction of Classification of material into conducting, semi conducting and insulating materials -Resistance and factors affecting it such as alloying and temperature - Classification of conducting material as low resistivity and high resistivity materials - Low resistance materials - Introduction to handle conductors and its applications - Low resistivity copper alloys, their practical applications with reasons for the same - Applications of special metals - High resistivity materials and their applications– Super conductivity.

UNIT-II (10 Lectures)

SEMI- CONDUCTING MATERIALS:

Introduction - Semi-conductors and their properties , Different semi-conducting materials (silicon and germanium) used in manufacture of various semiconductor devices (i.e p-type and n-type semiconductors) , Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.

UNIT-III (14 Lectures)

INSULATING MATERIALS - GENERAL PROPERTIES:

Electrical Properties - Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant, Physical Properties - Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness, Thermal Properties- Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics, Chemical Properties - Solubility, chemical resistance, weather ability, Mechanical properties - mechanical structure, tensile structure.

UNIT-IV (10 Lectures)

INSULATING MATERIALS AND THEIR APPLICATIONS:

Plastics- Definition and classification, thermosetting materials, Thermo-plastic materials; Natural insulating materials, properties and their applications; Gaseous materials – Ceramics-properties and applications.

UNIT-V (14 Lectures)

MAGNETIC MATERIALS AND SPECIAL MATERIALS:

Introduction and classification - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop (including) coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect, Soft Magnetic Materials, Hard magnetic materials , Hall effect and its applications. Thermocouple, bimetals, leads soldering and fuses Material - their applications.

TEXT BOOKS :

1. SK Bhattacharya, *"Electrical and Electronic Engineering Materials"* 1st edition Khanna Publishers, New Delhi,2006.(Unit 1,2,3)
2. A.J. Dekker *"Electrical Engineering Materials"*, PHI, 2006. (Unit 4,5)

REFERENCES :

1. Grover and Jamwal, *"Electronic Components and Materials"* DhanpatRai and Co., New Delhi.
2. Sahdev, *"Electrical Engineering Materials"*, Unique International Publications
3. C. S. Indulkar& S. Thiruvengadam, *"Electrical Engineering Materials"*, S. Chand & Com. Ltd, New Delhi -55
4. S.P. Seth, P.V. Gupta *"A course in Electrical Engineering Materials"*, DhanpatRai& Sons.