

**1/4 B.Tech. FIRST SEMESTER
ELECTRICAL ENGINEERING MATERIALS**

EE1T5**(Only for EEE during I B.Tech., I Semester)****Credits: 3****Lecture: 3 periods/week****Internal assessment: 30 marks****Tutorial: 1 period /week****Semester end examination: 70 marks****Course Objectives:**

To effect the economy in manufacturing electrical machines without sacrificing quality, every electrical engineer must have sound knowledge about materials during selection and application.

- To provide knowledge about the conducting materials
- To give knowledge about semiconductor materials
- To give knowledge about the insulating materials and their applications
- To acquire the knowledge about the dielectric materials.
- To have knowledge about magnetic materials
- To have knowledge about special purpose materials.

Course Outcomes:

1. Student will acquire the knowledge about different forms of materials and their properties.
2. Student will acquire complete knowledge about conducting and semiconducting Materials.
3. Students will have complete knowledge about insulating materials and also studies behavior of dielectrics.
4. Student will learn completely about the magnetic properties of the material and special purpose materials.

Unit I**Conducting materials**

Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials – classification of electrical materials – concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting, resistivity of electrical materials electrical/mechanical/thermal properties of copper, aluminium, iron, steel, lead, tin and their alloys – applications.

Unit II**Semiconductors and high resistivity conductors**

Introduction – semiconductor materials – characteristics of semiconductors – atomic structure p Intrinsic and extrinsic semi conductors – preparation of semiconductors – Germanium and silicon – doping materials P type and N type crystals – Diode and transistor, their application. High Resistivity materials – electrical / thermal / mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

Unit III**Dielectrics**

Introduction – solid, liquid and gaseous dielectrics, leakage current, permittivity, dielectric constant, dielectric loss – loss angle – loss constant, Breakdown voltage and dielectric strength of – solid, liquid and gaseous dielectrics, effect of break down – electrical and thermal effects, Polarisation – electric, ionic and dipolar polarization. Effect of temperature

and frequency on dielectric constant of polar dielectrics. Ferro electric materials and their application, piezo electric property, piezo electric materials and their applications.

Unit IV

Insulating Materials

Introduction – characteristics of a good electrical insulating materials – classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials, electrical, thermal and mechanical properties of Micanite, Asbestos, Bakelite, rubber, plastics, thermo plastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids – their electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties .

Gaseous insulators – classification based on dielectric strength – dielectric loss, chemical stability properties and their applications.

Unit V

Magnetic materials and special purpose materials

Introduction – classification of magnetic materials, Ferro magnetism – properties of ferro magnetic materials – properties of magnetically soft materials, iron, silicon steel, permalloy, mumetal, perminvar, alnico – magnetic properties of ferrites. B-H curves of soft magnetic materials – effect of temperature – heat treatment and grain orientation on magnetic properties – losses in magnetic materials – Hysterisis loss – factors affecting permeability and hysteresis loss.

Special purpose materials:

Soldering materials – properties, materials for hard soldering and soft soldering.

Fuse materials – properties of fuse materials- re-wirable fuses, HRC fuses.

Contact materials – classification, materials for light and moderately loaded contacts.

Learning Resources

Text Book:

R.K.Rajput , "Electrical engineering Materials", Laxmi Publications

Reference Books:

1. G.K. Mithal, "Electrical Engineering Materials", Khanna Publication 2nd Edition.
2. A.J. Dekker, "Electrical engineering Materials", Prentice Hall of India eprinty 2005
3. C.S. Indulkar and S.Thiruvengadam “An Introduction to electrical engineering materials”, S.Chand & Co
4. "Electrical engineering Materials" by T.T.T.I, Madras
5. S.P.Seth, “A course in electrical engineering materials" Dhanapatrai & Sons, New Delhi

Web resources:

1. <http://nptel.ac.in/courses.php>
2. <http://jntuk-coeerd.in/>