

## 2/4 B.Tech SECOND SEMESTER

EE4T5

MATERIAL SCIENCE

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks

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### OBJECTIVE:

1. To make understand the different types of materials and their properties
2. To give knowledge about the conducting materials
3. To give knowledge about the insulating materials and their applications
4. To acquire the knowledge about the dielectric materials in static fields
5. To study the behaviour of dielectrics in alternating fields
6. To have knowledge about magnetic materials
7. To have knowledge about the atomic interpretation to magnetic properties of materials.
8. To have knowledge about the measurement of electric and magnetic parameters

### LEARNING 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 behaviour of dielectrics in static and alternating fields .
4. Student will learn completely about the magnetic properties of the materials
5. Students will acquire the knowledge about measurement of electrical and magnetic parameters .

### **Unit -1 Introduction to materials:**

Classification of materials: difference between metals and non – metals, atomic and electronic Transitions. Atom arrangement in material , classification of electrical engineering materials: conductors, insulators and semiconductors, magnetic materials, Energy band description of materials, properties of engineering materials- Physical, electrical , mechanical, magnetic and chemical (Electrical Engg. Materials by R. K. Rajput)

### **Unit 2: Conducting Materials:**

Conductors ,factors affecting resistivity of electrical materials electrical conducting materials - lamp , filament, transmission lines, contact materials, stranded conductors, skin Effect Thermal and electrical conductivity of metals, and some applications of conducting materials ,conductivities of semiconductors and properties of semiconducting materials for Ge,Si .hall effect ( Electrical Engg. Materials by R.K.Rajput

### **Unit 3: Insulating materials and their applications:**

Classification of insulating materials-solids ,liquids, gases and fibrous materials ,factors affecting the characteristics of insulating materials ,materials for electrical devices ,properties of insulating materials- physical, electrical ,mechanical ,thermal chemical and their engineering applications (Electrical Engg. Materials by R.K.Rajput)

**Unit 4: Dielectric Properties of Insulators in Static Fields:**

Static dielectric constant, Polarization and dielectric constant, Atomic interpretation of the dielectric constant of monatomic gases Qualitative remarks on the dielectric constant of polyatomic molecules, Internal field in solids and liquids, Static dielectric constant of solids, Some properties of ferroelectrics materials, Spontaneous polarization, Piezoelectricity. (Electrical Engg. Materials by S.P.Seth)

**Unit 5: Behavior of Dielectric in Alternating Fields:**

Frequency dependence of the electronic polarizability, Ionic polarization as a function of frequency, Ionic conductivity in insulator complex dielectric constant of non-dipolar solids, dipolar relaxation, dielectric losses. (Electrical Engineering materials by S.P.Seth)

**Unit 6: Magnetic Properties of Materials:**

Summary of concepts pertaining to magnetic fields, Magnetic dipole moment of a current loop,

Magnetization from a macroscopic viewpoint, orbital magnetic dipole moment and Angular momentum of two simple atomic models, Lenz's law and induced dipole moments. (Electrical Engineering Materials by G.K.Mitthal)

**Unit 7: Atomic Interpretation of Magnetic Properties of Materials:**

Classification of magnetic materials, diamagnetism, origin of permanent magnetic dipoles in matter, paramagnetic spin systems, properties of ferromagnetic materials, spontaneous magnetization Ferroelectric materials.,B-H curve ,Losses in magnetic materials (Electrical Engg. Materials by R.K.Rajput) and the Curie Weiss law, Ferromagnetic domains and coercive force, Antiferromagnetic materials,

**Unit 8: Measurements of electrical and magnetic properties:**

Introduction, conductivity measurements, dielectric measurements, magnetic measurements, measurements of Semiconductor parameters (Electrical Engineering Materials by C.S. indulkar, S.thiruvengadam, S.Chand &company)

**Text Books:**

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

**Reference Books:**

1. G.K. Mithal, "Electrical Engineering Materials", Khanna Publication 2nd Edition.
2. Robert M. Rose, "Structure and Properties of Materials", Willey Eastern Vol. IV
3. S.O. Pillai, "Solid State Physics", New Age International
4. Kakni, "Material Science", Tata McGraw Hill
5. A.J. Dekker, "Electrical engineering Materials", Prentice Hall of India Reprinty 2005

