

I Year I Semester

Code: 20ES1013

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MATERIAL SCIENCE

Course Objectives:

1. To introduce the fundamental concepts of Material Science and the classification of materials
2. To understand different types conducting, semiconducting, magnetic, nano, micro and smart materials

Course Outcomes:

A student who successfully fulfils this course requirement will be having:

1. An ability to understand the fundamental concepts of Material science
2. An ability to classify different materials
3. An ability to illustrate the characteristics of conducting materials
4. An ability to understand the characteristics of Semiconducting and Magnetic materials
5. An ability to understand the principles of Nano, Micro and Smart materials

UNIT-I: Fundamental concepts of Material Science

Atomic structure and bonding in materials, Crystal structure of materials, crystal systems, unit cells and space lattices, miller indices of planes and directions, packing geometry in Metallic, Ionic and Covalent solids, Crystal growth techniques, Imperfections in crystalline solids and their role in influencing various properties.

UNIT-II: Classification of materials

Metals and Alloys: Importance of alloying, microstructure, properties and applications of ferrous and non-ferrous alloys (Al, Cu and its alloys). **Ceramics:** Structure, properties, processing and applications of traditional and advanced ceramics. **Polymers:** Classification, polymerization, structure and properties, additives for polymer products, processing and applications. **Composites:** Properties and applications of various composites

UNIT-III: Conducting Materials

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (Manganin, Constantan, Nichrome, Tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

UNIT-IV: Semiconducting and Magnetic Materials

Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basics of amorphous and organic semiconductors. **Magnetic Materials:** classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.

UNIT-V: Nano, Micro and Smart Materials

Nano Materials: Nano material – definition, properties and applications.

Micro Electronic Materials: Introduction, special properties of silicon, Manufacturing of IC chips.

Smart Materials: Introduction, classification and applications of intelligent materials.

Text Books:

1. Materials Science and Engineering: An Introduction – William D.Callister Jr., John Wiley & Sons Inc.
2. Material science and Engineering – V. Raghavan, Prentice Hall of India
3. Essential of Materials Science and Engineering – Donald R.Askeland, Cengage

Reference Books:

1. Material Science for Engineering Students – Fischer, Elsevier Publishers
2. Introduction to Physical Metallurgy – Sidney H. Avenner, McGraw Hill
3. Materials Science and Metallurgy – C.DanielYesudian, D.G.Harris Samuel, SciTech
4. Material Science and Metallurgy for Engineers –V.D.Kodegire, SV Kodigire