

G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE
(For Women)

(AUTONOMOUS)
Shaikpet, HYDERABAD - 500 104

B.Tech. II year , II-Semester

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MATERIAL SCIENCE
(Common to ECE, EEE & ETE)

Course Objectives: The students will be able

1. To understand basic introduction to the different classes of materials relevant to Engineering in general.
2. To understand to relate the underlying molecular structure of the materials to their physical and chemical properties
3. To classify the materials and their applications.
4. To know the environmental and social issues in material science

UNIT 1: (10 Lecture Hours)

Introduction: classification of engineering materials, levels of structure , structure property relationships in materials, Atomic Bonding - Ionic, Covalent, metallic Bonding, Hydrogen and Vander Waal's bonding. Crystal Structure: -Basic definitions, Space lattice, Crystal structures of metals - Simple cubic structure, Body centered cubic structure, Face centered cubic structure, Hexagonal closely packed structures, packing of atoms inside solids.

Classification of polymers, structure of long chain polymers, structure of silica and silicates.

UNIT 2: (10 Lecture Hours)

Types and applications of materials- Ferrous alloys, Non-ferrous alloys, Glasses, Ceramics, Plastics, Fibres.

Mechanical properties of metals: Yield strength, tensile strength and ductility of materials, tensile stress- strain curve. Plastic deformation- Plastic deformation by slip, Deformation by twinning, types of twins, Necking.

Creep- Mechanism of Creep and Creep resistant materials. Fatigue- Stress cycle, Fatigue failure, mechanism of fatigue failure

UNIT 3: (8 Lecture Hours)

Thermal properties of metals- Heat capacity, thermal expansion, thermal conductivity, thermal stress, thermal fatigue, thermal shock.

Electrical properties of metals- Electrical conductivity, electronics and ionic conduction, energy band structures in solids, electrical resistivity of metals, electrical characteristics of alloys used for commercial purposes.

UNIT 4: (8 Lecture Hours)

Magnetic materials: Terminology and classification, magnetic moments due to electron spin, ferromagnetism and related phenomena, soft magnetic materials and hard magnetic materials.

Dielectric materials; Polarization, temperature and frequency effects, electric breakdown, ferroelectric materials.

Insulating materials: Types and Properties

1) N. Mallikarjuna

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2) N. Subrahmanyam

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4) S. Srinivasulu

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UNIT 5: (8 Lecture Hours)

SPV Materials, mono crystalline and poly crystalline materials, amorphous materials
Nano materials- Classification of nano materials, processing of nano materials and properties of nano materials-mechanical, electrical, magnetic and other properties of materials.

Material selection- Economic consideration, Environmental and societal considerations. Issues in material science - Recycling issues in material science.

Text Books

1. V. Raghavan Material Science and Engineering : A first course , 6th edition prentice Hall India ,2016
2. S.L. Kakani , Amit kakani, Material science , New age international (p) limited publishers,2006
3. William D.Callister, David G.Rethwisch, Material Science and Engineering : An introduction, 7th Edition ,Wiley publisher

Reference Books

1. I.P..Sing, Subhash Chander ,Rajesh K.Prasad, Material science & Engineering, Jain brothers.2014
2. William F.Smith, Javad Hastami, Ravi Prakash, Material Science and Engineering, McGraw Hill education, 5th edition. 2014.
3. M. Armugam, Material Science ,Anuradha publications.

Online Resources :

1. <https://freevidelectures.com>
2. Online courses: <https://onlinecourses.nptel.ac.in>

Course outcomes: At the end of the course students should be able to

1. Identify crystal structure for various materials
2. Understand the mechanical properties of metals
3. Classify the metals and their applications
4. Assess the thermal and electrical properties of metals
5. Classify the Nonmaterial and properties
6. Analyse the economic, environmental and social issues in material science

1) N. Mallesh

2) S. Subramanian

3) S. S. Subramanian

4) S. S. Subramanian

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15) S. S. Subramanian

16) R. Balasubramanian