GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 3

Metallurgy Engineering

Subject Code 132101

Subject Name **Elements of Metallurgy and Material Science**

Sr.No	Course content
1.	**Introduction to Material Science and Metallurgy :** Classification of Engineering Materials, Engineering requirements of materials, Structure-property relationships in materials, Properties of engineering materials, Criteria for selection of materials for engineering applications.
2.	**Metallic materials :** Types, Properties and applications, Imperfection in crystals, Elastic and plastic deformation of metallic materials, Cold working and annealing, effects of grain size, alloying elements and heat treatment on properties of single phase and two phase materials, Processing of metals.
3.	**Ceramic materials :** Classification of ceramics, Structure of ceramics, Properties of Ceramics, Conventional Ceramic and Glass structures, Glass products in general, glass ceramics, Traditional ceramics, Brick and tile, Cement and cement products, Refractories, Advanced ceramics for electrical and magnetic use, Abrasives, Processing of ceramics and glasses.
4.	**Organic materials :** Polymerization mechanisms, Polymer structures, Classification of polymers, Plastics, Synthetic resins, Rubber, Fibres and filaments, Behaviour of polymers. Processing of polymers, Protective coatings
5.	**Composite materials :** Classification, Wood-A natural composite, Asphalt concrete, Brief description of metal matrix, polymer matrix and ceramic matrix composites, Advanced composites, Processing of composites, Nanocomposites.
6.	**Electronic, Optical and Magnetic materials :** Conductors, Insulators, Ferroelectrics, Piezoelectrics, Semiconductors, Lasers, Optical fibers, Liquid crystal displays, Photoconductors, Metallic magnets, Superconducting magnets, Ceramic magnets.
7.	**Scope of metallurgy :** Various fields of metallurgical engineering, Status of metallurgical and materials industry in India.

8.	**Occurance of important ores and minerals :** Sources of metals Basic outline of the principles of production of iron and steel, copper, aluminium, zinc, lead.
9.	**Introduction to foundry metallurgy :** Moulding, Melting and Casting methods.
10.	**Metal forming :** Rolling, Forging, Extrusion, Wire drawing, tube drawing, Powder metallurgy.
11.	**Metal joining:** Welding, Soldering, Brazing.
12.	**Testing of metals and alloys:** Destructive tests: Hardness, Tensile strength, Ductility Non-destructive tests: Dye penetrant, Radiography, Ultrasonic, X-ray Radiography, X-ray Fluoroscopy
13.	**Material degradation and Preventive Measures:** Corrosion: Principle, Causes, Types & Characteristics. Corrosion Testing. Corrosion Prevention Methods Degradation of plastics & composite materials

Reference Books:

1. Material Science and Engineering: An Introduction , W. D. Callister, John Wiley.
2. Introduction to Materials Science for Engineers, James, F. Shackelford, Prentice Hall.
3. Engineering Materials and their Applications, Richard A. Flinn and P. K. Trojan, Jaico Pub. House.
4. Elements of Materials Science, L. H. Van Vlack, Addison-Wesley.
5. The Science and Engineering of Materials, Donald R. Askeland and Pradeep P. Phule, Thomson.
6. Elements of Metallurgy, D. Swarup, Banaras Hindu University Press, Varanasi.
7. A Text book of Metallurgy, A. R. Bailey, Macmillan & Co Ltd., London.
8. Materials Science and Processes, S. K. Hajra Choudhary, Indian Book Distributing Co., Ilifo book distributiors Co., Kolkata, 1985
9. Corrosion Engineering, Fontanna M. G. and Green N. D., McGraw Hill.