

Devi Ahilya University, Indore, India Institute of Engineering & Technology				II Year B.E. (Mechanical Engg.) (Full Time)			
Subject Code & Name	Instructions Hours per Week			Credits			
MER3C3 MATERIAL SCIENCE	L	T	P	L	T	P	Total
Duration of Theory Paper: 3 Hours	3	1	2	3	1	1	5

Learning Objectives:

1. To render the information that involves investigating the relationship that exists between the structures and properties of materials.
2. To provide the knowledge of Engineering Materials.
3. To give basic concepts of Material properties in terms of their utilization in machine design.
4. To provide the knowledge about testing of materials.

Pre requisite(s): Engineering chemistry, Engineering Physics.

COURSE CONTENTS

UNIT-I

Description of Crystal Structure and Imperfections in metal crystals : Review of crystal structure :Seven Crystal System. Bravais lattice. Symmetry and properties of simple crystal structure, Millers indices. Imperfections in metal crystals, Point Defects, Edge Dislocation, Screw dislocations slip planes.

UNIT-II

Ferrous and Non-Ferrous Metals and Alloys : Properties and application of various steels and cast iron. Effect of impurities, in ferrous metals. Effect of common alloying elements on the steels, High speed steels, Stainless steel, Other steel. Corrosion and its prevention. Composition, microstructure, properties and applications of Aluminum and its principle alloys, Copper and its principle alloys, Nickel and its principle alloys.

UNIT-III

Concept of Phase Diagrams and Equilibrium Diagrams : Iron Allotropy, cooling curves, phase diagrams, Gibbs phase rule, Various types of phase diagrams, Interpretation of Phase diagrams, Iron carbon equilibrium diagram, Classification of Equilibrium Diagrams: Eutectic, Eutectoid and Peritectic transformation, Iron carbon equilibrium diagram, TTT diagrams, Comparison of Iron carbon equilibrium diagram and TTT diagrams.

UNIT-IV

Heat Treatment of Metals and Alloys and Powder metallurgy : Classification of Heat treatment processes, Surface or case hardening of steel, Defects in heat treated parts. Manufacturing of metal powders. Sintering and secondary operations. Design considerations and applications.

UNIT-V

Metallography , Destructive and Non-Destructive Testing : Introduction to Metallography, Study of sample preparation and metallurgical Microscope. Study of Mechanical Properties and their significance in Engineering Applications, Classification of testing of materials, Tensile, Compression, Bend, Torsion, Fatigue, Impact, Hardness, Creep Tests, Ultrasonic, Magnetic, Radiography Tests etc.

Learning Outcomes :

After Completing the Course, Student will be able to:

1. Have the knowledge of materials.
2. Understand the mechanical properties of materials.
3. Know about the development of new materials having comparable properties.
4. Consider the “cradle-to-grave” life cycle of materials relative to machine design and manufacturing processes.

BOOKS RECOMMENDED:

- [1] Callister W.D.Jr., Materials Science and Engineering an Introduction, Wiley Publications(P) Ltd,2004.
- [2] Askeland D. R.,Fulay,P.P., Essentials of Materials Science and Engineering, Cengage Learning Publications,2010
- [3] Raghavan, V.,Materials Science and Engineering, Prentice-Hall of India (P) Ltd.,2001.
- [4] Khanna, O.,P., Material Science and Metallurgy, Dhanpat Rai Publications,2005

LIST OF PRACTICAL ASSIGNMENT

1. Performance of hardness test of ferrous materials using Rock Well hardness testing machine
2. Performance of magnetic particle crack detection to detect the cracks
3. Performance of impact test on a plastic test sample to detect impact strength of material.
4. Performance of crack detection using ultrasonic crack detector.
5. Study and perform steps involved in sample preparation for observing the microstructure under metallurgical microscope
6. Study and perform various heat treatment process using muffle furnace
7. Study of construction and function of metallurgical microscope.
8. Study of microstructures of ferrous metal alloys
9. Study of iron carbon diagram
10. Study of T.T.T. diagram
