



SILVER OAK UNIVERSITY
College of Technology (01)
Diploma in Mechanical Engineering
Subject Name: Materials Science and Metallurgy
Subject Code: 1010122211
Semester:3rd

Prerequisite: Zeal to learn the subject

Objective:

Basic principles of science are used to study the structure-properties relationships of various materials for their proper applications in this subject. Especially study of different types of ferrous and non-ferrous metals and alloys, in terms of their composition, structure, properties and applications; non-destructive testing are included in this course to understand the basic concept of selection and processing of metals and materials for their applications. Corrosion covers the mechanism, types and prevention techniques.

Teaching and Examination Scheme:

Teaching Scheme					Evaluation Scheme				Total Marks
L	T	P	Contact Hours	Credit	Theory		Practical		
					CIE (TH)	ESE (TH)	CIE (PR)	ESE (PR)	
3	0	2	5	4	40	60	30	20	150

Content:

Unit No.	Contents	Teaching Hours	Weightage %
1	INTRODUCTION OF ENGINEERING MATERIALS: Definition: Material science and Metallurgy, Engineering Materials: their Classifications and Application, Engineering requirements of materials, Criteria for selection of materials for engineering Applications. Properties of Engineering materials: Mechanical, Electrical, Chemical, Physical, Thermal and Technological Properties.	5	15
2	Structure of Materials: Unit Cell, Crystal structure, Bravais lattice, atomic packing, coordination number, crystal structures of metallic elements, crystal directions and planes, Miller indices, Mechanism of crystallization - nucleation and growth, factors influencing nucleation and growth.	6	10
3	Phase Diagram: Structure of solids, Solidification of metals, Classification of Equilibrium diagram, Gibb's phase rule, Hume-Rothery rules. Allotropy of Iron, Iron carbon diagrams.	8	15
4	FERROUS METALS AND ITS ALLOYS: Concept and classification of Ferrous metals and its alloys. Types of	6	15

	cast iron, their properties and applications. Types of steel, their properties and applications. Effect of alloying elements on steel and cast iron. Standards and designations of steel and cast iron as per BIS.		
5	Heat Treatment of Steel and TTT diagram: Time-Temperature-Transformation Diagram, Isothermal and continuous transformations. Study of heat treatment processes such as annealing, normalizing, spheroidizing, hardening, tempering, carburizing, Nitriding, cyaniding, induction hardening, flame hardening and hardenability of steel, Heat treatment furnaces.	9	15
6	Non-ferrous alloys: Types, Properties and Applications of copper, aluminium, magnesium, titanium, lead, tin, zinc, nickel, manganese and its alloys.	5	10
7	Non Metallic Materials: Types, applications and properties of non-metallic materials such as Plastics, Ceramics, Composite, Rubber, Glass and Refractory materials.	5	10
8	Metallography: Metallurgical Microscope, Preparation of Specimen Microscopic Examination.	*	10

***Note: Topic No. 8 of the above syllabus is to be covered in Practical Hours**

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	Understand the basic concept of Material Science and Metallurgy	1,2
CO-2	Identify various ferrous and non-ferrous metals and alloys based on composition, properties and application	4,6,7
CO-3	Recommend heat treatment of steel material using phase diagram	3,5
CO-4	Analyze the microstructure of ferrous and nonferrous material.	8

Teaching & Learning Methodology:

The various methods or tools follows by the faculties to teach the above subject are:

1. Chock and Board
2. PPT
3. Flip Class Room
4. Video Animations

List of Experiments/Tutorials:

1. To study different crystal structure and atomic packing Factors of materials.
2. To get acquainted with the operation, construction, use and capabilities of a metallographic microscope.
3. To study procedure of specimen preparation for microscopic examination and to carry out a specimen preparation.
4. To understand what is micro examination, importance of micro examination and to study various ferrous, non-ferrous microstructures.

5. To identify the different types of material available for design, manufacturing and processing of various components based on structure-property-performance processing relationships.
6. Study various heat treatment processes and perform hardening process on ferrous material. Measure the hardness before and after hardening.
7. To understand the concept of hardenability and its relevance to heat treatment procedure to be adopted in practice.
8. Study various heat treatment furnaces.
9. Study of different heat treatment processes- annealing, normalizing, hardening and tempering, surface and casehardening to improve properties of steel during processes and applications.

Major Equipment:

1. Metallurgical microscope, Standard specimen set of steel, cast iron and non-ferrous metals and alloys
2. Muffle furnace, standard specimens of steels and cast iron for heat treatment
3. Hardness tester
4. Universal tensile testing machine.

Books Recommended:

1. Callister's Material Science and Engineering, R. Balasubramaniam, Wiley India.
2. Material science and Metallurgy, O.P. Khanna, Dhanpat Rai Publication.
3. Elements of Material Science and Engineering, Lawrence H. Van Vlack, Pearson Education.
4. Raghavan V., Materials Science and Engineering- A first Course, PHI publication
5. Material Science, R.K. Rajput, Laxmi Publication, Dariyaganj, New Delhi
6. Principles of Materials Science and Engineering, W F Smith, McGraw Hill.
7. Materials Science and Metallurgy, K. I. Parashivamurthy, Pearson Education.
8. Physical Metallurgy, Sydney H. Avner, Tata McGraw-Hill.

List of Open Source Software/learning website:

1. <http://silveroakuni.ac.in/video-lecture>
2. <https://nptel.ac.in>
3. www.vlab.co.in