



Semester –III

Subject Code: 09ME1304

Subject Name: MATERIAL SCIENCE AND METALLURGY

Objective: Engineering Materials play an important role as the vital tool for solving the problems of material selection and application in the production and manufacturing of equipment/machines, devices, tools, etc. Hence, this course provides the fundamental science and principle relevant to material. Furthermore, course provides the understanding the relationship between microstructure and properties of material. This course possess the knowledge about phase diagrams, various types of heat treatment processes, electrolysis and powder metallurgy concept. Therefore, an engineering diploma student must be conversant with the properties, composition and behaviour of materials from the point of view of reliability and performance of the product. Subject is concerned with the changes in structure and properties of matter. The study of basic concepts of material science and metallurgy will help the students understanding engineering subjects where the emphasis is laid on the application of these materials

Credits Earned: 4 Credits

Course Outcomes: After completion of this course, student will be able to

- To identify the properties of metals with respect to crystal structure and grain size.
- Understand the concept of phase diagrams of material.
- Classify the ferrous and non ferrous metal.
- To understand various heat treatment processes.
- To understand concept of powder metallurgy.

Pre-requisite of course: Applied Mechanics

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
3	0	2	4	50	30	20	25	25	150



Contents:

sr.no.	Topics	Teaching hrs.	Weightage
1	ENGINEERING MATERIALS: Types of bonds, Construction and characteristic of electrovalent, covalent, hydrogen and metallic, Intermolecular force of attraction, Molecular arrangement in different phases, Structure of solid, Properties of material, Solidification of metals	05	10
2	PHASE DIAGRAMS: Equilibrium diagrams, Time Temperature Transformation curve-(TTT curve), Iron carbon equilibrium diagram, Concept, characteristics & need, Heat treatment processes, Annealing, normalizing, carburizing, case hardening, hardening, tempering etc, Types of furnaces, Quenching mediums	10	25
3	METALLURGICAL MICROSCOPE: Metallographic examination and microstructures need and importance, Principle & working of metallurgical microscope Preparation of specimen for microscopic examinations	3	8
4	METALS AND ITS ALLOYS: Classification of metal, Flow diagram for the production of iron and steel, ferrous metal and classification, Non ferrous & classification, Composition and properties, Coding method as per BIS, ASME, Microstructure mostly used for ferrous and non ferrous material.	10	24
5	NON METALLIC MATERIALS: Introduction and classification of non metallic material, Classification of Polymers, Properties and applications of polymers, Surface coating methods, setup, working, Composites, Non metallic material properties, Designation & coding.	06	13
6	ELECTROLYSIS: Introduction, Electrolytes and Non-electrolytes, Types of electrolytes, Construction and working of electrochemical cell, Standard conditions, Corrosion-types and reasons.	04	10
7	FLUID AND POWDER MATERIALS: Classification of fluid and powder materials, Oils, Types and properties, Designation methods as per BIS, Paints and varnishes, Powder metallurgy	04	10



References:

1. Materials science by R.K. Rajput, Laxmi publication, dariya ganj, New Delhi.
2. Materials science by R.S.khurmi and R.S. sedha by S. chand publication.
3. Physical Metallurgy by Sidney Avner by Tata Mc-grawhill education, 2011
4. Materials science and Metallurgy by D.S. Nutt by S.K. katariya and sons publication, New Delhi.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
28%	35%	37%	-	-	-

Suggested List of Experiments:

1. Factors affecting the selection of material and properties of material
2. To study about various types of heat treatment processes
3. Perform hardening process on material. Measure the hardness before and after hardening.
4. Examine the given specimen by use of Metallurgical microscope.
5. Prepare ferrous micro specimen and examine them.
6. Prepare non ferrous micro specimen and examine them.
7. To study about various types corrosive materials.
8. Visit one relevant industry which has specifically heat treatment processes.
9. Machine component...

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory



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