INSTITUTE	**DIPLOMA STUDIES**
PROGRAM	**DIPLOMA ENGINEERING (MECHANICAL ENGINEERING)**
SEMESTER	**3**
COURSE TITLE	**MATERIAL SCIENCE AND METALLURGY**
COURSE CODE	**09ME2304**
COURSE CREDITS	**3**

Objective:

1 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 behavior 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

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

1 To identify the properties of metals with respect to crystal structure and grain size.
2 Understand the concept of phase diagrams of material.
3 Classify the ferrous and nonferrous metal.
4 To understand various heat treatment processes.
5 To understand concept of powder metallurgy.

Pre-requisite of course: Applied Mechanics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
2	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
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, Nano Materials	5

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Contents : Unit	Topics	Contact Hours
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	2
3	**METALLURGICAL MICROSCOPE** Metallographic examination and microstructures need and importance, Principle & working of metallurgical microscope, Preparation of specimen for microscopic examinations	3
4	**METALS AND ITS ALLOYS** Classification of metal, Flow diagram for the production of iron and steel, ferrous metal and classification, Nonferrous & classification, Composition and properties, Coding method as per BIS, ASME, Microstructure mostly used for ferrous and nonferrous material	6
5	**NON METALLIC MATERIALS** Introduction and classification of nonmetallic material, Classification of Polymers, Properties and applications of polymers, Surface coating methods, setup, working, Composites, Nonmetallic material properties, Designation & coding	6
6	**ELECTROLYSIS** Introduction, Electrolytes and Non-electrolytes, Types of electrolytes, Construction and working of electrochemical cell, Standard conditions, Corrosion-types and reasons	2
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	4
Total Hours		**28**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Demonstration of metallurgical microscope** Demonstration of metallurgical microscope	2
2	**Examine the microstructure of given specimen by metallurgical microscope** Examine the microstructure of given specimen by metallurgical microscope	2
3	**Preparation of specimen and observe microstructure** Preparation of specimen and observe microstructure	2
4	**Tension test on ductile material** Tension test on ductile material	2
5	**Hardness testing of given material using BHN test** Hardness testing of given material using BHN test	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	**Hardness testing of given material using RHN test** Hardness testing of given material using RHN test	2
7	**Heat treatment process on mild steel to study effect of annealing process** Heat treatment process on mild steel to study effect of annealing process	2
8	**To show the effect of different quenching media (Oil, Water) on the hardness of mild steel** To show the effect of different quenching media (Oil, Water) on the hardness of mild steel	2
9	**To study about various types of corrosive materials** To study about various types of corrosive materials	2
10	**To understand designation and coding of ferrous and nonferrous metals** To understand designation and coding of ferrous and nonferrous metals	2
11	**To understand the process of powder metallurgy** To understand the process of powder metallurgy	2
12	**Selection of suitable material for given application** Selection of suitable material for given application	2
13	**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	2
14	**ELECTROLYSIS** Introduction, Electrolytes and Non-electrolytes, Types of electrolytes, Construction and working of electrochemical cell, Standard conditions, Corrosion-types and reasons	2
Total Hours		**28**

Textbook :

1 Material Science and Metallurgy, G H Upadhyay, Atul Prakashan, 2018

References:

1 Materials science, Materials science, R.K. Rajput, Laxmi publication, dariya ganj, New Delhi, 2013

2 Materials science, Materials science, R.S. Khurmi, S. chand publication, 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as 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 / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking**
28.00	35.00	37.00			

Instructional Method:

1. 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, Quiz, Virtual lab, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses.

Supplementary Resources:

1. https://nptel.ac.in/courses/113106032

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