

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN MECHATRONICS ENGINEERING

SEMESTER: V

Subject Name: **Materials Science**

Sr. No.	Course content
1.	Introduction and Properties of Engineering Material : 1.1 Introduction, need, classification of metals and non-metals. 1.2 Materials Properties. <ul style="list-style-type: none"> • Mechanical • Chemical Properties • Thermal Properties • Electrical / Electromagnetic 1.3 Stress and strain-concept, relationship
2.	Metallurgical Consideration of Metals : 2.1 The concept of crystalline structure of metal, BCC, FCC, HCP. 2.2 The concept of solidification of metals, crystal, grain, grain boundaries, dendritic solidification, effect of cooling rates on material properties. 2.3 Equilibrium diagrams 2.5 TTT Curve, applications. TTT curve for stainless steel 2.6 Iron-carbon equilibrium diagram and its characteristic.
3.	Ferrous Metals and its Alloys: 3.1 Introduction and classification of ferrous metals. 3.2 Flow diagram for production of Iron and steel. 3.3 Ferrous metals – standards & designations (According to BIS, EN, ASME, JIS, DIN), composition, properties and uses. 3.4 Alloying of metals-properties and effect 3.5 Shape memory alloys-concepts, materials, properties, applications 3.6 Coding of alloy steels as per BIS, DIN, ASME, EN and JIS, comparisons and equivalents. Introduction and designation/standards (as per BIS, DIN, ASME, EN and JIS) of sponge iron, properties and applications 3.7 Microstructures study of ferrous metals
4.	Non Ferrous Metals and its Alloys: 4.1 Role of non ferrous metals and its alloys related to engineering field. 4.2 Types, properties, capabilities, designations (According to BIS, EN, ASME, JIS, DIN), composition, and industrial applications of : <ul style="list-style-type: none"> • copper alloys. • aluminum alloys. • bearing metals. 4.3 Microstructure study of all non ferrous metals.

5.	Non Metallic and Composite Materials: 5.1 Introduction ,main composition and applications of non metallic material -Plastic, rubbers, ceramic, refractories, insulators, abrasives, lubricants, adhesives, fiber and Teflon. 5.2 Composite materials-concept, structure, common materials, properties ,advantages and industrial applications.
6.	Heat Treatment: 6.1 Introduction to heat treatment 6.2 Types, method /process, process parameters and applications of various heat treatment processes/methods 6.2 Study of quenching medias and their properties.
7.	Selection and Specification of Materials: 7.1 Types of commercially available materials. 7.2 Specification of metals as per BIS, EN,ASME,JIS, and DIN 7.3 Factors to be considered while selecting material.
8.	Non-Destructive Testing: 8.1 Working principle, working, equipment specification, process parameters ,procedure, and applications of various nondestructive testing methods.
9.	Powder Metallurgy: 9.1 Basic concept of powder metallurgy and its applications, merits, demerits. 9.2 Manufacturing process of powder metallurgy.
10.	Surface Coatings: 10.1 Needs and scope of surface coatings 10.2 Procedure and method of preparing surface 10.3 Procedure of various surface coating methods 10.2 Types of surface coatings and applications

Laboratory Experiences :

Experience Number	Description of Laboratory Experience
1	Given various items of metals, identify materials of them. Also state the criteria to identify the material. State properties of each material. Also identify main alloying elements and reasons to add them.
2	Demonstration and study of Microscope.
3	Prepare ferrous micro specimens and examine them. Also prepare report on this.
4	Prepare non-ferrous micro specimen and examine it. Also prepare report on this.
5	Demonstration and study of Heat treatment furnaces.

6	Perform hardening process on various steel components. Measure the hardness of hardened components.
7	Perform hardening process specific material. Vary the quenching media and temperature. Prepare a comparative report on hardness of component varying quenching media and temperature.
8	Seminar preparation and representations by students. Each student is expected to deliver the talk for 10 minutes. Topic should be covered from the chapters not being covered in practicals.
9	Demonstration/Industrial visit on non destructive testing/heat treatment processes/surface coating/powder metallurgy. Also prepare industrial visit report.

NOTES :

1. Term work report content of each experience should also include following.
 - a. Experience description / data and objectives.
 - b. Skill/s which is / are expected to be developed in student after completion of experience.
 - c. Drawing of experience / setup with labels/nomenclature to carry out the experience
 - d. The specifications of machines / equipments / devices / tools / instruments / items/elements which is / are used to carry out and to check experience.
 - e. Process parameters / setup settings' values applied to carry out experience.
 - F Steps / Process description to execute experience.
 - g. Observations
 - h. Information on recent machines / equipments / devices / tools / instruments / items available in market to carry out the experience. e.g. Special / Additional notes or remarks.
2. Term work report of student of regular mode should exclude Distance Learning manual, photocopies , printed content, etc. Focus should be on developing the term work as original efforts of students.
3. Term work content of industrial visit report should also include following.
 - a. Brief details of industry visited.
 - b. Type ,location, products, rough layout, human resource, etc of industry.
 - c. Details, description and broad specifications of machineries/processes observed.
 - d. Safety norms and precautions observed.
 - e. Student's own observation on Industrial environment, culture and attitude.
 - f. Any other details / observations asked by accompanying faculty.
4. Term work also includes experience logbook duly certified by subject teacher/s.

Reference Books:

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| 1. Materials & Metallurgy | - G.B.S. Narang |
| 2. Workshop Technology Vol.I | - Hajara & Chaudhary. |
| 3. Material Science & Processes | - G.R.Nagpal |
| 4. Elements of Engg. Metallurgy | - S.P.Nayak |
| 5. Elements of Metallurgy | - Dr.Swaroop |
| 6. Heat Treatment of Metals | - Zakharov |
| 7. B.I.S.,ASME.DIN.JIS for materials. | |
| 8. Materials science for engineers – James F. Shackelford, Madanapalli K. Murlidhara, PEARSON Education | |