GUJARAT TECHNOLOGICAL UNIVERSITY

Diploma in Fabrication Technology

Semester: 3

Subject Code
Subject Name MATERIALS & METALLURGY

Sr. No.	Course content
1	**INTRODUCTION TO ENGINEERING MATERIAL :** 1.1 Need, scope & importance of material science in industries 1.2 Classification of engineering material 1.3 Properties of engineering Material 1.4 Factor affecting the selection of material for engineering purposes. 1.5 Commercial form of material used in industry 1.6 Identification of metal & alloy
2	**CODED FERROUS METAL IN INDUSTRY :** 2.1 Classification of ferrous metal & alloy. 2.2 Chemical composition, classification, characteristic & application of Pig iron, cast iron, steel, low alloy steel, High alloy steel (stainless steel) 2.3 Effect of alloying elements on properties of steel alloy steel, stainless steel, forged steel & cast iron 2.4 Study of material test certificate with reference to ASME code
3	**CODED NON FERROUS METAL IN INDUSTRY :** Chemical composition characteristic & application of 3.1 Copper & its alloys 3.2 Aluminum & its alloy 3.3 Ni & its alloy 3.4 Titanium & its alloy
4	**NON METALLIC & MISCELLANEOUS MATERIAL :** 4.1 Classification of non metallic material 4.2 Properties & application of elastomer, plastic, composite, Teflon , glass wool , glass, adhesive & insulating materials 4.3 Cladded Material -- Introduction , Objective of cladding ,Available forms of cladded material, Methods of cladding, Application of cladding
5	**PHYSICAL METALLURGY :** 5.1 Crystallography -- Type of solid, Structure of atoms, Space lattice, Unit cell 5.2 Study of different crystal structure of metal like, BCC, FCC, HCP 5.3 Introduction & types of solid solution 5.4 Phase diagram

	5.5 Iron Carbon system 5.6 Solidification of metal 5.7 Metallography
6	**HEAT TREATMENT :** 6.1 Classification of heat treatment process 6.2 Purpose of heat treatment process 6.3 Introduction to annealing, normalizing, hardening by quenching, tempering Process, Austempering, Martempering & maraging 6.4 Case Hardening & Surface treatment
7	**FAILURE & STRENGTHENING OF METALS :** 7.1 Failure analysis 7.2 Fracture -- Definition, Process, types & mechanism 7.3 Fatigue -- Fatigue limit, mechanism, characteristics of fatigue fracture, fatigue loading, fatigue damage 7.4 Creep -- Definition & concept, Creep curve, low temperature & high temperature creep, mechanism , creep fracture 7.5 Solid solution hardening 7.6 Age hardening 7.7 Particulate strengthened system 7.8 Phase transformation hardening 7.9 Strain hardening 7.10 Strain ageing
8	**CODE & STANDARD :** 8.1 Need, Scope & importance of codes & standards in industries 8.2 Introduction of codes and standard ASME-II-A,B,C,D ,DIN,ASTM, BIS,EN,JIS 8.3 Chemical composition, mechanical properties & application of coded materials used in industries such as : -BIS 2002, 2062 etc. -SA 515, 516, 105, 106, 336, 386 etc -SS 304, 304L, 316, 316L, 310, 321, 347 etc - EN-8 etc

LABORATORY EXPERIENCE :

Sr. No.	DESCRIPTION OF LABORATORY EXPERIENCE
1.	**DEMONSTRATION & STUDY (REPORT / OBSERVATION WRITING) :** 1. Read process equipment drawing (carbon steel & SS), Structure drawing and identify material from bill of material (BOM) or Material of construction (MOC) 2. Study properties of materials(including weldability) used in fabrication industries such as process equipment, structural, piping, Ship building etc.

	3. Interpret material test certificate used in fabrication industry 4. Demonstration & study of Metallurgical Microscope 5. Study of principle of SEM & TEM 6. Identify different alloying elements, Reasons of adding it to Carbon Steel, Low alloy steel, High alloy steel (SS) 7. Demonstration of Failed / Fractured components and parts. Prepare report on it.
2.	**JOB PREPARATION (WRITE SEQUENCE AND PARAMETERS OF JOB) :** 1. Job-1 Prepare micro specimen of SA 515 / SS 304 L & examine it. Write a report on procedure of micro specimen preparation , etchant used & etching process 2. Job-2 Prepare micro specimen of Copper / Brass / Aluminum & examine it. Write a report on procedure of micro specimen preparation, etchant used & etching process
3.	**SEMINAR & PRESENTATION & GROUP DISCUSSION :** 1. Prepare a Seminar using Power Point Presentation / Transparencies on the topic covered in syllabus / beyond the syllabus 2. Give 10 minutes presentation 3. Group discussion
4.	**PREPARATION OF MODELS , CHARTS QUIZ COMPETITION & SLOGANS (GROUP / INDIVIDUAL)**
5.	**INDUSTRIAL VISIT**
6.	**SHEET & SKETCH WORK :** 1. Prepare a Sheet of micro constituents of ferrous metal, non ferrous metal & crystal structure 2. Prepare a sheet of IC diagram, TTT diagram, CCT diagram, & Heat treatment diagram
7.	**REPORT WRITING :** 1. Write a report on technological properties of materials 2. Write a report on report on properties and application of elastomer, plastic, composite, Teflon , glass wool , glass, adhesive & insulating materials 3. Write a report on cladded material 4. Write a report on need of heat treatment process & different heat treatment processes 5. Write a report on different etchants used for micro specimen preparation.
8.	**BEYOND SYLLEBUS ACTIVITIES (DEVELOP CREATIVE & INNOVATIVE IDEAS AMONG STUDENTS) :** Display Article, Information, Sketch, under Knowledge Zone(K-Zone), Inspiration Zone(I-Zone) & Creative zone(C-Zone)

9.	**LITERATURE SURVEY :** 1. Library Assignment 2. Internet Surfing 3. Refer Product Pemplates 4. Technical Magazines
10.	**SHOP TALK :** 10 minutes presentation on shop floor / laboratory during the preparation of job / laboratory experience by the students
11.	**AUDIO VISUAL AIDS (Prepare Audio Cassette, Photograph Lab Manual, Technical Video Download)**
12.	**PAPER SOLUTION**
13.	**SCHOOL WITHIN SCHOOL :** 1.Guiding / Sharing /Mentoring the know-how by meritorious students to lower performing students.
14.	**SELF LEARNING :** 1. Contact with field expert ,seniors, alumni and get further know-how individually or in a group. 2.Read related book/magazine/article/literature and share the content.

NOTES:

1. Term work report content of each experience should also include following.
   a) Experience description/ data and objective.
   b) A skill which is/are expected to be developed in student after competition of experience.
   c) Drawing of experience / set up with labels / nomenclature to carry out the experience.
   d) The specification of machine / equipment / devices / tools / instruments/items / elements which is / are used to carry out and to check experience**.**
   e) Process parameters / set up settings values applied to carry out experience
   f) Steps / process description to execute the experience.
   g) Observation
   h) Information on resent machine / equipment / devices / tools/ instrument/ item available. In market to carry out the experience.
   i) Special / additional notes or remarks.
2. Term work report of student of regular more should exclude distance learning manual, photocopy, printed content, etc. focus should be on developing the term work as original efforts of student.
3.. Term work also include experience logbook duly certified by subject teacher.

REFERENCE BOOKS:

1. Material science and metallurgy	O.P.Khanna
2. Material and metallurgy	G.B.S. Narang
3. Material science and processes	G.R. Nagpal
4. Element of engineering metallurgy	S.P. Nayak
5. Elements of Metallurgy	Dr. Swarup
6. Heat treatment of metals	Zakhrov
7. Physical Metallurgy	Vijendra Singh
8. Codes and standard ASME-II-A,B,C,D ,ASTM, BIS	