GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING

TEACHING SCHEME (w. e. f. 10th Jan,' 11)

SEMESTER- VI (Re-Revised on 15-3-11)

Sr. No.	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	361905	Industrial Management	3	0	0	3
2	362101	Corrosion of Metals	4	0	2	5
3	362102	Project (with Seminar)	0	0	8	7
4	362103	Alloy Steel	3	0	2	4
5		Elective -I	3	0	2	4
6		Elective -II	3	0	2	4
		TOTAL	16	0	16	27

Select **ANY TWO** elective from the following Subjects

Sr.No.	Subject Code	Name of Subject (Elective)
1	362104	Advance Foundry
2	362105	Advance Engineering Materials
3	362106	Thermal Treatment of Metals & Alloys
4	362107	Advance Non. Ferrous Metal Production
5	362108	Computer Aided Metallurgy

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING
SEMESTER- VI

Subject Code : 361905

Subject Name: INDUSTRIAL MANAGEMENT.

Sr. No.	Subject Content	Hrs.
1	**1.0 INTRODUCTION TO INDUSTRIAL MANAGEMENT.** 1.1 Know the objectives of learning this subject. 1.2 Need, Scope & importance of Industrial Management in industries. 1.3 Need of attitude, knowledge & skill required for application of Industrial Management. 1.4 System- concept , definition, types, parameters , variables and behavior. 1.5 Management – definition and functions. 1.6 Features and need of various laws , regulations and acts such as factory act , minimum wages act , etc.	4
2	**2.0 ORGANISATION STRUCTURE AND ORGANISATIONAL DYNAMICS.** 2.1 Organisation structure-definition, goals, factors considered in formulating structure. 2.2 Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralisation and decentralisation in industrial management. 2.3 Types, advantages, disadvantages and applications of organisation structure. 2.4 Organisational culture and climate –meaning , differences and factors affecting them. 2.5 Moral-factors affecting moral. 2.6 Relationship between moral and productivity. 2.7 Effect of high and low moral. 2.8 Job satisfaction- factors influencing job satisfaction. 2.9 Case study and analysis of any two related situations.	8
3	**3.0 MATERIALS MANAGEMENT .** 3.1 Material management-definition, functions, importance, relationship with other departments. 3.2 Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. 3.3 Storekeeping- functions , classification of stores as centralised and decentralised with their advantages, disadvantages and	12

	application in actual practice. 3.4 Functions of store keeper, types of records maintained by store, various types and applications of storage equipments, need and general methods for codification of stores. 3.5 Definition of inventory control, objectives of inventory control, derivation for expression for Economic Order Quantity (EOQ), ABC analysis, other modern methods of analysis, various types of inventory models such as Willson's inventory model, replenishment model and two bin model. 3.6 Material Requirement Planning(MRP)-concept ,applications and brief details about software packages available in market. 3.7 Waste control- need and ways to reduce material wastage, recycle/reuse, 3.8 Case study and analysis-study and analyse any two related cases. Note : Examples (2 to 3) from 3.5 above(application type) of 8-10 marks out of total 70.	
4	**4.0 PRODUCTION, PLANNING AND CONTROL (PPC):** 4.1 PPC-meaning, phases, importance and objectives. 4.2 Explain in detail the functions of PPC along with necessary forms used in it, softwares available in market and their features. 4.3 Types of productions, calculation of Economic Batch Quantity (EBQ), critical ratio scheduling and Gantt charts. 4.4 Given the data, schedule the production using Gantt chart. Note : Example from 4.3 above(application type) of 4-6 marks out of total 70.	6
5	**5.0 CRITICAL PATH METHO AND PRE EVALUATION REVIEW TECHNIQUE (CPM/PERT).** 5.1 CPM & PERT-meaning, features, difference, applications. 5.2 Understand different terms used in network diagram. 5.3 Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO. 5.4 Determination of critical path on network. 5.5 Floats, its types and determination of floats. 5.6 Crashing of network, updating and its applications. Note : Examples (1 to 2-application types) of 8-10 marks out of total 70.	8
6	**6.0 VALUE ANALYSIS (VA) :** 6.1 VA-definition, terms used, process, importance and methods. 6.2 VA flow diagram. 6.3 Case study and analysis of any three related cases which can be studied/analysed under VA application. Note : Question/s (application type) of 4-6 marks out of total 70.	4
	Total	42

Notes:

A. FOR STUDENTS.

a. It is advised that student download this copy of syllabus and plan to achieve the objectives of learning this subject.

B. FOR PAPER SETTER/MODERATOR.

a. Refer GTU syllabus and do not take reference of previous TEB question papers.
b. Ask the questions from each topic having marks weightage proportionate to hours allotted to that topic.
c. Optional questions must be asked from the same topic. That is weightage of compulsory attendance part of questions will be equal to proportionate to hours allotted to each topic.
d. Marks ratio of knowledge: comprehension: application types questions must be 30:30:40 respectively.
e. Submit solution / answer keys along with distribution of marks in each question for the paper being submitted.

Reference Books:

1. System Analysis	O.Optner
2. Learning Package on Industrial Management	TTTI, Bhopal
3. What every supervisor should know	Lester R.
4. CPM & PERT principles and Applications	L.S.Srinath
5. Modern Production Management	Buffa
6. Materials Management	N. Nair
7. Value Analysis	Mikes
8. Industrial Engineering & Management	O. P. Khanna

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING
Semester: VI

Subject Code : 362101

Subject Name: **CORROSION OF METALS**

Sr. No.	Subject Content	Hrs.
1.	**1.0 Introduction To Corrosion** 1.1 Definition of corrosion. 1.2 Emphasise the cost factors involved in preventing corrosion of metals. 1.3 Explain the need for corrosion prevention by showing the harmful effects of corrosion. 1.4 Distinguish between "Erosion" and "Corrosion". 1.5 Differentiate between wet corrosion and dry corrosion.	6
2.	**2.0 Factors Affecting Corrosion.** 2.1 List the environment affecting corrosion. 2.2 Explain the effects of soil. 2.3 Explain the effects of chemicals. 2.4 Explain the effects of moisture and atmospheric gases. 2.5 Explain the effects of temperature and velocity. 2.6 Effects of metallurgical factors.	8
3.	**3.0 Theories of Corrosion.** 3.1 Define electrochemical reaction. 3.2 Explain electrochemical nature of corrosion. 3.3 Explain oxidation-reduction reactions involved in corrosion. 3.4 Define electrochemical cell with reference to anode, cathode and electrolyte. 3.5 Explain standard electrode potential. 3.6 Explain electromotive force (EMF) series. 3.7 Write and interpret EMF series. 3.8 Explain the process of rusting of iron by electrochemical reaction. 3.9 Explain the meaning of galvanic effect. 3.10 Explain and interpret galvanic series. 3.11 Compare EMF series and galvanic series. 3.12 Influence of E.M.F. on rate of corrosion.	10

4.	**4.0 Forms of Corrosion** 4.1 Corrosion rate expression and measurement. 4.2 Uniform corrosion. 4.3 Galvanic corrosion. 4.4 Crevice corrosion. 4.5 Intergrenular corrosion. 4.6 Selective leaching. 4.7 Stress corrosion.	18
5.	**5 .0 Corrosion Prevention** 5.1 Material selection and design. 5.2 Control of environment. 5.3 Coatings as a method of corrosion prevention (Tinning, Galvanizing, Painting). 5.4 Cathodic protection. 5.5 Anodic protection. 5.6 Electroplating and anodising. 5.7 Phosphotizing, chromizing.	14
	Total	**56**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Demonstrate the electrochemical nature of corrosion by observing effect of acid on different metals. Displacement of metal in aq. solution (Fe-CuSO4).
2. Demonstrate the effect of passivity by observing effect of Nitric acid (Dilute, Conc.)on steel.
3. Measurement of corrosion rate by weight loss method by keeping MS in various corrosive environment like acid, alkali.
4. To find standard electrode potential of given metal (Pure Copper) as per IS code.
5. To observe and interpret the microspecimen /specimen for identification of intergrenular corrosion stress corrosion cracking etc.
6. Perform electroplating for corrosion prevention as per IS code.
7. To study anodic protection and cathodic protection as a method of corrosion prevention.
8. Demonstrate the galvanic effect as a method of cathodic protection using silver coating.
9. To study corrosion resistant materials.
10. Industrial visit

References Books:

1. Corrosion engineering by Fontanner & Green
2. Introduction to electro chemistry by Gladston
3. Electro metallurgy by Saran and
4. Corrosion and passivity by U.R.Evas
5. Corrosion and corrosion control by H.H.Ublig
6. Metallic coatings for corrosion control by V.E. Carter
7. " H.B.Darji Lecturer "

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING
Semester: VI

Subject Code : 362102
Subject Name: **PROJECT (With Seminar)**

Note :
Following are the minimum experiences required, but the college can do more experiences if possible.

Sr. No.	Subject Content
1.	**1.0 Rationale:** This course enable the students to exercise some of the knowledge and/or skills developed during the programme to new situation orproblem for which there are number of Engineering solutions. Thiscourse includes a planning of the programme which is to becompleted within the time allocated, the maintenance of a logbook and the preparation of a report. The report contains the reasons for all decisions taken. Thus by studying this course abilities like creativity,initiative, performance qualities are developed in students.Student will be given a specific topic of current interest in any field of Metallurgy like production/ Fabrication/ Materials. Student will be required to carryout a literature survey/ library work pertaining to the given topic with the guidance of faculty. Student is required to prepare a detailed report. Bound report should include the details of process, equipment, Testing, Drawings, diagrams & charts and should be in given std. proformas. Student should present his observations in seminar / group discussion in classroom. Three times in a semester. The first seminar at the end of first month. The second will be at end of second month and Third seminar at time of final submission. 20 %, 20 % and 60 % will be the allotment of marks respectively for 3 seminars suggested.
2.	**2.0 Technology Related Skills and Enabling Objectives :** TRS 1. Integrate generic and technology related skills in Project work.
3.	**3.0 Communication Skills:** 3.1 Give instructions orally. 3.2Present papers in Seminars. 3.3 Face oral examinations confidently. 3.4 Give written instructions to carryout jobs. 3.5 Write report on project work (mini and major) undertaken. 3.6 Write brief reports of various types (inspection,installation, commissioning,

	progress report, test reports, trouble reports, status report ofmaterials, industrial visits, shift reports inlog books etc
4.	**4.0 Laboratory Experiences : (Project Seminar)** A specific topic of current metallurgical interest will be given to 4/5 students in group. They will work under guidence of a senior faculty member/ faculty member he will do :

Project :

[A] Stages:

(1) Literature/Market survey
(2) Selection of project
(3) Justification of selection
(4) Selection of materials
(5) Selection of Manufacturing processes, machine tools, Cutting tools, forming tools, Inspection tools, holding tools, cutting parameters and its applications.
(6) Process planning for all the components.
(7) Design and /or production drawing preparation. (computer may be used here)
(8) Activity planning and work distribution with Time Schedule using Gantt chart and CPM.
(9) Execution of the Project.
(10) Problem encountering in Materials and processes.
(11) Strategies used for finding solution of problem.
(12) Manufacture components parts etc.
(13) Assembly .
(14) Try-out.
(15) Modification if necessary.
(16) Costing.

[B] Report Writing Format:

- Rationale (Brief of Project in one page)
- Acknowledgment.
- Index :

(1) Selection of project.
(2) Detail and Assembly drawing
(3) Activity planning and work distribution with time schedule.
(4) Sequences of Manufacturing Processes adopted .
(5) Process of Assembling .
(6) Try-out, Testing and analysis of results in the forms of tables, graph,bar charts and other charts.
(7) Costing .
(8) Technical problem and its solution.
(9) Specifications of machine tools, measuring instruments, equipment, tools and hand tools used.
(10) Specifications of purchased parts
(11) Utility of the project.
(12) Conclusion.

(13) References

Seminar:

Project should be defended by the group before whole class in the presence of atleast TWO expert teachers and ONE expert from industry as external examiner. Minimum three experts should be involved and minimum time for defense per group should be 30 minutes. Project brief of one page should be circulated to all students and experts. The students should be encouraged to ask questions for further clarification.

Note to Teachers:-

* The major project should be:-
- Innovative in nature
- Feasible using the infrastructure of the Institute.
- To give practice for drawing/drafting.
- Incorporating major manufacturing processes if possible.
- Non repetitive in nature
- To develop the generic as well as Technology related skills.
- Having measurable and analytical end results.

* The typical examples of the Major project could be :-
_ Tooling Equipment
_ Attachments
_ Mechanisms
_ Working model of equipment or machine
_ Test Benches
_ Energy conservation Units
_ Non Conventional Energy equipment
_ Laboratory demonstration Units
_ Measuring and Inspection set ups etc.

References Books:

* Use of library.
(1) Reference books.
(2) Handbooks.
(3) Encyclopedia.
(4) Magazines.
(5) Periodicals.
(6) Journals.
(7) Visits of
    (i) Industries
    (ii) Organizations related
    (iii) Institutions as per requirement.
(8) Internet sites

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING

Semester: VI

Subject Code : 362103

Subject Name: **ALLOY STEEL**

Sr. No.	Subject Content	Hrs.
1.	**1.0 Introduction to Ferrous Alloys :** 1.1 Importance of iron as engineering materials. 1.2 Properties of iron group of alloys. 1.3 Classification of iron alloys.	2
2.	**2.0 Steel and its Classification:** 2.1 Different types of steels. 2.2 Carbon steels : Effects of elements (content) on carbon steels.Iron - Carbon diagram. TTT diagram. Composition, properties and applications of different types of carbon steels. Limitations of carbon steels. 2.3 International standards like ASTM, DIN, IS, BS.	6
3.	**3.0 Low Alloy Steels :** 3.1 Need/ importance of addition of alloying elements on steels 3.2 General effects of alloying elements. 3.3 Effects of Nickel, Chromium and Tungeston on Mechanical properties of steels and applications of these steels. 3.4 Effects of Vanedium, Silicon, Manganese, Cobalt, Molybdenum on Mechanical properties of steel and applications of these steels. 3.5 Low alloy structural and high strength steels.	8
4.	**4.0 High Alloy Steel (Tool Steel):** 4.1 Water hardening. 4.2 Shock resistant steel. 4.3 Cold work. 4.4 Hot work. 4.5 High speed. 4.6 Special purpose.	8
5.	**5.0 High Alloy Steel (Other Than Tool Steel):** 5.1 Stainless steel, 5.2 Corrosion and oxidation resistance steel. 5.3 Heat resistance steels. 5.4 Steels for electric and magnetic applications.	8

6.	**6.0 Special Alloys Steel**: 6.1 Alloys used in application where special properties are required. (a) Inconels (b) Hastealloys (c) Nimonic (d) Monels (e) Constantants (f) Cupronickles (g) Invar (h) Permalloy (i) Cobalt based alloy	7
7.	**7.0 Surface and Case Hardening Alloy Steels:** 7.1 Steel for (a) Carburising (b) Nitriding (c) Carbonitriding (d) Cynading	3
	Total	**42**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. To study and understand the effect of Carbon on micro structure and properties of Hypo eutectoid steel.
2. To study and understand the effect of Carbon on micro structure and properties of Hyper eutectoid steel.
3. To study and understand the effect of alloying elements like Cr and Mn.
4. To study and understand the effects of alloying elements on hardenability.
5. To identify and understand different types of Stainless steel with respect to properties, microstructure and application.
6. To identify and understand different types of High speed steel with respect to properties, microstructure and application.
7. To measure case depth for carburising steel.
8. To study the effect of alloying elements on
   (i) Critical cooling rate.
   (ii) Hardness.
   (iii)Transformation temperature.
9. Identification of various types of micro defects such as Seggregation - network - inclusion.
10. Industrial visit.

Reference Books: 1. Physical Metallurgy for Engineers Clerk & Warne

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING
Semester: VI

Subject Code : 362104

Subject Name: **ADVANCE FOUNARY (Elective)**

Sr. No.	Subject Content	Hrs.
1.	**1.1 Introduction** 1.1 Advancement in material handling systems in foundry. 1.2 Quality aspects in foundry. 1.3 Pollution control in foundry.	3
2.	**2.0 Solidification:** 2.1 Structure of pure metals. 2.2 Solidification of alloys. 2.3 Construct structure properties relationship. 2.4 Characteristics of liquid metal. 2.5 Inoculation and other treatment.	6
3.	**3.0 Riser and Gating System** 3.1 Castings design. 3.2 Riser design parameters. 3.3 Riser calculation. 3.4 Feeding distance. 3.5 Gating types : Pressurised and non pressurised. 3.6 Gating calculation. 3.7 Gating ratio.	6
4.	**4.0 Special Casting Methods:** 4.1 Investment casting. 4.2 Shell moulding. 4.3 Die casting.	6
5.	**5.0 Casting of Ferrous Metals:** 5.1 Properties of green sand mould for steel casting. 5.2 Solidification of steel casting. 5.3 Gating and riser for steel casting. 5.4 Steel melting. 5.5 Production of S.G.Iron.	11

6.	**6.0 Casting of Non Ferrous Metals:** 6.1 Aluminium alloying principle. 6.2 Al alloys castings properties. 6.3 Engg. properties of Al casting alloys. 6.4 Cu alloys foundry practice. 6.5 Al casting practice.	10
	Total	**42**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Preparation of Simple pattern for steel castings.
2. Preparation of mould and measurement of mould hardness by mold hardness tester.
3. To perform melting and casting of Aluminum.
4. To measure fluidity of casting metals.
5. To study microstructure of cast steels.
6. To measure the graphite flakes size and type in C.I.
7. To identify and understand various casting defects with their causes and remedies.
8. To determine the effect of hardness and moisture on permeability of sand.
9. To determine the gffect of grain size and clay content on permeability of sand.
10. Industrial visit.

Reference Books:

1. Principles of metal casting. by Heine & Rosenthal.
2. Foundry practice. by Salman & Simons.
3. Foundry technology. by M.Lal.
4. Fundamentals of metal casting. by P. Mukerji
5. Foundry engineering by N.K.Shrinivasan.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN METALLURGY ENGINEERING

Semester: VI

Subject Code : 362105

Subject Name: **ADVANCE ENGINEERING MATERIALS (Elective)**

Sr. No.	Subject Content	Hrs.
1.	**1.0 Classification of Materials and Selection of Materials:** 1.1 Classification of materials. 1.2 Properties required in Engineering materials. 1.3 Criteria of selection of materials. 1.4 Requirements / needs of advance materials.	3
2.	**2.0 Non Metallic Materials:** 2.1 Classification of non metallic materials. 2.2 Rubber : Types, properties and processing applications. 2.3 Plastics : Thermosetting and Thermoplastics, Applications and properties. 2.4 Ceramics : Types, properties and applications. 2.5 Adhesives: Types, properties and applications. 2.6 Optical fibers : Properties and applications. 2.7 Composites : Types, composition, properties and applications.	5
3.	**3.0 High Strength Materials:** 3.1 Methods of strengthening of alloys. 3.2 Materials available for high strength applications. 3.3 Properties required for high strength materials. 3.4 Applications of high strength materials.	5
4.	**4.0 LOW AND HIGH TEMPERATURE MATERIALS (8)** 4.1 Effect of temperature on mechanical properties of metals. 4.2 Properties required for low temperature applications. 4.3 Materials available for low temperature applications. 4.4 Requirements of materials for high temperature applications. 4.5 Materials available for different ranges of high temperature applications. 4.6 Applications of low and high temperature materials.	7
5.	**5.0 Spring Materials:** 5.1 Requirement for spring materials. 5.2 Materials for springs.	3

6.	**6.0 Wear Resistant Materials:** 6.1 List of diverse applications of wear resistant materials. 6.2 Antifriction materials : Properties required and materials available for specific application. 6.3 Journals and shafts : Properties required,materials available, surface hardening treatment. 6.4 Friction materials : Properties required and materials available. 6.5 Tool materials : Properties required and materials available.	4
7.	**7.0 Corrosion and Oxidation Resistant Materials:** 7.1 Requirements of corrosion and oxidation resistant materials. 7.2 Materials available with applications.	4
8.	**8.0 Materials with Special Physical Properties:** 8.1 Nuclear materials : Applications, properties required for each application and materials required for each applications. 8.2High and low thermal conductivity materials : Applications and materials available. 8.3 Materials with special electrical properties : Various properties required and materials available. 8.4 Materials with magnetic properties : Various properties required and materials available.	6
9.	**9.0 Nanomaterials:** 9.1Definition, Types of nanomaterials including carbon nanotubes and nanocomposits 9.2 Methods for creating nano structures 9.3 Physical and mechanical properties and their applications.	5
	Total	**42**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. To study classification of materials and selection of materials.
2. To study properties required in Engineering materials.
3. To study and applications of Non metallic materials.
4. To study and applications of High strength materials.
5. To study and applications of Low and high temperature materials
6. To study and applications of Spring materials with its microstructure
7. To study and applications of Wear resistant materials with its microstructure.
8. To study different forms of Corrosion and materials available for combating corrosion.

Note :
Above experiments shall be of study type and will cover those aspects of materials which remains untouched in the theory
portion due to the vastness of topics.
The student shall do necessary library work and collect as much data as is available regarding materials which will be included in term work.

Reference Books:

1. Material science for engineers by Van Vlack
2. Materials and processes by J.F.Young
3. Physical metallurgy of engg. materials by E.R.Petty
4. Engineering materials and applications by F.Trojan
5. Nano Structured Material Processing, Properties & Applications
   by Carl C. Kuch,Juico B M, 2006.

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN METALLURGY ENGINEERING

Semester: VI

Subject Code : 362106

Subject Name: **THERMAL TREATEMENT OF SPECIAL METALS AND ALLOYS (Elective)**

Sr. No.	Subject Content	Hrs.
1.	**1.0 Introduction to Thermal Treatment:** 1.1 Definition of thermal treatment. 1.2 Classification and list of thermal treatment. 1.3 Brief discussion of various important thermal processes.	2
2.	**2.0 Thermal Treatment Furnaces:** 2.1 Classification and list of various thermal treatment furnaces. 2.2 Salient features of important thermal treatment furnaces. (a) Muffle furnace. (b) Saltbath furnace. (c) Continuous type furnace. 2.3 Atmosphere control in thermal treatment furnaces. 2.4 Temperature measurement & control in thermal treatment furnaces.	5
3.	**3.0 Thermal Treatment of Commercial Steels:** 3.1 Thermal treatment of Low Carbon steel. 3.2 Thermal treatment of Medium carbon steel. 3.3 Thermal treatment of High carbon steel.	8
4.	**4.0 Thermal Treatment Of Cast Iron:** 4.1 List the thermal treatment for Cast iron. 4.2 Thermal treatment for Gray Cast iron. 4.3 Malleabilizing of White Cast iron. 4.4 Thermal treatment for S.G.iron. 4.5 Thermal treatment for special C.I. (a) Ni-Hard white C.I. (b) Ni-Resist C.I.	8
5.	**5.0 Thermal Treatment of Alloy Steel:** 5.1 Thermal treatment of Hadfield - Mn - steel. 5.2 Thermal treatment of Spring steel. 5.3 Thermal treatment of Bearing steel (Cr - steel).	8

6.	**6.0 Thermal Treatment of Special Steel:** 6.1 Thermal treatment of Structural steel.like rolled, cold drawn and cold rolled steels. 6.2 Thermal treatment of H.S.S. 6.3 Thermal treatment of Stainless steel like Austentic S.S., Ferritic S.S., Martensitic S.S.	8
7.	**7.0 Quality Control in Thermal Treatment:** 7.1 List of defects during thermal treatment. 7.2 Causes of defects during thermal treatment. 7.3 Remedies of defects during thermal treatment. 7.4 Steps and objectives of quality control. 7.5 Process of inspection. 7.6 Functions of quality control department. 7.7 List the factors affecting the quality of thermal treatment product.	3
	Total	**42**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. To determine the effects of quenching media on hardness of steels.(air,oil,brine,water)
2. To perform H.T.of Ball Bearing steel. (Annealing, Hardening, Tempering.
3. To perform H.T. of Spring steel. (Hardening, Tempering.)
4. To perform H.T.of En-24 steel. (Hardening, Tempering.)
5. To perform H.T.of En-8 steel. (Hardening, Tempering.)
6. To identify defects in thermal treated products.
7. To calculate Energy consumption in thermal treatment from given data.

Note :

Factory visit for practical (1) and (2).

Reference Books:

1. Heat treatment principles & techniques by T.V.Rajan & C.P.Sharma
2. Handbooks of heat treatment by K.H.Prabhudev
3. Physical metallurgy for Engineers by Clark & Varney
4. Physical metallurgy by Avener

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN METALLURGY ENGINEERING

Semester: VI

Subject Code : 362107

Subject Name: **ADVANCE NON FERROUS METAL PRODUCTION (Elective)**

Sr. No.	Subject Content	Hrs.
1.	**1.0 Introduction:** 1.1 Engineering requirements of non-ferrous metals and their application. 1.2 Non-ferrous industries in India.	3
2.	**2.0 Production of Noble Metals:** 2.1 **Production of Gold :** (a) Minerals and ores. (b) Steps for production of Gold.--Cyanidation, Leaching, Precipitation, Refining (c) Properties and application of Gold. 2.2 **Production of Silver :** (a) Minerals and ores. (b) Chloridising, Roasting, and Silver ore. (c) Cyanding of Silver. (d) Electrolytic refining of Silver. (e) Properties and application of Silver.	10
3.	**3.0 Production of Nuclear Metals:** 3.1 **Production of Thorium.** (a) Ores and minerals of Thorium. (b) Flow chart for production of Thorium. (c) Methods for production of Thorium. 3.2 **Production of Zireonium.** (a) Ores and minerals. (b) Production of Zireonium Carbide. (c) Production of Zireonium Chloride. (d) Properties of Zireonium.	9
4.	**4.0 Production of Chromium:** 4.1 Occurance and source of Chromium. 4.2 Production of ferro-chrome. 4.3 Production of metallic Chromium. 4.4 Production of electrolytic Chromium.	10

	4.5 Chromium platting. 4.6 Properties and alloys of Chromium. 4.7 Application of Cr and Cr alloys.	
5.	**5.0 Non-Ferrous Alloys:** 5.1 **Copper alloys:** Production, Composition, properties, microstructure and applications of following copper alloys (a) Brasses (b) Bronzes (c) Cu-Al (c) Cu-Ni (d) Cu-Mn 5.2 **Aluminium alloys :** Composition, properties, microstructure and applications of following copper alloys : (a) Al-Mn (b) Al-Mg	10
	Total	**42**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Study of samples of non ferrous ores with respect to composition and location.
2. Demonstrate the working principle and construction details of Jaw crusher.
3. Demonstrate the working principle and construction details of Ball mill.
4. Demonstrate the working principle of magnetic seperation method for ferrous ore.
5. Demonstrate the working principle and construction details of the Wiefly table.
6. Demonstrate the working principle and
7. Demonstrate the working principle and construction details of the Froth flatation.

Note :
Two INDUSTRIAL/INSTITUTE visits are required for above practicals.

Reference Books:

1. An outline of metallurgical practice by Hayward
2. Metallurgy of non-ferrous metals by W.H.Dennis
3. Engineering Metallurgy Part - I by R.A.Higgins

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN METALLURGY ENGINEERING
Semester: VI

Subject Code : 362108

Subject Name: **COMPUTER AIDED METALLURGY (Elective)**

Sr. No.	Subject Content	Hrs.
1.	**1.0 Computer Aided Estimating and Costing:** 1.1 Basic concepts of programming. 1.2 Elements of costing. 1.3 Fundamentals of estimating. 1.4 Estimation of rough casting. 1.5 Estimation of forged parts.	5
2.	**2.0 Design of Riser and Gating System:** 2.1 Principles of designing of risers and gating system. 2.2 Computer aided design of gating and riser system for cast iron. 2.3 Computer aided design of gating and riser system for steel casting.	10
3.	**3.0 Computer Aided Design Parameters for Process Control:** 3.1 Computer aided design parameters for process control.	9
4.	**4.0 Simulation Software for Furnace Control:** 4.1 Simulation software for furnace control.(like VOD, VD, Arc furnace etc.)	9
5.	**5.0 Exposure to Proprietory Software Available In Metallurgical Field.** 5.1 Exposure to proprietory software available in metallurgical field. 5.2 Computer Aided Process like Rolling, Wire drawing, Extrusion etc. **Treatment :** Use of softwares on computer. Industry visit is necessary for demonstration of software which are not available with institute..	9
	Total	**42**

Note :

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Cost estimation of rough castings.
2. Cost estimation of forged parts.
3. Design of steel castings.
4. Design of cast iron castings.
5. Design of process control parameters.
6. Simulations softwares for furnace control as a helping tools to decision making for various parameters of furnace control.
7. Exposure to properietory softwares in metallurgical field.
   Treatment : Use of software.

Reference Books:

1. Mechanical estimating and costing by D.P.Sinha
2. Mechanical estimating and costing by TTTI, Madras.