

Scheme of Teaching and Examination for

4 th Semester of 3 Years Diploma in Metallurgy Engineering

Duration of Semester : **14 Weeks**

Student Contact Hours : **36 Hrs**

Total Marks : **800**

Effective from : 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Basic Foundry Technology	MET402	Theory	3	-	-	3	100	80	20	26	40
2.	Iron Making	MET403	Theory	3	-	-	3	100	80	20	26	40
3.	Non Ferrous Metallurgy	MET404	Theory	3	-	-	3	100	80	20	26	40
4.	Mechanical Metallurgy	MET405	Theory	3	-	-	3	100	80	20	26	40
5.	Geology & Chemical Analysis	MET406	Theory	3	-	-	3	100	80	20	26	40
6.	Basic Foundry Technology Lab	MET407	Practical	-	-	4	4	100	80	20		40
7.	Mechanical Metallurgy Lab	MET408	Practical	-	-	2	4	50	40	10		20
8.	Chemical Analysis Lab	MET409	Practical	-	-	2	4	50	40	10		20
9.	Geology Lab	MET410	Practical	-	-	2	4	50	40	10	-	20
10.	Professional Practice II	401	Sessional			4		50	30	20		25
Total Hours of Teaching per week :				15		14						

Total Marks : Theory : Practical : Sessional :
 L : Lecture, T : Tutorial P : Practical

- Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
 2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
 3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
 4. Board will depute examiner for Practical examination.
 5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Basic Foundry Technology

SUBJECT CODE : MET402

L T P

3 0 4

Full marks 100 (80 + 20) Theory

OBJECTIVES :

1. To make the students conversant with castings of various metals and alloys.
2. To impart the knowledge of shaping of metals that can't be produced by mechanical working processes.
3. To impart the knowledge of foundry raw materials, their properties and uses.
4. To enable students to acquire proficiency in production of quality castings.
5. To be able to detect the casting defects and capable of taking remedial/preventive actions.

CONTENTS :

1. Pattern making : (H-8, M- 15)
Production of patterns, Types of pattern ,Pattern : design consideration, allowances, construction and pattern layout, ISI colour code on pattern
2. Core and mould : Types of core, core materials, core making (H-8,M-15)
Mechanism, core setting, core baking, core application.
3. Mould making : (H-6, M-10)
mould, types of mould, moulding sand, binders, Properties of mouldingsand , types of moulding sands, Properties and conditioning of sand.
4. Solidification of castings : (H-5, M-10)
Concept of solidification of molten metals,nucleation and growth, mechanism of dendrite formation, Growth, effect of alloying elements on solidification behavior of molten metals. Chvorinov's rule, Progressive and directional solidification control of solidification to obtain sound casting.
5. Gating system : Requirements, Functions of gating system (H-5,M-10)
Types of gates; pressurized and unpressurized gating system, Elimination of slag and dross, Calculation of down sprue, runner and gate area for given sample castings.
6. RISERING SYSTEM : (H-5,M-10)
Function of risers, types of riser, riser and directional solidification, riser efficiency, riser shape and size.
7. Post shake-out Treatment of Castings: (H-5,M-10)
Surface cleaning treatments, sand blasting, shot blasting, Fettling operation on castings.

Basic Foundry Technology Lab

Subject Code : MET407

List of Experiments

1. Study of Foundry Tools
2. Pattern and Pattern Making
3. Determination of moisture content in moulding sand
4. Determination of permeability in moulding sand
5. Determination of clay content in moulding sand
6. Determination of optimum binder content in moulding sand
7. Effect of grain size of sand on mould quality
8. Study of pattern allowances for castings
9. Practice of green sand mould making
10. Study of role of core in castings
11. Study of risers system
12. Study of Mould and its effect on quality of castings
13. Study of pouring system
14. Study of solidification Pattern of molten metals
15. Study of casting defects



Iron making

Subject code : MET403

Full marks :100 (80 +20)

Rationale:

Iron making mainly deals with the important techniques involved in ferrous metallurgy .The extraction of ferrous metals in pure and semi pure form from their minerals is the stepping-stone in understanding the advance metallurgical aspects. Emphasis is given on iron production, the resources available and practices adopted from Indian viewpoint

Objectives:The students will be able to

1. Acquire knowledge regarding raw materials required for iron production
2. Understand the principles of iron making
3. Know the constructional details of blast furnace
4. Know the different methods of production of iron and sponge iron

Contents:

A. Theory :

1. Raw materials and burden preparation for iron making : H 08 M 14

Types of iron ores and its valuation. Fuels and fluxes required for iron production. Properties, function and application of fuels and fluxes. Beneficiation of iron ore. Agglomeration: principle and process of sintering and pollicisation.

2. Construction of blast furnace : H 14 M 28

Blast furnace details: hearth, stack, bosh, etc. refractory's used in blast furnace. Hot blast stove, gas cleaning plant, burden charging systems

3. Blast furnace operation : H 14 M 28

Working principle of blast furnace, chemical reactions in the different zones of blast furnace, efficiency of blast furnace, irregularities in blast furnace operation and their remedies, modern trends in blast furnace.

4. Sponge iron production :

H 06 M 10

Physical chemistry of sponge iron or D R I, HyL process, ,Midrex process and rotary kiln process, use of sponge iron, sponge iron making India

Textbook

1. Modern iron making : By Dr.R.H.Tupkari

References :

1. Elements of metallurgy : By Dr. D. Swaroop
2. General metallurgy : By Kuznestsov
3. Principles of blast furnace iron making : A.K.Biswas



Non-Ferrous Metallurgy

Course code : MET404

TOTAL : 42

L T P

3 0 0

Rationale :

Non-ferrous metallurgy mainly deals with the different non-ferrous extraction processes from their ores. Knowledge of non-ferrous metallurgy is essential for understanding application of different field of non-ferrous metals and alloys.

The students will be able to

1. Understand the principle of extraction of different non-ferrous metals.
2. We familiar with pyro, hydro and electro metallurgical methods
3. Acquire knowledge about various minerals and their relevant ore dressing technique.
4. Know the Indian position regarding the sources of raw materials and status of non-ferrous industries.

Contents :

A. Theory :

1. Introduction : H 04 M 08
Sources of non-ferrous minerals and ores. Principle of roasting, calcinations, drying, concept of pyrometallurgy, hydrometallurgy and electrometallurgy.
2. Preparation of ores : H 06 M 11
Crusher: study and use of jaw crushers, gyratory crushers, cone crushers and quality stamp mill.
Grinders : study and use of Ball mill, rod mill and tube mill. Combination, Laws of combination, Froth flotation technique.
3. Extraction of copper : H 07 M 14

Ores of copper, extraction of copper from sulphide ores. Refining of copper.
Hydrometallurgy of copper

4. Extraction of Aluminium : H 07 M 14
Ores of aluminium, cryolite and carbon electrodes. Aluminium cell, construction, working, composition and properties of bath .Anode effect. purification of bauxite ores by Bayers process. Refining of aluminium
5. Extraction of lead : H 06 M 11
Ores of lead, blast furnace process. Huntington, Heberlein process. Dwight-Lloyd sintering machine. Softening, Parks process of desilverization and refining of base bullion.
6. Extraction of Zinc : H 06 M 11
Ores of zinc. Pyrometallurgical process: roasting and distillation Belgian process. refining of spelter by Reverberatory process and electrolysis process. Electrolysis, production of zinc in blast furnace, principle of smelting .
7. Extraction of Tin : H 06 M 11
Ores of tin. Metallurgy of tin. Concentration ,smelting, smelting in reverberatory furnaces , ore smelting, Refining.

References:

1. Extraction of non-ferrous metals : by H. S. Ray
2. Extractive metallurgy : by R. S. Rosengwest
3. Elements of metallurgy : by Dr. D. Swaroop
4. Mineral dressing : by A. M. Gaudin
5. General metallurgy : by Kuznestsov
6. Mineral Engineering : B.A. Bills

MECHANICAL METALLURGY

COURSE CODE : MET405

L	T	P
3	0	2

Total Hrs 42

FULL MARKS : 100 (80 + 20) Sessional - 50 (30+20)Marks

RATIONALE :-

The shaping of metals into useful forms requires adequate knowledge and know how of various methods and processes of metal working. Mechanical Metallurgy deals with principles equipments and application of various metal shaping methods i.e. rolling, forging , extension, wire drawing etc.

OBJECTIVES:-

Students will be able to-

1. Understand the basic principles of metal working.
2. Acquire Knowledge of rolling, forging, extension, wire drawing.
3. Interpret different types of defects occurs in rolled, forged, extruded ad wire drowned product and these correction measures.

Contents:-

Sl.No.	Description	Hrs	Marks
01.	Plastic deformation: Objective and classification of metal working processes. Elastic and Plastic deformation, cold working and Hot working. Cold work-annealed cycle, grain growth.	6	10
02.	Rolling of Metals : Principle of metal rolling. Classification of rolling mills hot & cold rolling, parameters in rolling. Derivation of angle of bite roll pass sequences for bloom , billets, plates and sheets. Defects in rolled products and their remedies.	10	20
03.	Forging of metals : Principle of metal forging open and closed die forging High energy rate forging technique Forging defects and their remedies working principles of a. Mechanical hammer ie Board drop hammer.	10	20

	<p>b. Power hammers ie steam and pneumatic hammer.</p> <p>c. Mechanical press ie crank press.</p> <p>d. Hydraulic Press.</p>		
04.	<p>Extrusion of metal : Deformation in extension, direct and indirect extrusion. High velocity rate extrusion. Hydrostatic extrusion, Impact extrusion, Extrusion equipment, dies and lubricant used in extrusion. Extrusion defects and their remedies.</p>	10	20
05	<p>Drawing of wire and Rod</p> <p>Preparation of wire and rod for drawing. Deformation of metal in drawing die. Effects of friction and die angle in wire drawing. Die material. Draw benches and wire drawing machines. Defects in wire drawing. Heat treatments of wire.</p>	6	10
		42	80



COURSE : MECHANICAL METALLURGY LAB

COUSRE CODE : MET408

List of Experiments:

1. To study the effect of plastic deformation on principles and structure of metals.
2. Study two high and two high reversing mills.
3. To study the effect of rolling on principles and structures of metals.
4. To study the effect of forging on the principles and structures of metels.
5. Study mechanical hummers ie board drop hammers.
6. Study steam hammers.
7. Study pneumatic hammers.
8. Study Mechanical press.
9. Study Hydraulic press.
10. Study to direct extrusion process.
11. Study the indirect extrusion process.

References:

- | | |
|---|---------------------|
| 1. Mechanical Metallurgy | George. E. Dieter |
| 2. Making , shaping and Treating of Steel | US Steels |
| 3. Metallurgical Processes | Comphell |
| 4. Engineering Metallurgy Part II | Raymond A Higgins |
| 5. Press Working | Shukhov and Elenyev |

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Geology and Chemical Analysis

Course code: MET406

L T P

3 0 0

Full marks: 100

A. Geology

1. General geology, information about interior of the earth, origin of the earth: nebular and continental depth theory, plate tectonics **8 Hrs (M-16)**
2. Mineralogy: composition of the crust, geo chemical classification of elements , types of bonds : ionic , covalent, metallic, van der waal **8 Hrs (M-16)**
3. Physical property of minerals: isomorphism, polymorphism, pseudo orphism, optical properties. **5 Hrs (M-8)**

B. Chemical analysis

1. Sampling of cores and alloys and their metallurgical products, sampling methods and their importance. **5 Hrs (M-8)**
2. Gravimetric and volumetric analysis: effect of temperature, salt effect , and effect of pH on completion of precipitation **4 Hrs (M-8)**
3. Instrumental methods: spectroscope- principle and application, colorimetric – operation and application **6 Hrs (M-12)**
4. Quantitative analysis of silicon, carbon, sulphur and phosphorous in steel **6 Hrs (M-12)**

Books

- 1 Textbook of Geology P K Mukarjee
2. General and Engg Geology Prveen K Singh
3. MANUAL OF Procedure for Chemical & Instrumental Analysis Indian Bureau of Mines

Geology Lab

Course code: MET410

L T P

0 0 2

Full marks – 50

1. Mineral identification and preparation of chart of different minerals
2. Rock identification and preparation of chart
3. Study of rock structure and deformation behaviour
4. Preparation of charts for unknown rocks
5. Study of seismicity and earthquakes
6. Study of optical behaviour appox
7. Study of Mineralogical Microscope
8. Study of pattern of structure quartz
9. Study of pattern of structure Feldspar
10. Study of pattern of structure hematite ore.



Chemical Analysis Lab

Course code: MET409

L T P

0 0 2

Full marks – 50

1. Preparation of standard samples for analysis
2. Study of strohleim apparatus
3. Determination of C,S,P,Si in steel
4. Study of colorimetry
5. pH determination of solutions
6. preparation of dilute and standard solutions
7. study of spectroscope
8. study of muffle furnace
9. sampling and sampling techniques
10. Study of segregation in casting.



Professional Practices-II

Subject Code : 401

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

1. Acquire information from different sources
2. Prepare notes for given topic
3. Present given topic in a seminar
4. Interact with peers to share thoughts
5. Prepare a report on industrial visit, expert lecture

Sl. No.	Activity Heads	Activities	Suggested Hrs
1.	Acquire information from different sources	Topic related to the branch and current area of interest i.e. articles in internet on which research or review is undergoing may be decided for the students group. The group may be restricted to maximum 5 students. Literature survey from Internet , print media and nearby practices may be undertaken. Minimum of 10 to 15 papers may be suggested for reading to get an overview and idea of matters.	12
2.	Prepare notes for given topic	Making review or concept to be penned down in form of a article .(the article or review may be of 8 – 10 pages length in digital form of 12 font size in Times New Roman font)	4
3.	Present given topic in a seminar	A seminar or conference or work shop on branch related topic is to be decided and all students in group of 5-6 students may be asked to present their views.	4
4.	Interact with	A power point presentation of the article prepared in stage 2	4

	peers to share thoughts	may be presented before the classmates and faculty members.	
5.	Prepare a report on industrial visit, expert lecture	A topic on best practices and product / software development may be assigned to the student group. The group may be asked to prepare a survey, come to opinion making and list out the activities to develop the activities with SWOT analysis.	12

