STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES

DISCIPLINE: METALLURGY ENGINEERING						**SEMESTER: 4TH**						
SL NO	**SUBJECT CODE**	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**						
			L	**T**	**P**	**SESSIONAL EXAM**			**END SEM EXAM**	**TERM WORK**	**PRACTICAL EXAM**	**TOTAL MARKS**
						TA	**CT**	**Total**				
THEORY												
1.	MTT 401	IRON MAKING	5	-	-	10	20	30	70	-	-	100
2.	MTT 402	PHYSICAL METALLURGY	5	-	-	10	20	30	70	-	-	100
3.	MTT 403	PRINCIPLES OF EXTRACTIVE METALLURGY	4	-	-	10	20	30	70	-	-	100
4.	MTT 404	MANUFACTURE OF SPONGE IRON AND FERRO - ALLOYS	5	-	-	10	20	30	70	-	-	100
5.	MTT 405	POWDER METALLURGY	4	-	-	10	20	30	70	-	-	100
PRACTICAL/TERM WORK												
5.	MTP 401	MACHINE DRAWING / CAD	-	-	6	-	-		-	50	-	50
6.	MTP 402	WORKSHOP PRACTICE - II	-	-	4	-	-		-	50	50	100
7.	MTP 403	METALLURGICAL ANALYSIS LAB.	-	-	6	-	-		-	50	50	100
GRAND TOTAL			**23**	**-**	**16**	**50**	**100**	**150**	**350**	**150**	**100**	**750**

Total Contact hours per week: 39
Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test
Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%

IRON MAKING

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTT 401	Semester	4th
Total Period:	75	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assignment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE:

Pig Iron is by far the most important and maximum used engineering material. Therefore, ferrous metallurgy is one of the most important subjects in steel and cast iron maintenance under metallurgical engineering studies.

OBJECTIVES :

To know details about the raw materials and burden preparation, principle and process, different furnaces, accessories, irregularities and its remedies for making pig iron.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	TOPIC	PERIODS
1.	Source of ferrous raw – materials in India and	
2.	Raw – Materials for iron making	05
3.	Burden preparation	10
4.	Blast Furnace Fuels	10
5.	Blast Furnace operations	10
6.	Blast Furnace accessories	8
7.	Blast Furnace irregularities and blast furnace operational problems	12
8.	Chemistry of blast furnace operation & charge calculation	12
9.	Modern development of blast furnace operation	8

COURSE CONTENTS:

1.0 Sources of raw materials in India and raw materials for iron making

1.1 State different sources of raw materials for ferrous and non-ferrous in India.

2.0 Raw Materials for Iron Making

2.1 Different Raw Materials
2.2 Different types of iron ores
2.3 Evaluation of iron ore
2.4 Metallurgical coal
2.5 Difference between coal and coke
2.6 Required properties of coke for making iron

2.7 Flux and its types
2.8 Evaluation of Flux (available base & basicity)

3.0 Burden Preparation

3.1 Quality of burden (physical & chemical properties)
3.2 Different types of agglomeration required for burden preparation for blast furnace

4.0 Blast Furnace Fuel :

4.1 Function of coke
4.2 Quality requirement of coke
4.3 Preparation of B.F. fuel in India
4.4 Auxiliary fuels
4.5 Fuel Injection
4.6 Factors affecting fuel consumption in blast furnace

5.0 Blast furnace Operation

5.1 Charging methods and process
5.2 Blowing in
5.3 Drying
5.4 Filling
5.5 Blowing out
5.6 Banking in
5.7 Blowing down
5.8 Tapping
5.9 Fanning
5.10 Back draughting
5.11 Disposal of slags
5.12 Slags granulation & their utilization

6.0 Blast furnace Accessories :

6.1 Blast furnace refractories
6.2 Stack lining
6.3 Hearth lining
6.4 Hearth walls
6.5 Bosh lining
6.6 Blast furnace cooling arrangement
6.7 Shaft coolers
6.8 Hearth & bosh coolers
6.9 Tap holes and top hole drilling machine
6.10 Cast house
6.11 Tuyeres assembly
6.12 Raw materials section
6.13 Charge hosting appliances
6.14 Top charging system
6.15 Blowers, boilers, pumps
6.16 Gas cleaning plant

6.17 Blast furnace stoves

7.0 Blast Furnace irregularities and Remedies :

7.1 Hanging
7.2 Scaffolding
7.3 Slip
7.4 Chilled hearth
7.5 Pillaring
7.6 Break out
7.7 Chocking of gas off take
7.8 Flooding and coke ejection through tap hole
7.9 Leaking tuyers tap holes and coolers
7.10 Channeling

8.0 Chemistry of Blast Furnace operation :

8.1 Blast furnace profile
8.2 Thermal, physical and chemical profile
8.3 Physical chemistry of blast furnace process
8.4 Reactions in tuyere zone
8.5 Reaction in stack
8.6 Reaction in bosh
8.7 Reaction in hearth
8.8 Efficiency of B. F. process
8.9 Direct & indirect reduction
8.10 Silicon & sulphur reaction
8.11 Burden calculation for B/F operation

9.0 Modern Development of Blast furnace operation

9.1 Bell less charging
9.2 High top pressure operation
9.3 Humidification & oxygen enrichment of blast
9.4 External disiliconisation
9.5 desulphurization

Learning Resources:

Text Books

Sl.No	**Name of Authors**	**Title of the Book**	**Name of the publisher**
1	Basforth	Iron & Steel (Vol-1)	
2	Brick	Ferrous production	
3	Tupkaray R. H	Iron Making	Khanna Publications
4	Frier	Iron Making	
5	A. K. Biswal	Iron & Steel Making	
6	E. R. Rogers	Iron ore reduction	
7	Ward	An introduction to physical chemistry of iron & steel making	
8	A. K. Biswas	Blast Furnace Iron Making	SBA Publications

PHYSICAL METALLURGY

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTT 402	Semester	4th
Total Period:	75	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assignment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE :

Physical properties of metals and alloys are dependent on their crystal structures. Physical metallurgy explains different aspects of crystal structures of metals and alloys. It is, therefore, a very important subject for a metallurgical engineering.

OBJECTIVES :

To know physical properties & related mechanical properties, solidification, crystal structures and equilibrium diagrams of metals and alloys; iron carbon equilibrium diagram, metallurgical and electron microscope.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	TOPIC	PERIODS
1.	Crystal Structure of metals	10
2.	Solidification of Pure metals and alloys	10
3.	Equilibrium Diagrams	20
4.	Solid Solution	12
5.	Cast Iron	15
6.	Metallurgical Microscope	8
	Total :	75

COURSE CONTENT:

1.0 Crystal Structure of metals :

- 1.1 Define crystal and crystallography
- 1.2 Define space lattice and unit cell
- 1.3 Compare different types of crystal lattices, bravis lattices and primitive lattices.
- 1.4 Define with sketch B.C.C., F.C.C & H.C.P.
- 1.5 Define Miller indices, planes and directions
- 1.6 Define isotropy and anisotropy in metallic materials
- 1.7 Define imperfections in metallic materials
- 1.8 Differentiate between types of imperfections : point defect, line defect, surface defect and volume defect (elementary idea)

2.0 Solidification of pure metals & alloys :

- 2.1 Define alloys and solid solution
- 2.2 Define solidification and crystallization
- 2.3 Explain role of free energy thermodynamic potential in conversion of liquid to solid
- 2.4 Define super cooling, under cooling, degree of super cooling

2.5 Explain mechanism of solidification/ crystallization, nucleation, critical size nucleus, spontaneous nucleation, relation between ration of nucleation and grain growth.

2.6 Discuss shape of crystals and solidification of ingot.

3.0 Equilibrium Diagram :

3.1 Define equilibrium diagram

3.2 Discuss the importance of equilibrium diagram

3.3 Draw equilibrium diagram of binary alloys

3.4 State types of equilibrium diagram

3.5 Explain isomorphous equilibrium diagram with examples

3.6 Explain eutectic type and eutectoid equilibrium diagram with example

3.7 Explain peritectic type and peritectoid equilibrium diagram with example

3.8 Define phase rule, lever rule

3.9 Apply phase rule, and lever rule in each equilibrium diagram.

3.10 Draw iron carbon equilibrium diagram and describe different phases and micro constituent in iron carbon diagram

3.11 Discuss role of carbon with iron to differentiate steel and cast iron

3.12 Apply lever rule in iron and carbon diagram

3.13 Differentiate between iron-carbon, iron-cementite, and iron-graphite diagram.

4.0 Solid solution :

4.1 Define solution, alloying

4.2 Explain different types of solid solution

4.3 Differentiate between substitutional and interstitial solid solution, chemical compound, mechanical mixture and intermetallic compounds.

4.4 Differentiate between ordered and disordered solid solution.

4.5 Define Hume Rothery rule and describe the different factors governing the formation of solid solutions.

5.0 Cast iron :

5.1 Define cast iron, differentiate between steel and cast iron, alloy steel and alloy cast iron.

5.2 Discuss different types of cast iron with their composition

5.3 Define graphitization and role of graphitization in cast iron

5.4 Draw structures of cast iron

6.0 Metallurgical Microscope :

6.1 Differentiate between metallurgical microscope & biological microscope

6.2 Describe different types of metallurgical microscope

6.3 State working principle of metallurgical microscope

6.4 Define magnifying power & resolving power, spherical and chromatic aberration.

6.5 Explain with sketch principle of electron microscope

6.6 Prepare a sample for study of microstructures e.g. sampling, cutting, grinding, rough polishing, intermediate polishing, fine polishing and etching.

Learning Resources:

Text Books

Sl.No	Name of Authors	Title of the Book	Name of the publisher
1	Laktin	Engineering Physical Metallurgy	
2	Reed Hill	Physical Metallurgy	

3	Raghavan	Material Science and Engineering	Prentice Hall of India Pvt Ltd.
4	Smallman	Physical Metallurgy	
5	C.Mohapatra	Introduction to Engineering Materials	JJTP,Bhubaneswar

PRINCIPLES OF EXTRACTIVE METALLURGY

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTT 403	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	3P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assignment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE :

This subject deals with different methods and principles of extraction of metals from their mineral/ores. It is therefore, a very important topic under metallurgical engineering.

OBJECTIVES:

On completion of the course, the students should know the followings :-

1. Different types of extraction process – pyrometallurgical extraction, hydrometallurgical extraction, and electrometallurgical extraction.
2. Extraction process applications to different ores.
3. Refining operation of the extracted metal.
4. Application of metallurgical thermodynamics and kinetics in extraction processer.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	TOPIC	PERIODS
1.	Definition of metallurgical terms	5
2.	Principles of pretreatment of ores for metal extraction	10
3.	General methods and principle of extraction	25
4.	Basic approaches to refining	3
5.	Principles of metal extractions	10
6.	Principles of metallurgical thermodynamics reaction kinetics	7
	Total :	60

COURSE CONTENT:

1.0 Definition of metallurgical terms :

- 1.1 Define ores and minerals
- 1.2 Define gangue, flux and slag
- 1.3 Define matte and speiss
- 1.4 Define metals and alloys

2.0 Principle of pre-treatment of ores for metal extractions :

- 2.1 Explain drying
- 2.2 Define and explain calculation
- 2.3 Explain different agglomeration process like briquetting nodulising, vacuum extrusion, sintering, palletizing.

3.0 General Methods of Extraction :

3.1 Pyrometallurgical processes

3.2 Explain roasting and different roasting methods

3.3 Explain Ellingham diagram (oxides) and predominance area diagram (sulphides)

3.4 Explain smelting and different smelting practices, Flash smelting, hearth smelting, matte smelting

3.5 Explain the method of distillation and sublimation

3.6 Explain the process of converting of matte and pig iron

3.7 Explain hydrometallurgical process

3.8 Explain different stages of hydrometallurgical process

3.9 Write the flow diagram of hydrometallurgical extraction

3.10 Explain leaching and different leaching methods, bacterial leaching and pressure leaching

3.11 Electrometallurgical process

3.12 Define electrolysis, ionic conductivity, EMF series, faraday's law of electrolysis

3.13 Explain electro wining, electro refining

4.0 Basic approaches to refining :

Explain refining, process – zone refining, fire refining

5.0 Principle of metal extractions :

5.1 Explain principles of metallurgical thermodynamics, zeroth law of thermodynamics

5.2 Review 1st, 2nd, and 3rd law of thermodynamics, explain their application to metallurgical process.

5.3 Explain on details the concept of Internal Energy, enthalpy, entropy and entropy change, Free energy of a chemical reaction.

5.4 State Henry's law and Sivert's Law.

6.0 Reaction Kinetics :

6.1 Explain first order reaction and its significance.

6.2 Explain the application of first order reaction of metallurgical processes.

Learning Resources:

Text Books

Sl.No	Name of Authors	Title of the Book	Name of the publisher
1	H. S. Roy, Shridhar & Abraham	Extraction of Non-ferrous Metals	
2	R. S. Parket	Introduction to Chemical Metallurgy	
3	J. Newton	Extraction Metallurgy	
4	A. Ghosh & H. S. Roy	Principle of Extractive Metallurgy	
5	R. H. Trupkary	Metallurgy Thermodynamics	Khanna Publications

MANUFACTURE OF SPONGE IRON AND FERRO ALLOYS

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTT 404	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	3P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assignment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE:

Sponge iron and Ferro alloys have lot of importance as raw materials for steel manufacture; sponge iron is gradually replacing pig iron due to scarcity of coke in India and its use in B. F. to produce pig iron.

OBJECTIVES:

To know about raw material, principle & process and different furnaces used for making sponge iron and ferroalloys.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	TOPIC	PERIODS
1.	Review of Sponge Iron Making Processes: `	12
2.	Thermodynamics of Sponge Iron Making:	12
3.	Parameters of Sponge Iron Making:	08
4.	Plant Operating Parameters:	08
5.	Quality Control in Sponge Iron Plant	06
6.	Environmental Management in DRI Plants:	06
7.	Production of Ferro-alloys:	08
		Total: 60

COURSE CONTENTS:

Chapter-1: Review of Sponge Iron Making Processes:

1.1 Historical Development.
1.2 Reasons for Rapid growth of DR Process
1.3 Chronological Evolutions of some of the DRI Processes
1.4 Conventional versus DRI Steel Making
1.5 Direct Reduction of Iron Ore.
1.6. Major Direct Reduction Processes: Coal based Processes using Rotary Kilns and Gas based Processes.
1.7. Different Sponge iron Making Processes: Krupp Rein ,Krupp CODR ,SL/RN, ACCAR,OSIL,TDR,Poppuri and Inmetco Rotary Hearth,
1.8. Gas Based Process: Midrex, Fluidized Bed, FIOR, HIB, Rotary Hearth Furnace Technology- FASTMET, FASTMELT Technology, IT mark3 process.
1.9. Tunnel kiln process: Hoganas and Kinglor – Metor process and Advantages of Tunnel Kiln process.

Chapter-2: Thermodynamics of Sponge Iron Making:

2.1. Principles of Direct Reduction Reactions.
2.2. Reaction between Coal, Oxygen and Carbon dioxide. (Set-I).
2.3. Reaction between Iron ore and CO (Set-II).
2.4. Reaction Mechanism in Coal based DRI
2.5. Reaction Mechanism in Gas based DRI.
2.6. Reduction by Carbon monoxide
2.7. Reduction by Hydrogen

2.8. Boudourd reaction and Reduction by Carbon
2.9. Carbon Deposition
2.10. Kinetics in DRI
2.12. Factors Influencing the Reducibility of Iron Ore.
2.13.Rate Controlling Theories.

Chapter-3: Parameters of Sponge Iron Making:
3.1 Raw materials of Sponge Iron Making
3.2. Chemical and Physical Tests on iron ore: Chemical composition, Reducibility, Strength, Tumbling, Abrasion and Shatter Index, Porosity, Bulk Density, Thermal Degradation Index (TDI).
3.3. Tests on Non Coking Coal: Proximate and Ultimate Analysis, Reactivity, Calorific Value, Coking Index, Swelling Index, Ash Fusion Temperature, Bulk Density.
3.4. Effect of Iron Ore size on Reduction
3.5 Carbon Enrichment of Sponge Iron
3.6 How Carbon Enrichment of Sponge Iron is performed
3.7. Flow of Solids in the Reactor or Kiln
3.8. Process Parameters of Sponge Iron Production: Raw materials, Iron Ore Feed Rate, Coal Feed Rate, C/FeRatio, Dolomite Feed, Rate, Reduction Coal to Blow Coal Ratio , Ratio of coarse and Fines in Blow Coal, Blow Coal Pressure, Temperature Profile, Kiln Speed,Ore Retention Time and Cooler Discharge end Pressure.
3.9. Non magnetic Percentage in the Kiln Discharge
3.10. Properties of the Refractory used in the plant: Refractoriness, Resistance to Thermal Shock or spalling and
Resistance to Kiln Gas Atmosphere

Chapter-4: Plant Operating Parameters:
4.1. Daily Operating Parameters.
4.2. Operational Abnormalities: Process Pressure Fluctuations, Temperature Deviations, Back Spill, Loss of Process Fan(s), High Temperature of Cooler Discharge, Loss of Product Quality
4.3. Major Problems of DRI Kiln Operation: Injection Coal Jam, Feed Pipe Jam, Transfer Chute Jam, Main Drive Problem, Refractory Failure their causes and remedies
4.4. Shutdown Procedure: Normal Shutdown Schedule for a 500 TDP Kiln.
4.5. The Start Up process: Heating of the Reactor Refractory
4.6. Accretion Formation
4.7. Key notes on process plant operation.

Chapter-5: Quality Control in Sponge Iron Plant

5.1. Sampling: Sponge Iron and the Raw materials
5.2. Chemical Analysis of Sponge Iron, Iron Ore, Lime Stone/Dolomite and Coal
5.3. Scheme of Quality Control of input Raw Materials: Reactor Feed Iron Ore, Reactor Feed Coal, Back –Spill Coal, Slinger Coal.
5.4. Determination of Total Iron (FeT), Ferrous Iron and metallic Fe.
5.5. Determination of Phosphorus, Carbon, Sulpher and Free Carbon (Graphite) in Sponge Iron.
5.6. Analysis of Gangue materials in Sponge Iron: Percentage Alumina, CaO and MgO.
5.7. Various Physical Tests such as Tumbler and Thermal Degradation tests on iron ore, lime stone and dolomite.
5.8. Physical tests on Coal: Loss on ignition, Free Swelling Index, Raga Index and reactivity of Coal

Chapter-6: Environmental Management in DRI Plants:
6.1. Air Pollution Mitigation Measures

6.2. Fugitive Dust Generation
6.3. Water Pollution Mitigation Measures
6.4. Solid Waste Generation and Disposal
6.5. Hazardous Wastes and Chemicals
6.6. Occupational Health and Safety
6.7. Environmental Monitoring
6.8. Environmental Standards

Chapter - 7: Production of Ferro-alloys:
7.1. Introduction to Ferro-alloying elements.
7.2. Different ferro alloys.
7.3. General methods of producing ferro alloys: carbothermic and aluminothermic reductions,
7.4. Refining of ferro alloys.
7.5. Production of individual ferro alloys: Ferro manganese, ferro chrome, charge chrome, ferrosilicon Fe-Ti, Fe-W, Fe-Mo and Fe-V.

Learning Resources:

Text Books

Sl.No	Name of Authors	Title of the Book	Name of the publisher
1	Amit Chattergee	Sponge iron Production by Direct Reduction of Iron oxide	PHI
2	S. Dasgupta, T. K. Ray & B. Ray	DRI Process and its relevance to India	M. N. Dastur & companies Pvt Ltd
3	Alis Chalmers	DRI Process in Rotary kiln	USA
4	A. Riss, Y. Khodorrosky	Production of ferro alloys	
5	C.Mohapatra & D. Patnaik	Fundamentals of Sponge Iron making	JJTP BBSR

POWDER METALLURGY

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTT 405	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	3P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assignment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE: Metals and alloys are converted into usable products of different shapes and sizes by a number of manufacturing processes. Powder metallurgy is the measure manufacturing process for shaping of metals and production of light weight objects.

OBJECTIVE: On completion of the course the students will be able to know various techniques involved in the powder metallurgy and to produce different complicated shapes.

TOPIC WISE DISTRIBUTION OF PERIODS

SI. No.	Topics	Periods
1.	Scope of Powder Metallurgy	05
2.	Methods of Powder Production	15
3.	Compaction of Metal Powders	10
4.	Sintering of Metal Powders	15
5.	Flow Sheets of Production of P/M Compants	15
	Total :	60

COURSE CONTENTS:

1.0 Scope of Powder Metallurgy.

1.1 Define powder metallurgy.

1.2 Depict the historical development of powder metallurgy.

1.3 Mention advantages disadvantages and applications of P/M

1.4 Briefly describe primary and secondary characteristics of powders.

2.0 Methods of Powder Production

2.1 Name different methods of powder production.

2.2 Describe the mechanical, physical, chemical and electro chemical methods.

3.0 Compaction of Metal Powders.

3.1 Give the significance and different methods of conditioning.

3.2 Explain different die-compaction techniques,

3.3 Describe isostatic pressing with advantages, limitation applications.

3.4 Give brief outline on continuous compaction.

4.0 Sintering of Metal Powder.

4.1 Define sintering and Explain its various stages.

4.2 Explain briefly mechanism of sintering process.

4.3 Explain the process variables and furnaces used for sintering

4.4 Give a note on liquid phase sintering.

5.0 Flow Sheets of Production

5.1 Give Flow Sheets for the Production of the Following.

a. Porous bearing

b. Sintered friction materials

c. Sintered carbides

d. Magnetic Materials

e. Cermets

f. Dispersion strengthened materials

Learning Resources:

Text Books

Sl.No	Name of Authors	Title of the Book	Name of the publisher
1	A.K.Sinha	Introduction to Powder Metallurgy	Dhanpatrai
2	R.L.Sande & C.R.Sha	Powder Metallurgy	Geore Newton Ltd. London
3	Curton	Applied Metallurgy for Engineers	
4	Badman	Manufacturing Process	

MACHINE DRAWING/CAD

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTP 401	Semester	4TH
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P / week	Term Work	50
Maximum marks:	50	End Semester Examination:	

1. Isometric projection of solids and sections of solids
2. Drawing of Isometric views of Nuts, Bolts, Screws, Rivets and Locking devices
3. Drawing of different thread forms : left and right, single and multi start.
4. Assembly drawing of Knuckle and cotter joints
5. Assembly drawing of plummer block and flange coupling
6. Drawing of machine components – stuffing box, crank, pulley and piston.
7. Autocad theory & practice

RECOMMENDED BOOKS :

	TITLE	AUTHOR	PUBLISHERS
1.	Machine Drawing :	N. D. Bhatt.	CPH

WORKSHOP PRACTICE – I I

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTP 402	Semester	4TH
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P / week	Term Work	50
Maximum marks:	100	End Semester Examination:	50

1.0 MACHINE SHOP

1.1 Shop talk on different types of machine tools, their functions, different tools used and general safety precautions to be observed.

1.2 Study a centre lathe

1.3 Operate a centre lathe on a cylindrical ob and perform following operations turning, taper turning, facing, parting

1.4 Operate a drill machine to perform drilling and counter boring operation on a job

1.5 Observe milling, shaping and grinding operations during demonstration at the shop floor

2.0 FOUNDRY SHOP

2.1 Prepare a simple wooden pattern

2.2 Make a green sand mould using above pattern

3.0 WELDING SHOP

3.1 Observe demonstration of different type of welding electrodes and TIG & MIG welding

REFERENCE BOOKS :

	Name of the publisher
1. Engineering Thermodynamics – P. L. Balleney	Khanna Publications
2. Workshop Technology – II , Hazra & Choudhury	Media Promoters and Publishers

METALLURGICAL ANALYSIS LAB.

Name of the Course: Diploma in Metallurgy Engineering

Course code:	MTP 403	Semester	4TH
Total Period:	105	Examination	4 hrs
Lab. periods:	7 P / week	Term Work	50
Maximum marks:	100	End Semester Examination:	50

(Students are required to perform at least five experiments)

1. Proximate analysis of coal
2. Determination of flash point and fire point
3. Determination of Fe in iron ore
4. Determination of Mn in manganese ore
5. Determination of Calcium, Magnesium in Dolomite
6. Determination of Cu, Zn in Brass
7. Determination of Chromites ore

LIST OF EQUIPMENTS:

1.	Pensky Martin Digital flash and fire Point Apparatus.	2 nos
2.	Electrolytic Analyzer.	2 nos
3.	Heating Oven(heating up to 130 deg. C	2 nos
4.	All standard set up for chemical analysis.	