

METALLURGICAL ENGINEERING

DETAILED SYLLABUS FOR PART-3 (3RD. YEAR) : FIFTH SEMESTER

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION											
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES											
DURATION OF COURSE: 6 SEMESTERS											
SEMESTER : FIFTH											
BRANCH : METALLURGICAL ENGINEERING											
SR. NO.	SUBJECT	CREDITS	PERIODS			EVALUATION SCHEME					
			L	TU	PR	INTERNAL			ESE	PR	Total Marks
						TA	CT	Total			
1	STEEL MAKING PROCESS	4	4	-	2	10	20	30	70	50	150
2	FOUNDRY TECHNOLOGY	4	4	-	4	10	20	30	70	100	200
3	METAL PROCESSING	3	4	-	2	10	20	30	70	50	150
4	ELECTIVE - I: ALLOY STEEL & CAST IRON	4	4	-	-	10	20	30	70	-	100
5	ENERGY & ENVIRONMENT CONTROL	3	3	-	-	10	20	30	70	-	100
6	COMPUTER AIDED DRAFTING	3	-	-	2	-	-	-	-	50	50
7	INDUSTRIAL PROJECT & ENTREPRENEURSHIP DEVELOPMENT	2	-	-	2	-	-	-	-	50	50
8	PROFESSIONAL PRACTICE - III	2	-	-	2	-	-	-	-	50	50
Total:		25	19	-	14	50	100	150	350	350	850
STUDENT CONTACT HOURS PER WEEK : 33 hrs ; DURATION : 15 WEEKS / SEMESTER											
Theory and Practical Period of 60 Minutes each.											
L- Lecture, TU- Tutorials, PR- Practical, TA- Teachers Assessment, CT- Class Test, ESE- End Semester Exam.											

STEEL MAKING PROCESS

Subject Code MET / S 5 / T1 / SPM	Course offered in Part - III , 5 TH . Semester	Course Duration 15 Weeks	4 lecture contact periods @ 60 Minutes per week	Full Marks 70
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OBJECTIVE :

1. Gather concept about basic principle of steel making .
2. Understand about different processes of steel making .
3. Gather knowledge about process of Secondary steel making .
4. State about process of Ingot preparation , defects ,remedies etc.

MODULAR DIVISION OF THE SYLLABUS

GROUP	MODULE	TOPIC	CONTACT PERIODS
A	1	Principles of steel making	10
	2	Review of older steel making process	10
B	3	Basic oxygen converter Process	10
	4	Electric Arc furnace Steel Making	10
C	5	Secondary Steel Making	10
	6	Ingot casting practice .	10
			TOTAL PERIODS: 60

EXAMINATION SCHEME

Group	Chapter	Objective Question				Subjective Question			
		No. of questions to be set	No of questions to be answered	Marks for each question	Total Marks	No. of questions to be set	No of questions to be answered	Marks for each questions	Total marks
A	1, 2 .	7	6	1	6	4	3	5	15
B	3, 4,	8	7	1	7	5	4	5	20
C	5, 6	8	7	1	7	4	3	5	15
					20				

Reference Books :-

1. Modern Steel Making --- Dr. R.H.Tupkary .
2. Iron Making & steel Making - Theory and Practice – Ahindra Ghosh , Amit Chatterjee - PHI .
3. Steel Making -- A.K.Chakrabarty -- PHI .
4. Physical Chemistry of Iron & Steel making --- R.G.Ward .
5. Manufacture of Iron & steel , Iron Production – Vol – I ,II & III --- G.R.Bashforth.

DETAIL COURSE CONTENT

1.0 Principle of Steel Making .	10 PERIODS
1.1 Basic theory & Principle.	
1.2 Chemistry of different refining reaction.	
1.3 Carbon reaction.	
1.4 Sulphur reaction.	
1.5 Manganese reaction.	
1.6 Silicon reaction.	
1.7 Phosphorous reaction.	
1.8 Nitrogen & Hydrogen reaction .	
1.9 Slag formation & nature of slag; role of basicity and other factors on solute removal	
2.0 Review of older steel making process .	10 PERIODS
2.1 Acid & basic Bessemer processes – their limitations; reason for their obsolescence	
2.2 Basic principle of Open Hearth Process - Acid and Basic process .	
2.3 Reasons for decline of Open Hearth Process .	
3.0 Basic oxygen converter Process	10 PERIODS
3.1 LD converter process , Refractory lining.	
3.2 Reactions in LD converter .	
3.3 Bath Agitation Process (BAP) – combined blowing – Brief outline .	
3.4 LDAC / OLP Process - Brief outline.	
3.5 KALDO Process - Brief outline .	
3.6 ROTOR Process - Brief outline .	
3.7 Q- BOP PROCESS -, basic features , advantages , disadvantages.	
3.8 Brief outline of refining process in Q - BOP PROCESS .	
4.0 Electric Arc Furnace Steel Making.	10 PERIODS
4.1 Basic principle .	
4.2 Electric arc furnace constructional features & its accessories.	
4.3 Charge materials, refining . double slag practice .	
4.4 Development in EAF Technology – Name of different processes .	
4.4.1 Ultrahigh power (UHP) transformer – brief outline .	
4.4.2 Furnace shell design - brief outline .	
4.4.3 Design of cooling system for side wall and roof – brief outline.	
4.4.4 New design of electrode - brief outline.	
4.4.5 DC electric arc furnace - brief outline.	
4.4.6 Oxyfuel Burners and Oxygen Lancing - brief outline.	
4.4.7 Foamy slag practice - brief outline.	
4.4.8 Preheating of slag and waste heat recovery - brief outline.	
4.4.9 Use of sponge iron as charge material - brief outline.	
4.4.10 Use of hot metal and iron carbide as charge material - brief outline.	
5.0 Secondary Steel Making.	10 PERIODS
5.1 Objectives of secondary steel making.	
5.2 Various processes .	
5.3 Vacuum ladle degassing	
5.3.1 Recirculation Degassing (RH) – brief outline .	
5.3.2 Recirculation Degassing with oxygen top lance (RH-OB) - brief outline .	
5.3.3 Ladle Degassing (VD, Tank Degassing) - brief outline .	
5.3.4 Vacuum Oxygen Decarburization (VOD) - brief outline .	
5.4 Ladle Furnace (LF) - brief outline .	
5.5 Ladle desulfurization by injection of active agents , Powder injection , Cored wire injection - brief outline .	
5.6 Ladle-to-mold degassing - brief outline .	
5.7 Deoxidation of steel - - brief outline .	
5.7.1 Deoxidation by metallic deoxidizers - Killed steels , Semi-killed steels , Rimmed steels -	
5.7.2 Deoxidation by vacuum .	
5.7.3 Diffusion deoxidation	
5.8 Desulfurization of steel	
5.9 Electroslag Remelting (ESR) - . - brief outline	
5.10 Argon - oxygen decarburization (AOD) – basic principle and application .	

6.0 Ingot Casting Practice .**10 PERIODS**

- 6.1 Tapping & teeming of killed, semi-killed & rimming steels .
- 6.2 Types of Ingots & Ingot models .
- 6.3 Ingot defects — their causes & remedies.
- 6.4 Continuous casting of steel . Definition ,
- 6.5 Types of continuous casting machine & diagram ,
- 6.6 Tundish – brief outline.
- 6.7 Common defects in concast products and remedies.

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Subject Code MET / S 5 / P1 / SPM	Course offered in Part - III , 5 TH . Semester	Course Duration 15 Weeks	2 lecture contact periods @ 60 Minutes per week	Full Marks 50
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PRACTICAL : LABORATORY EXPERIMENTS :

SL. No.	NAME OF EXPERIMENT
1.0	Charts on raw materials , different routes & plants in steel making.
1.1	To draw chart showing basic raw material for steel making .
1.2	To draw flow chart on different routes of steel making .
1.3	To draw chart showing name of different Indian Steel Plants, furnaces , capacity.
2.0	Lay out of different steel making shop .
2.1	To draw lay out of BOF shop .
2.2	To draw lay out of Open Hearth shop .
2.3	To draw lay out of Electric Arc furnace shop .
3.0	Flow charts on steel making process .
3.1	To draw the L.D.Converter , showing blowing , sequence of elimination of impurities curve , refractory lining , oxygen consumption , oxygen flow rate, etc .
3.2	To draw the LDAC / OLP Process
3.3	To draw KALDO Process .
3.4	To draw ROTOR Process
4.0	Diagram on different defects in steel ingots .
4.1	To draw different types of defects in Killed steel ingots .
4.2	To draw different types of defects in Semi – skilled steel ingots .
4.3	To draw different types of defects in Rimming & Capped steel ingots .
5.0	Diagram of Continuous casting machines with labeling of different parts. .

EXAMINATION SCHEME

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Fifth Semester.
2. Distribution of marks : Performance of Job – 15, Notebook – 10.
3. External Assessment of 25 marks shall be held at the end of the Third Semester on the entire syllabus.
4. Distribution of marks for External Assessment : On spot job – 10, Viva-voce – 15

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FOUNDRY TECHNOLOGY

Subject Code MET / S 5 / T2 / FT	Course offered in Part – III , 5 th . Semester	Course Duration 15 weeks	4 lecture contact periods @ 60 Minutes per week	Full Marks 70
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OBJECTIVE

1. Gather concept about Foundry technology .
2. Understand about pattern making , material & application .
3. Gather knowledge about use of different mould & core in foundry.
4. State the process & metallurgy of solidification process .
5. Gather knowledge about gating & risering system .
6. Know about different defects & remedial measures in casting process .
7. Know about cupola operation & production process of S.G.Iron, malleable iron , Nodular cast iron & metallurgy of all varieties .

MODULAR DIVISION OF THE SYLLABUS

GROUP	MODULE	TOPIC	CONTACT PERIODS
A	1	Introduction	2
	2	Pattern making	10
	3	Sand Casting	10
B	4	Gating & Risering	10
	5	Special Molding Processes	10
C	6	Fettling & Salvaging of Castings	10
	7	Melting Practices : Cupola operation .	8
			TOTAL PERIODS: 60

Reference Books :-

1. Principles of Metal Casting --- Heine , Loper & Rosenthal .
2. A Hand book on Foundry Technology --- O.P.Khanna .
3. Indian Foundry Journal --- Published by Institute of Indian Foundrymen .
4. Metals Handbook , Casting, --- ASM International , Ohio.
5. NPTEL Lecture Notes

EXAMINATION SCHEME

Group	Chapter	Objective Question				Subjective Question			
		No. of questions to be set	No of questions to be answered	Marks for each question	Total Marks	No. of questions to be set	No of questions to be answered	Marks for each questions	Total marks
A	1,2,3.	9	8	1	8	6	5	5	25
B	4,5.	8	7	1	7	4	3	5	15
C	6,7.	6	5	1	5	3	2	5	10
					20				
									50

DETAIL COURSE CONTENT

1.0 Introduction

- 1.1 Brief History ,
- 1.2 Advantages and Limitations . Applications
- 1.3 Different sections of a foundry; raw materials required

2.0 Pattern making

- 2.1 Pattern materials , advantages and limitations.
- 2.2 Pattern allowances,
- 2.3 Types of pattern,
- 2.4 Color code scheme.

3.0 Green and dry sand casting process

- 3.1 Types of sand and their properties, advantages and limitations.
- 3.2 Molding sand and its properties .
- 3.3 Molding sand composition.
- 3.4 Cores : Use , core material, types of cores, advantages and limitations .
- 3.5 Core prints, chaplets.

4.0 Gating & Riser

- 4.1 Gating System : Element of gating systems, types of gates.
- 4.2 Riser System : use, placement, riser design considerations.
- 4.3 Caine's method & Kvoronov's rule.

5.0 Special Molding Processes

- 5.1 Carbon dioxide molding process , brief outline , advantages and limitations.
- 5.2 Investment casting process , - , brief outline , advantages and limitations.
- 5.3 Die casting process - , brief outline , advantages and limitations.
- 5.4 Shell molding process , brief outline , advantages and limitations.
- 5.5 Full molding process . , brief outline , advantages and limitations.
- 5.6 Vacuum-Sealed casting process , brief outline , advantages and limitations.
- 5.7 Centrifugal casting processes – true & semi-centrifugal casting ; centrifuging

6.0 Fettling & Salvaging of Castings .

- 6.1 Fettling steps; salvaging of castings by welding
- 6.2 Types of different defects found in castings.
- 6.3 Causes and remedies of defects such as blowholes, pinholes, blisters, hot tears, cold shut, metal penetration.

7.0 Melting Practices : Cupola operation .

- 7.1 Description about Cupola operation.
- 7.2 Chemical reactions in cupola furnace.
- 7.3 Charge calculations,

Subject Code MET / S 5 / P2 / FT	Course offered in Part – III , 5 th . Semester	Course Duration 15 weeks	4 Practical contact periods @ 60 Minutes per week	Full Marks 100
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PRACTICAL : LABORATORY EXPERIMENTS :

SL. No.	NAME OF EXPERIMENT
1.0	SIEVE ANALYSIS OF MOULDING SAND
1.1	Analysis technique of Sand by sieve analysis.
1.2	Plotting graph on sieve analysis .
1.3	Inference on results .
2.0	MAKING SAND SAMPLES USING SAND RAMMER
2.1	Handling & operation of muller & Mixer .
2.2	Mixing of sand and other additives .
2.3	Specimen preparation by ramming .
3.0	DETERMINATION CLAY CONTENT IN MOULDING SAND
3.1	Basic principle of measuring clay-content in sand.
3.2	Handling and drawing of the apparatus.
3.3	Inference on results .
4.0	DETERMINATION OF MOISTURE CONTENT IN MOULDING SAND
4.1	Description & drawing of moisture content machine .
4.2	Basic principle
4.3	Inference on results .
5.0	DETERMINATION OF GREEN & DRY STRENGTH OF DIFFERENT MOULDING SAND MIXTURES.
5.1	Description & drawing of Sand strength Testing machine .
5.2	Determination of Green sand strength (compression & shear).
5.3	Determination of Dry sand strength (compression & shear).
6.0	DETERMINATION OF PERMEABILITY IN MOULDING SAND
6.1	Definition & Basic principle .
6.2	Drawing of the apparatus .
6.3	Process description and results .
6.4	Inference on results .
7.0	DETERMINATION OF HARDNESS OF MOULDING SAND
7.1	Definition & Basic principle .
7.2	Apparatus description .
7.3	Results & inferences.

EXAMINATION SCHEME

1. Continuous Internal Assessment of 50 marks is to be carried out by the teachers throughout the Fifth Semester.
2. Distribution of marks : Performance of Job – 35, Notebook – 15.
3. External Assessment of 25 marks shall be held at the end of the Third Semester on the entire syllabus.
4. Distribution of marks for External Assessment : On spot job – 25, Viva-voce – 25

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METAL PROCESSING

Subject Code MET / S 5 / T3 / MP	Course offered in Part – III , 5 th . Semester	Course Duration 15 weeks	4 lecture contact periods @ 60 Minutes per week	Full Marks 70
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OBJECTIVE

1. Gather concept about Controlled rolling processes .
2. Understand about Metal Joining process & application .
3. Gather knowledge about Powder Metallurgy .
4. Gather knowledge about Surface Coating process .

MODULAR DIVISION OF THE SYLLABUS

GROUP	MODULE	TOPIC	CONTACT PERIODS
A	1	Controlled Rolling Processes	10
	2	Metal Joining process	20
B	3	Powder Metallurgy	15
C	4	Surface Coating	15
			TOTAL PERIODS: 60

EXAMINATION SCHEME

Group	Chapter	Objective Question				Subjective Question			
		No. of questions to be set	No of questions to be answered	Marks for each question	Total Marks	No. of questions to be set	No of questions to be answered	Marks for each questions	Total marks
A	1, 2 .	11	10	1	10	7	6	5	30
B	3	6	5	1	5	3	2	5	10
C	4	6	5	1	5	3	2	5	10
					20				

Reference Books :-

1. Welding Technology --- O.P.Khanna .
2. Welding & Welding Technology --- L.K.Little .

DETAIL COURSE CONTENT

1.0 Controlled Rolling Processes

- 1.1 Thermo-mechanical controlled process .
- 1.2 Graphical time-temperature presentation ;
- 1.3 Rolling of TMT bars and automobile sheets .
- 1.4 Metallurgical features of controlled rolling;
- 1.5 Rolling of thin sheets and aluminum foils

2.0 Metal Joining process

- 2.1 Different joining process - welding , soldering , & Brazing , their applications .
- 2.2 Classification of different welding processes .
- 2.3 Gas welding , Oxy-acetylene gas welding – brief outline .
- 2.3 Arc Welding - brief outline , its application.
- 2.4 Submerged-arc welding , brief idea , its application.
- 2.5 TIG process , brief idea , its application.
- 2.6 MIG process , brief idea , its application.
- 2.7 Resistance welding , brief idea , its application .
- 2.8 Ultrasonic welding , brief idea , its application .
- 2.9 Explosives welding , brief idea , its application .
- 2.10 Thermit welding, , brief idea , its application .
- 2.11 Thermal effects of welding on parent metal.
- 2.12 Different zones , Definition of HAZ.
- 2.13 Metallurgical aspects of soldering & Brazing.
- 2.14 Defects in welds & its Remedies

3.0 Powder Metallurgy

- 3.1 Powder metallurgy: scope and importance
- 3.2 Production of metal powders.
- 3.3 Compaction and sintering processes.
- 3.4 Secondary and finishing operations ,
- 3.5 Economics, advantages, and applications of powder metallurgy.

4.0 Surface Coating

- 4.1 Surface coating of metals : objectives and importance
- 4.2 Classification of surface coatings / modification techniques.
- 4.3 Electro- and electroless- plating : mechanisms .
- 4.4 Bath characteristics and electrochemical parameters.
- 4.5 Anodizing, chromating, phosphating etc.
- 4.6 Spray coating processes, hot dipping and weld coating methods.
- 4.7 Testing and quality control of coatings. Selection of coating materials and methods.

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Subject Code MET / S 5 / P3 / MP	Course offered in Part – III , 5 th . Semester	Course Duration 15 weeks	2 Practical contact periods @ 60 Minutes per week	Full Marks 50
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PRACTICAL : LABORATORY EXPERIMENTS :

SL. No.	NAME OF EXPERIMENT
1.0	Sketch on Controlled Rolling Processes
1.1	Sketch the different types of Controlled Rolling Processes .
1.2	Sketch & Practice on Arc welding .
2.0	Sketch chart of essential Arc welding equipments .
2.1	Practicing arc welding , studying problems encountered & avoidable remedies .
2.2	Studying about straight polarity / Reverse polarity .
2.3	Draw the TIG welding set up and Sketch the penetration pattern for various shielding gases.
3.0	Study of strength & microstructure in HAZ .
3.1	Studying tensile strength & hardness in HAZ .
3.2	Studying microstructure in HAZ .
4.0	Charts on Failure & remedies of weld structure .
4.1	Charts on different defects in welds, such as cracks, distortion, inclusion, blow holes, poor fusion, under cutting, overlapping etc. & remedies .

EXAMINATION SCHEME

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Fifth Semester.
2. Distribution of marks : Performance of Job – 15, Notebook – 10.
3. External Assessment of 25 marks shall be held at the end of the Third Semester on the entire syllabus.
4. Distribution of marks for External Assessment : On spot job – 15, Viva-voce – 10.

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ALLOY STEEL & CAST IRON

Subject Code MET / S 5 / T 4 / ASCI	Course offered in Part III – 5 TH . Semester	Course Duration 15 weeks	4 lecture contact periods @ 60 Minutes per week	Full Marks 70
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OBJECTIVE

1. Gather concept about structural back ground & defination of alloy steel .
2. Understand about different alloy steels , their compositions & applications like -- Nickel chromium steel . High speed steel , stainless steel , Maraging steel .
3. Gather knowledge about H.S.L.A steel & its applications .
4. State about process Thermo mechanical treatment .
5. Gather knowledge about Alloy Cast irons .

MODULAR DIVISION OF THE SYLLABUS

GROUP	MODULE	TOPIC	CONTACT PERIODS
A	1	Structural back ground	2
	2	Role of alloying elements	8
	3	Low alloy steels	10
B	4	Stainless Steel	10
	5	Special Alloy Steels	10
C	6	Thermo-mechanical treatment of steels.	10
	7	Alloy Cast irons.	10
			TOTAL PERIODS: 60

Reference Books :-

1. Engineering Physical Metallurgy --- Y. Lakhtin .
2. Introduction to Physical Metallurgy --- S.H.Avner .
3. Elements of Physical Metallurgy --- A.G.Guy .
4. Metals Hand Book --- American Society of Metals .
5. Physical Metallurgy for Engineers --- Clark & Varney .
6. Metallurgy for Engineers --- E.C. Rollason .
7. Physical Metallurgy , Principles & Practice --- V. Raghavan .

EXAMINATION SCHEME

Group	Chapter	Objective Question				Subjective Question			
		No. of questions to be set	No of questions to be answered	Marks for each question	Total Marks	No. of questions to be set	No of questions to be answered	Marks for each questions	Total marks
A	1,2,3.	9	8	1	8	4	3	5	15
B	4,5	7	6	1	6	5	4	5	20
C	6,7.	7	6	1	6	4	3	5	15
					20				

DETAIL COURSE CONTENT

1.0 Structural background	2 PERIODS
1.1 Plain carbon steel, its definition.	
1.2 Limitation of plain carbon steel.	
1.3 Definition of alloy steel .	
1.4 Cast irons – types, a brief review	
2.0 Role of alloying elements	8 PERIODS
2.1 Different group of alloying elements .	
2.2 Role of Mn, Ni, W, Mo, V, Boron, Si on Iron carbon diagram.	
2.3 Role of alloying elements on structure and properties.	
2.4 Hot-shortness, cold shortness.	
2.5 Effect of composition on hardenability of steels	
2.6 Role of alloying elements on eutectic carbon, eutectic temperature, critical cooling rate .	
3.0 Low alloy steels	10 PERIODS
3.1 Merits & demerits of adding Ni in alloy steel.	
3.2 Merits & demerits of Cr in alloy steel.	
3.3 Air-hardening steel.	
3.4 Ball-bearing steels – properties, heat treatment; quality control .	
3.5 Silicon steels for electrical applications	
3.6 HSLA and microalloyed steels –characteristic features and applications	
4.0 Stainless steel.	10 PERIODS
4.1 Introduction, classification of stainless steels .	
4.2 Ferrite stainless steel, composition, characteristic, application.	
4.3 Martensitic stainless steel, composition, characteristic, application.	
4.4 Austenitic stainless steel, composition, characteristic, application.	
4.5 Duplex stainless steels – wrought and cast, properties and heat treatment	
4.6 Substitution of Ni in Stainless steel.	
4.7 Sensitization, stabilization.	
5.0 Special Alloy Steels	10 PERIODS
5.1 Spring steels.	
5.2 Non deforming – non shrinking tool steel – grades, composition, heat treatment and application.	
5.3 High Mn-alloy steel (Hadfield steel) - production, composition , heat treatment , properties, application	
5.4 Maraging steel- composition, properties and heat treatment , application	
5.5 Perm alloy , composition, heat treatment and application.	
5.6 Invar alloy , composition, heat treatment and application	
5.7 High speed steel , Composition, Heat treatment.	
5.8 Explanation of hardening temperature .	
5.9 Explanation of tempering temperature.	
5.10 Sub-zero treatment.	
6.0 Thermo-mechanical treatment of steels	10 PERIODS
6.1 Controlled rolling.	
6.2 Hot working , Cold working.	
6.3 Aus forming. Isoforming ,	
6.4 HSLA steels, Ultra-high strength steels , Composition , Characteristic.Heat treatment – applications .	
7.0 Alloy Cast irons	10 PERIODS
7.1 Introduction, effect of alloying elements on structure & graphite formation	
7.2 Effect of alloying on grey and white cast irons – improvement of properties; heat treatment and applications	
7.3 Corrosion –resistant cast irons – ‘Ni-resist’ and similar grades	
7.4 Wear-resistant cast irons – alloyed graphitic and ductile irons; ‘Ni-hard’ grades	
7.5 Alloyed ductile iron, high strength ductile irons; austempering	

ENERGY & ENVIRONMENT CONTROL

Subject Code MET / S 5 / T 5 / EEC	Course offered in Part III – 5 TH . Semester	Course Duration 15 weeks	3 lecture contact periods @ 60 Minutes per week	Full Marks 70
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OBJECTIVE

1. Gather concept about Energy control & its importance .
2. Understand about different Energy considerations in metallurgical industries .
3. Gather knowledge about Energy audit .
4. State about different processes of energy conservation & recovery .

MODULAR DIVISION OF THE SYLLABUS

GROUP	MODULE	TOPIC	CONTACT PERIODS
A	1	Introduction	3
	2	Energy consideration in metallurgical industries	14
B	3	Energy conservation & recovery	14
C	4	Energy audit	14
			TOTAL PERIODS : 45

Reference Books :-

1. Energy Management in Iron & Steel works - The Iron & Steel Institute, 1988.
2. New Energy Saving Technologies Operation Experience – I.I.S.I.
3. Statistics on Energy in Steel Industry – I.I.S.I.
4. Steel & Energy -- I.I.S.I.
5. National Seminar on Energy for Steel Industry, 23-29 Sep 1977, Rourkela, IIM.
6. National Seminar on Specific Energy Consumption in the Iron & Steel Industry, 10-12 Dec. 1982, Jamshedpur, IIM.
7. Seminar on Energy Conservation in Steel Industry, 14, Dec, 1991, :Bhilai IIM.
8. Symposium on Exploring - Alternative Source of Energy Conservation in Steel Industry, 14-15 Dec, 1984, Bhadravati, IIM.

EXAMINATION SCHEME

Group	Chapter	Objective Question				Subjective Question			
		No. of questions to be set	No of questions to be answered	Marks for each question	Total Marks	No. of questions to be set	No of questions to be answered	Marks for each questions	Total marks
A	1,2.	11	10	1	10	6	5	5	25
B	3.	6	5	1	5	4	3	5	15
C	4.	6	5	1	5	3	2	5	10
					20				
									50

DETAIL COURSE CONTENT

1.0 Introduction

- 1.1 Concept of Energy control & auditing .
- 1.2 Its importance in industries under present scenario , cost control .
- 1.3 Concept of energy management .

2.0 Energy consideration in metallurgical industries .

- 2.1 Energy consumption in Metallurgical Industries.
- 2.2 Application of thermodynamic principles and energy balance.
- 2.3 Different types of Fuels and their utility .
- 2.4 Energy consumption in electrometallurgical extraction processes , Rolling mill , Forging shop , Blast furnace , Arc furnace , L-D furnace , Induction furnace , Cupola , Heat treatment furnace , Sponge iron plant , Ferro- alloys plants etc.

3.0 Energy conservation & recovery .

- 3.1 Concept of Energy conservation .
- 3.2 Different types & utility .
- 3.3 Recovery processes .

4.0 Energy audit

- 4.1 Theory & concept of Energy audit & its management.
- 4.2 Conventional and non-conventional energy sources , their utility .

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COMPUTER AIDED DRAFTING

Subject Code MET / S 5 / P 6 / CAD	Course offered in Part – III , 5 TH .semester	Course Duration 15 weeks	2 Practical Contact Periods @ 60 Minutes per week	Full Marks 50
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OBJECTIVE

On satisfactory completion of the course, the students should be in a position

1. To solve two dimensional design & drafting problems by AutoCAD .
2. Being able to use AutoCAD commands to make a drawing, create text, dimension a drawing, hatch patterns and make & insert symbols & blocks.
3. They will also be able to plot drawings.

PRACTICAL : LABORATORY EXPERIMENTS :

SL. No.	NAME OF EXPERIMENT
1.0	GETTING STARTED – I .
1.1	Starting AutoCAD – AutoCAD screen components – Starting a drawing: Open drawings, Create drawings (Start from scratch, Use a template & Use a wizard) – Invoking commands in AutoCAD .
1.2	Drawing lines in AutoCAD – Co-ordinate systems: Absolute co-ordinate system, Relative co-ordinate system – Direct distance method – Saving a drawing: Save & Save As – Closing a drawing – Quitting AutoCAD.
2.0	GETTING STARTED – II
2.1	Opening an existing file – Concept of Object – Object selection methods : Pick by box, Window selection, Crossing Selection, All, Fence, Last, Previous, Add, Remove – Erasing objects: OOPS command, UNDO / REDO commands – ZOOM command – PAN command, Panning in real time – Setting units – Object snap, running object snap mode – Drawing circles .
3.0	DRAW COMMANDS
3.1	ARC command – RECTANG command – ELLIPSE command, elliptical arc – POLYGON command (regular polygon) – PLINE command – DONUT command – POINT command – Construction Line: XLINE command, RAY command , MULTILINE command .
4.0	EDITING COMMANDS
4.1	MOVE command – COPY command – OFFSET command – ROTATE command – SCALE command – STRETCH command – LENGTHEN command –TRIM command – EXTEND command – BREAK command – CHAMFER command – FILLET command – ARRAY command – MIRROR command –MEASURE command – DIVIDE command – EXPLODE command – MATCHPROP command – Editing with grips: PEDIT .
5.0	DRAWING AIDS
5.1	Layers – Layer Properties Manager dialog box – Object Properties: Object property toolbar, Properties Window – LTSCALE Factor – Auto Tracking – REDRAW command, REGEN command .
6.0	CREATING TEXT .
6.1	Creating single line text – Drawing special characters – Creating multiline text – Editing text – Text style .
7.0	BASIC DIMENSIONING .
7.1	Fundamental dimensioning terms: Dimension lines, dimension text, arrowheads, extension lines, leaders, centre marks and centre lines, alternate units – Associative dimensions – Dimensioning methods – Drawing leader.

EXAMINATION SCHEME

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Fifth Semester.
2. Distribution of marks : Performance of Job – 15, Notebook – 10.
3. External Assessment of 25 marks shall be held at the end of the Third Semester on the entire syllabus.
4. Distribution of marks for External Assessment : On spot job – 15, Viva-voce – 10

REFERENCE BOOKS / CD :

1. AutoCAD 14 For Windows – Bible (with Applications) / Sham Tickoo / Galgotia Publications Pvt. Ltd.
2. Advanced AutoCAD / Robert M. Thomas / Sybex BPD .
3. AutoCAD Part – 1 & 2: Banglay Prokashito Tutorial / CD Media / Sonolite, 55, Elliot Road, Kolkata – 16

INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT

Subject Code MET / S 5 / P 7 / IPED	Course offered in Part – III , 5 TH .semester	Course Duration 15 weeks	2 Practical Contact Periods @ 60 Minutes per week	Full Marks 50
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Objective :-

1. To identify and train potential entrepreneurs.
2. To motivate the entrepreneurial instinct
3. To develop necessary knowledge and skills among the participants.
4. To help in analyzing the various options to select the most appropriate product suiting to the entrepreneur and the market.
5. To give a clear picture about the process and procedures involved in setting up an small scale Industrial unit or a bigger unit
6. To impart basic managerial skills and understandings to run the project efficiently and effectively.
7. To analyst the environmental issues to be addressed relating to the proposed project.

PART A : Industrial Project

Following activities related to project are required to be dealt with, during this semester :

1. Form project batches & allot project guide to each batch. (Max. 4 students per batch)
2. Each project batch should select topic / problem / work by consulting the guide & / or industry. Topic / Problem / work should be approved by Head of department.
3. Each project batch should prepare action plan of project activities & submit the same to respective guide.
4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.
5. Action Plan should be part of the project report.

Part B : Entrepreneurship Development : OBJECTIVES : Students will be able to

- 1) Identify entrepreneurship opportunity.
- 2) Acquire entrepreneurial values and attitude.
- 3) Use the information to prepare project report for business venture.
- 4) Develop awareness about enterprise management.

PRACTICAL : LABORATORY EXPERIMENTS :

SL. No.	TITLE
1.0	Entrepreneurship, Creativity & Opportunities .
1.1	Concept, Classification & Characteristics of Entrepreneur
1.2	Creativity and Risk taking , Concept of Creativity & Qualities of Creative person.
1.3	Risk Situation, Types of risk & risk takers.
1.4	Business Reforms , Process of Liberalization , Reform Policies , Impact of Liberalization , Emerging high growth areas , Business Idea , Methods and techniques to generate business idea , Transforming Ideas in to opportunities , transformation involves . Assessment of idea , & Feasibility of opportunity , SWOT Analysis .
2.0	Information And Support Systems
2.1	Information Needed and Their Sources , Information related to project, Information related to support system, Information related to procedures and formalities .
2.2	SUPPORT SYSTEMS : Small Scale Business Planning, Requirements , Govt. & Institutional Agencies, Formalities Statutory Requirements and Agencies.
3.0	Market Assessment .
3.1	Marketing -Concept and Importance , Market Identification, Survey Key components , Market Assessment.
4.0	Business Finance & Accounts .
4.1	Cost of Project , Sources of Finance , Assessment of working capital , Product costing , Profitability , Break Even Analysis , Financial Ratios and Significance , Business Account , Accounting Principles, Methodology , Book Keeping , Financial Statements , Concept of Audit .
5.0	Business Plan & Project Report .
5.1	Business plan steps involved from concept to commissioning , Activity Recourses, Time, Cost .
5.2	Project Report - Meaning and Importance , Components of project report/profile (Give list) .
5.3	Project Appraisal - Meaning and definition , Technical, Economic feasibility , Cost benefit Analysis .
6.0	Enterprise Management And Modern Trends.
6.1	Enterprise Management , Essential roles of Entrepreneur in managing enterprise , Product Cycle: Concept And Importance , Probable Causes Of Sickness , Quality Assurance , Importance of Quality, Importance of testing , E-Commerce , Concept and process , Global Entrepreneur .
7.0	Project Report & its Components .
7.1	Project Summary (One page summary of entire project) Introduction (Promoters, Market Scope/ requirement) Project Concept & Product (Details of product) Promoters (Details of all Promoters- Qualifications, Experience, Financial strength) Manufacturing Process & Technology Plant & Machinery Required Location & Infrastructure required Manpower (Skilled, unskilled) Raw materials, Consumables & Utilities Working Capital Requirement (Assumptions, requirements) Market (Survey, Demand & Supply) Cost of Project, Source of Finance Projected Profitability & Break Even Analysis Conclusion.

EXAMINATION SCHEME

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Fifth Semester.
2. Distribution of marks : Performance of Job – 15, Notebook – 10.
3. External Assessment of 25 marks shall be held at the end of the Third Semester on the entire syllabus.
4. Distribution of marks for External Assessment : On spot job – 15, Viva-voce – 10

REFERENCE BOOKS / CD :

Sl. No.	Book	Author	Publisher
1.	Entrepreneurship Development	E. Gorden , K.Natrajan	Himalaya Publishing , Mumbai .
2.	Entrepreneurship Development Preferred	Colombo plan staff college for Technical education	Tata Mc Graw Hill Publishing co. ltd. New Delhi .
3.	A Manual on How to Prepare a Project Report	J.B.Patel , D.G.Allampally	EDI STUDY MATERIAL , Ahmadabad Website : http://www.ediindia.org
4.	A Manual on Business Opportunity Identification & Selection .	J.B.Patel , S.S.Modi	
5.	A Handbook of New Enterpreneurs	P.C.Jain .	
6.	Evaluation of Enterpreneurship Development Programmes .	D.N.Awasthi , Jose Sebastian	
7.	The Seven Business Crisis & How to Beat Them.	V.G.Patel , Poornima M. Charantimath .	
8.	Entrepreneurship Development of Small Business Enterprises .	Pearson Education, New Delhi Special Edition for MSBTE .	
9.	Entrepreneurship Theory and Practice	J.S. Saini , B.S.Rathore	Wheeler Publisher , New Delhi
10.	Entrepreneurship Development	TTTI, Bhopal / Chandigadh .	
11.	VIDEO CASSETTES ; Five success Stories : First Generation Entrepreneurs , Assessing Entrepreneurial Competencies,Business Opportunity Selection and Guidance , Planning for completion & Growth , Problem solving- An Entrepreneur skill .	EDI STUDY MATERIAL	http://www.ediindia.org
12.	Entrepreneurship in Action.	Mary Coulter.	Prentice Hall of India Pvt. Ltd., New Delhi.
13.	Fundamentals of Entrepreneurship	Mohanty, S.K	Prentice Hall of India Pvt. Ltd., New Delhi.

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PROFESSIONAL PRACTICE - III

Subject Code MET / S 5 / P 8 / PPIII	Course offered in Part – III , 5 TH . Semester	Duration 15 weeks	2 Practical contact periods (@ 60 Minutes) per week	Full Marks 50
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Objective :- 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

PRACTICAL : LABORATORY EXPERIMENTS :

Full Marks = 50 ; CONTACT PERIODS = 2 Practical @ 60 Minutes contact periods per week for 15 weeks .

SL. NO.	TITLE
1.0	Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the term work .
1.1	TWO industrial visits may be arranged in the following areas / industries : i) Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant . ii) Machine shop having CNC machines. iii) ST workshop / Auto service station iv) City water supply pumping station v) Manufacturing unit to observe finishing and super finishing processes.
2.0	Lectures by Professional / Industrial Expert / Student Seminars based on information .
2.1	Search to be organized from any THO of the following areas : i) Interview Techniques. ii) Modern Boilers – Provisions in IBR iii) Applications of Sensors and Transducers iv) Alternate fuels – CNG / LPG , Biodiesel, Ethanol, hydrogen, Piping technology .
3.0	Information Search : Information search can be done through manufacturer’s catalogue, websites, magazines, books etc. and submit a report any one topic .
3.1	Following topics are suggested : i) Engine lubricants & additives ii) Automotive gaskets and sealants iii) Engine coolants and additives iv) Two and Four wheeler carburetor. v) Power steering vi) Filters vii) Different drives / Transmission systems in two wheelers. viii) Types of bearings – applications and suppliers. ix) Heat Exchangers x) Maintenance procedure for solar equipment. xi) Tools holder on general purpose machines and drilling machines.
4.0	Seminar : Seminar topic shall be related to the subjects of fifth semester .
4.1	Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes) .
5.0	Mini Project / Activities : (any one) .
5.1	a) Prepare one model out of card board paper / acrylic / wood / thermocol / metal such as : i) Elliptical Trammel ; ii) Pantograph ; iii) Coupling ; iv) Cams and Followers ; v) Geneva mechanism . b) Dismantling of assembly (e.g. jig / fixtures , tool post , valves etc.) Take measurement and prepare drawings / sketches of different parts. C) Make a small decorative water fountain unit. d) Toy making with simple operating mechanisms.

EXAMINATION SCHEME

1. Continuous Internal Assessment of 25 marks is to be carried out by the teachers throughout the Fifth Semester.
2. External Assessment of 25 marks shall be held at the end of the Fifth Semester on the entire syllabus.

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