

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI**

DIPLOMA PROGRAMME IN METALLURGICAL ENGINEERING

Semester – V

COURSE OF STUDY AND SCHEME OF EXAMINATION

S.No	Board of Study	Course Code	Course	Periods/Week (in hours)			Scheme of Examination					Credit L+(T+P) /2	
				L	T	P	Theory			Practical			Total Marks
							ESE	CT	TA	ESE	TA		
1.	Metallurgical Engineering	238511 (38)	Metallurgical Analysis & Corrosion	4	2	-	100	20	20	-	-	140	5
2.	Metallurgical Engineering	238512 (38)	Industrial Metallurgy & Safety Engineering	4	2	-	100	20	20	-	-	140	5
3.	Metallurgical Engineering	238513 (38)	Fundamentals of Mechanical Metallurgy	5	-	-	100	20	20	-	-	140	5
4.	Metallurgical Engineering	238514 (38)	Non-ferrous Extractive Metallurgy	4	2	-	100	20	20	-	-	140	5
5.	Metallurgical Engineering	238515 (38)	Secondary Steel Making	4	-	-	100	20	10	-	-	130	4
6.	Metallurgical Engineering	238521 (38)	Metallurgical Analysis & Corrosion Lab	-	-	3	-	-	-	50	20	70	2
7.	Metallurgical Engineering	238522 (38)	Industrial Metallurgy & Safety Engineering Lab	-	-	2	-	-	-	50	20	70	1
8.	Metallurgical Engineering	238523 (38)	Fundamentals of Mech. Metallurgy Lab	-	-	3	-	-	-	50	20	70	2
9.	Metallurgical Engineering	238524 (38)	*Industrial Training Phase-II	-	-	1	-	-	-	80	20	100	1
TOTAL				21	6	9	500	100	90	230	80	1000	30

L : Lecture hours : T : Tutorial hours, P : Practical hours

ESE – End of Semester Exam.; CT – Class Test; TA- Teacher’s Assessment.

*Industrial Training, Phase II , organised after 4th Sem Exam.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI**

- A) SEMESTER : V
 B) SUBJECT TITLE : METALLURGICAL ANALYSIS & CORROSION
 C) CODE : 238511 (38)
 D) BRANCH/DISCIPLINE : METALLURGICAL ENGINEERING
 E) RATIONALE :

Most of the metallurgical processes are chemical in nature, so for efficient quality control, knowledge of metallurgical analysis (Chemical as well as Instrumental) is necessary. Also it is important for the student to know about different forms of corrosion and protection against corrosion.

F) TEACHING AND EXAMINATION SCHEME:

Course Code	Teaching Scheme (Hours/Week)				Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Total Hours	Theory			Practical		Total Marks	
					ESE	CT	TA	ESE	TA		
238511 (38)	4	2	-	-	100	20	20	-	-	140	5
238521 (38)	-	-	3	-	-	-	-	50	20	70	2

G) DISTRIBUTION OF MARKS AND HOURS:

Chapter No.	Chapter Name	Hours	Marks
	Part: I Analysis of Metals		
1	Introduction	10	05
2	Qualitative Analysis	10	10
3	Quantitative Analysis	10	20
4	Instrumental Methods of Analysis	10	10
5	Testing And Analysis of Sponge Iron	10	05
	Part: II Corrosion		
1	Introduction	04	02
2	Corrosion Principles	08	10
3	Different Forms of Corrosion	06	10
4	Environmental Aspects Of Aqueous Corrosion	05	05
5	Protection Against Corrosion	12	10
6	Oxidation Dry Corrosion	04	08
7	Interpretation & Measurement Of Corrosion	07	05
	Total	96	100

H) DETAILED COURSE CONTENTS:

Part-I Analysis of Metals

Chapter –1 Introduction:

- Importance of analysis,
- Classification of analysis,
- Chemical Methods of analysis, their merits & demerits,
- Instrumental methods of analysis.

Chapter –2 Qualitative Analysis:

- Spark method,
- Spot testing method.

Chapter –3 Quantitative Analysis :

- Method of sampling of ores,
- Volumetric & gravimetric methods of analysis based on oxidation, Reduction, Neutralization,
- Chemical method of analysis of steel for. C, Mn, S, P, Si, Ni, Cr & Mo.

Chapter –4 Instrumental Methods of Analysis:

Principles & methods of following instrumental method of analysis:

- Emission Spectroscopy,
- Dropping Mercury Paleography,
- X-Ray technique (Introductory level).

Chapter–5 Testing and Analysis of Sponge Iron:

- Degree of metallisation,
- Determination of metallic Iron by chemical method,
- Reducibility of Iron oxide used in Direct Reduced Iron (DRI),
- Reactivity of coal.

Part-II Corrosion

Chapter –1 Introduction:

- Definition, importance of corrosion studies,
- Classification of corrosion,
- Expression for corrosion rate.

Chapter –2 Corrosion Principles:

- Electrochemical principles of corrosion,
- Basic corrosion cell,

- Classification of electro chemical corrosion cell.

Chapter-3 Different Forms of Corrosion:

- Uniform attack, local attack, pitting, dezincification,
- Inter-granular corrosion, Hydrogen embitterment,
- Erosion, Corrosion,
- Stress corrosion Cracking,
- Corrosion fatigue.

Chapter-4 Environmental Aspects of Aqueous Corrosion:

- Corrosion in atmosphere,
- Corrosion in Water,
- Corrosion in Soil.

Chapter-5 Protections Against Corrosion:

- Different ways of protection,
- Design improvement,
- Modification of Metal,
- Use of Coating, metallic & non-metallic coating,
- Change of environment.

Chapter-6 Oxidation & Dry Corrosion:

- Formation of oxide layer, rate laws of oxide,
- The structure of oxides,
- Growth of thin oxide film,
- Oxidizing atmosphere,
- Oxidation protection.

Chapter-7 Interpretation & Measurement of Corrosion:

- Potential measurement, potential & current distribution measurement,
- Rotating electrode method for corrosion current,
- Polarization measurement.

I) INSTRUCTIONAL STRATEGIES:

▪ Lecture Method:

- a) Teaching through chalk board
- b) O.H.P, LCD Projector.
- c) Interaction with students through seminar.
- d) As far as possible concepts are to be visualized by extensive use of Charts & models.

▪ Industrial Visits:

- a) Bhilai Steel Plant, Bhilai.

b) Bharat Aluminum Company Limited Korba.

c) Industrial Estate, Bhilai.

▪ **Expert Lecturer:**

a) Expert lecturer as to be arranged on above subject through guest faculty.

▪ **Demonstration:**

a) Cut section models,

b) Operation of corrosion equipment,

c) Models, chart & transparencies.

J) LEARNING RESOURCES:

(a) Reference Books

Sl. No.	Title	Author, Publisher, Edition & Year
1	An Introduction of metallurgical analysis	S.K. Jain, Vikas Publishing House Pvt. Ltd., New Delhi
2	A text book of metallurgical analysis	Agarwal & Jain
3	Chemical Metallurgy	Moore
4	Corrosion Engineering	Fontana M.G., Mc Graw Hill International Publication

(b) Others

- VCD,
- Learning Packages through CD,
- Lab Manuals,
- Chart.

SUBJECT TITLE: METALLURGICAL ANALYSIS & CORROSION LAB

PRACTICAL CODE: 238521 (38)

Total Hours: 48

LIST OF PRACTICALS / TUTORIALS:

1. Chemical analysis of Iron Ore for determination of FeO, and various other ingredients.
2. Chemical analysis of limestone, dolomite SiO_2 , Al_2O_3 , Moisture.
3. Analysis of Iron & Steel by Spectroscope.
4. Determination of Carbon, Sulphur by Strohelene apparatus
5. Spark testing of metals & alloys.
6. Spot testing of alloy steels.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI**

- A) SEMESTER : V
 B) SUBJECT TITLE : INDUSTRIAL METALLURGY & SAFETY ENGG.
 C) CODE : 238512 (38)
 D) BRANCH/DISCIPLINE : METALLURGICAL ENGINEERING
 E) RATIONALE :

This subject includes metal joining process, powder metallurgy and safety engineering. The basic purpose of this subject is to understand the theories of Joining and apply this theory to various metal joining processes such as soldering, brazing and welding. The subject also covers various conventional and modern welding processes. Powder metallurgy has been included in the subject, which is an important technique of manufacture of some special engineering products. The knowledge of safety engineering is important before the student go to industry for work.

F) TEACHING AND EXAMINATION SCHEME:

Course Code	Teaching Scheme (Hours/Week)				Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Total Hours	Theory			Practical		Total Marks	
					ESE	CT	TA	ESE	TA		
238512 (38)	4	2	-	-	100	20	20	-	-	140	5
238522 (38)	-	-	2	-	-	-	-	50	20	70	1

F) DISTRIBUTION OF MARKS AND HOURS:

Chapter No.	Chapter Name	Hours	Marks
1	Metal Joining Processes	18	15
2	Powder Metallurgy	12	15
3	Introduction to Safety Engineering	15	10
4	Classification of Accidents	12	15
5	Accident Statistics and Pollution	12	15
6	Fire Hazards	12	15
7	Safety Rules for Different Metallurgical Shops	15	15
	Total	96	100

H) DETAILED COURSE CONTENTS:

Chapter – 1 Metal Joining Processes:

- Welding, Soldering and Brazing,
- Principles, application and equipments used in gas and Electric Arc welding,
- Other welding processes such as friction welding, explosive welding, diffusion welding, thermit inert gas welding (TIG), metals inert gas welding (MIG), electron beam welding, laser welding, plasma welding etc.,
- Metallurgy of welded Joints,
- Defects in welded joints, Inspection and testing of welded joints.

Chapter – 2 Powder Metallurgy:

- Application of powder Metallurgy, its advantage and limitations,
- Methods of production of metal powders,
- Compacting and Sintering of powders,
- Production of special materials such as cemented carbide tools, bulb's filament, small machine parts, self lubricating bearing.

Chapter – 3 Introductions to Safety Engineering:

- Importance of safety in Metallurgical and other engineering industries,
- Losses due to accidents,
- Direct and Indirect cost of accidents.

Chapter – 4 Classification of Accidents:

- Injury first aid cases, home cases, and Lost-time accidents,
- Mechanical, Non-Mechanical and Circumstantial accidents,
- Causes of accident-Personal, non-mechanical, mechanical and circumstantial causes.

Chapter – 5 Accident Statistics and Pollution:

- Injury frequency rate and injury severity rate,
- Working conditions, illumination, Ventilation, Noise and Industrial fatigue,
- Pollution caused due to different metallurgical process and their remedies.

Chapter – 6 Fire Hazard:

- Causes of fire,
- Fire extinguishers and Fire alarms,
- Fire Prevention and Protection.

Chapter – 7 Safety Rules for Different Metallurgical Shops :

- Blast furnace,
- Steel Melting shops, Coke ovens, Rolling mills, Cranes,
- Electric Hazards.

I) INSTRUCTIONAL STRATEGIES:

Lecture Method:

- Teaching through chalk board
- O.H.P, LCD Projector.
- Interaction with students through seminar.

Expert Lecturer:

- Expert lectures are to be arranged on above subject through guest faculty, Specially through Site Officers, Managers etc.

Industrial Visits:

- Bhilai Steel Plant, Bhilai with emphasis on hazards pollutant arises through different process.
- Bharat Aluminum Company Limited Korba.
- Industrial Estate, Bhilai etc.

Demonstration:

- Demonstration of various safety gazetts and their uses on different machining process.
- Demonstration of roll passes design using tables & charts.
- Demonstration of different joining processes and their safety measures.

J) LEARNING RESOURCES:**(a) Reference Books:**

Sl. No.	Title	Author, Publisher, Edition & Year
1	Welding Technology	O.P. Khanna
2	Engineering Metallurgy parts II	R.A. Higgins.
3	Powder Metallurgy	A.K. Sinha
4	Industrial Sfety	Hand book from Bhilai steel plant

(b) Others:

- Using CD & video films.
- Safety charts.
- Video films on safety and welding processes.

SUBJECT TITLE: INDUSTRIAL METALLURGY & SAFETY ENGG. LAB

PRACTICAL CODE: 238522 (38)

Total Hours: 32

LIST OF PRACTICALS / TUTORIALS:

1. Joining of two mild steel plates/pieces using oxy acetylene gas welding process.
2. Joining of two mild steel plate/pieces using electric arc welding process.
3. Microscopic examination of welding joints.
4. Different edge preparation for welding.
5. Study of Mechanical properties of welded joints.
6. Fractured surfaces examination with microscope.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI**

- A) SEMESTER : V
 B) SUBJECT TITLE : FUNDAMENTALS OF MECHANICAL METALLURGY
 C) CODE : 238513 (38)
 D) BRANCH/DISCIPLINE : METALLURGICAL ENGINEERING
 E) RATIONALE :

The purpose of this subject is to introduce concept of mechanical metallurgy to the students apart from fundamental principle, concept used in shaping and deformation processes. The subject covers the theories and practices of mechanical working of metals. The industrial application of the processes such as Rolling, Forging, Extrusion, Wire drawing & Sheet metal working have been included in the course content. The scope of the subject is wide & as such some process such as welding & powder metallurgy have been proposed to be included in the final year course.

F) TEACHING AND EXAMINATION SCHEME:

Course Code	Teaching Scheme (Hours/Week)				Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Total Hours	Theory			Practical		Total Marks	
					ESE	CT	TA	ESE	TA		
238513 (38)	5	-	-	-	100	20	20	-	-	140	5
238523 (38)	-	-	3	-	-	-	-	50	20	70	2

G) DISTRIBUTION OF MARKS AND HOURS:

Chapter No.	Chapter Name	Hours	Marks
1	Basic Theory of Plastic Deformation	10	10
2	Mechanism of Deformation	10	10
3	Principles of Rolling	10	10
4	Rolling Practice	10	15
5	Forging Practice	10	15
6	Forging Equipments	05	10
7	Extrusion	05	10
8	Wire Drawing	10	10
9	Other Cold Working Processes	10	10
10	Use Of Computers Simulation In Forming Processes		
	Total	80	100

H) DETAILED COURSE CONTENTS:

Chapter – 1 Basic Theory of Plastic Deformation:

- Theory of stress and strain,
- Elastic and Plastic strain, True stress – strain,
- Engg. Stress-strain,
- Relation between true stress and Engg. Stress and strains,
- Crystal imperfections, point, line, area and volume defects.

Chapter – 2 Mechanism of Deformation:

- Slip, dislocation and twinning in metals,
- Effect of strain rate and temperature on deformation,
- Laws of deformation,
- Strain hardening,
- Effect of Mech. Working on properties of metals,
- Effect of temperature on cold worked materials,
- Hot and cold working of metals,
- Importance of starting & finishing temperature in hot working.

Chapter – 3 Principles of Rolling:

- Zone of deformation,
- Angle of bite,
- Neutral Angle,
- Forward and Backward slip in rolling,
- Effect of rolling load,
- Roll flattening, Roll bending and mill spring,
- Power required in rolling,
- Rate of deformation in rolling.

Chapter – 4 Rolling Practice:

- Layouts of rolling mills (hot & cold) types of rolling mills,
- Ingot defects,
- Rolling of Rail structure & flat products,
- Type of passes for simple profiles as bloom, billet and rounds,
- Rolling defects & their rectification.

Chapter – 5 Forging Practice:

- Classification of forging processes,
- Forging operations – edging, fullering, drawing, swaging, piercing and punching,
- Open and closed die forging.

Chapter – 6 Forging Equipments:

- Forging hammers and presses,

- Forging dies,
- Forging defects and their rectification.

Chapter – 7 Extrusion:

- Classification of extrusion processes,
- Direct, Indirect and impact extrusion,
- Extrusion of tubes,
- Hydrostatic extrusion,
- Alloys suitable for extrusion,
- Extrusion defects and their rectification.

Chapter – 8 Wire Drawing:

- Process and equipments for wire drawing process,
- Die selection in wire drawing.
- Lubricants used in wire drawing

Chapter – 9 Other Cold Working Processes:

- Stretching, bending spin-stretch forming and embossing,
- Deep drawing and redrawing process,
- Defects of deep drawing process,
- Merits and limitations & different shaping methods,
- Application of main products.

Chapter – 10 Computers Simulation In Forming Processes:

- Introduction of computer simulation for forming processes,
- Application software for simulation and modeling of forming processes.

I) INSTRUCTIONAL STRATEGIES:

Lecture Method:

- Teaching through chalk board
- O.H.P, LCD Projector.
- Interaction with students through seminar.
- As far as possible concepts are to be visualized by extensive use of charts & models

Expert Lecturer:

- Expert lecturer are to be arranged on above subject through guest faculty.

Industrial Visits:

- Bhilai Steel Plant, Bhilai.

- Bharat Aluminum Company Limited Korba.
- Industrial Estate, Bhilai

Demonstration:

- Demonstration of boilers & power generation system in laboratory.
- Demonstration of mechanical devices and machine components, using small desktop models.
- Demonstration of roll passes design.

J) LEARNING RESOURCES:

(a) Reference Books

Sl. No.	Title	Author, Publisher, Edition & Year
1	Mechanical Metallurgy	Dieter, Mc Garw Hill
2	Process Metallurgy	Raymond A Higtins
3	Introduction to Dislocation	Hull. D
4	Principle of Mechanical Metallurgy	Lain Le May
5	Plastic Deformation of Metal	Honey Comb,R.W.K
6	Principles of Metal working	Suredra Kumar, Oxford & IBH Publishing Company

(b) Others:

- Models, charts, Transparencies & Video films.
- Process flow chart of different rolling mills.
- Drawing of various components in rolling mill & other sections.
- Charts showing details of different mechanical components.
- Design data book.
- Lab manual
- ISI-Codes.

SUBJECT TITLE: FUNDAMENTALS OF MECHANICAL METALLURGY LAB
PRACTICAL CODE: 238523 (38)
Total Hours: 48

LIST OF PRACTICALS / TUTORIALS:

1. To prove law of volume constancy of metals with the help of rolling and forging.
2. To prove law of least resistance of metals with the help of rolling and forging.
3. Study and sketch of blooming mill
4. Layouts of rolling mills
5. Study and sketch of forging hammer
6. Study and sketch of forging press

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI**

- A) SEMESTER : V
 B) SUBJECT TITLE : NON-FERROUS EXTRACTIVE METALLURGY
 C) CODE : 238514 (38)
 D) BRANCH/DISCIPLINE : METALLURGICAL ENGINEERING
 E) RATIONALE :

This subject is taught to the student to gain knowledge of extraction of Non-ferrous metals from their ores. It gives knowledge of the process and Technology used in different non-ferrous metal production.

F) TEACHING AND EXAMINATION SCHEME:

Course Code	Teaching Scheme (Hours/Week)				Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Total Hours	Theory			Practical		Total Marks	
					ESE	CT	TA	ESE	TA		
238514 (38)	4	2	-	-	100	20	20	-	-	140	5

G) DISTRIBUTION OF MARKS AND HOURS :

Chapter No.	Chapter Name	Hours	Marks
1	Non-Ferrous Metals and Alloys	08	05
2	General Principle of Non- Ferrous Metal Extraction	12	10
3	Metallurgy of Copper	15	20
4	Metallurgy of Aluminum	12	15
5	Metallurgy of Tin	12	15
6	Metallurgy of Zinc	15	15
7	Manufacture of Brasses, Bronzes	08	08
8	Manufacture of Aluminum Alloys	07	07
9	Manufacture of Important Magnesium Alloys	07	05
	Total	96	100

H) DETAILED COURSE CONTENTS:

Chapter – 1 Non-Ferrous Metals & Alloys

- Industrial importance of non-ferrous metals & alloys,
- Location of non-ferrous industries in India.

Chapter – 2 General Principle of Non- Ferrous Metal Extraction:

- Ellingham diagram (free energy temperature diagram),
- Principles of metal extraction from oxide ore and sulphide ore.

Chapter – 3 Metallurgy of Copper:

- Copper mineral and classification of copper ores,
- Roasting apparatus, Smelting of Copper in Reverberatory furnaces,
- Converting of copper metal,
- Fire refining of copper,
- Electrolytic refining of copper.

Chapter – 4 Metallurgy of Aluminum:

- Location of Aluminum industries in India,
- Ores of Aluminum, Bauxite and its varieties,
- Production of Alumina by Bayers' process,
- Production of Aluminum from Alumina,
- Refining of Aluminum.

Chapter – 5 Metallurgy of Tin:

- Ores of tin,
- Methods of extraction,
- Occurrence in India.
- Concentration, smelting, refining.
- Properties & uses of Tin.

Chapter – 6 Metallurgy of Zinc:

- Ores of tin,
- Extraction methods,
- Occurrence in India,
- Properties and uses of Zinc.

Chapter – 7 Manufacture of Brasses, Bronzes:

- Different types of Brasses their properties and uses,
- Manufacturing of important Brasses,
- Different types of Bronzes their properties and uses,
- Manufacturing of important Bronzes

Chapter – 8 Manufacture of Aluminum alloys:

- Manufacture of Al- Si Alloy & Al- Cu Alloys,
- Their properties & uses.

Chapter – 9 Manufacture of Magnesium alloys:

- Manufacture of Important Magnesium alloys,
- Their properties & uses.

I) INSTRUCTIONAL STRATEGIES:

- **Lecture Method:**
 - Teaching through chalkboard, O.H.P, LCD Projector.
 - Interaction with students through seminar.
 - As far as possible concepts are to visualized by extensive use of charts & models
- **Expert Lectures:**
 - Expert lectures are to be arranged on above subject through guest faculty.
- **Industrial Visits:**
 - Bhilai Steel Plant, Bhilai.
 - Bharat Aluminium Company Limited, Korba.
 - Industrial Estate, Bhiali
- **Demonstration:**
 - Demonstration of various metallurgical, extraction processes.

J) LEARNING RESOURCES:

a) Reference Books:

Sl. No.	Title	Author, Publisher, Edition & Year
1	Principles of extractive metallurgy	Roy & Ghosh, New Age International, Ltd
2	Elements of metallurgy	Dr. Swaroop, Saxena, Rastogi Publication Meeruth
3	General metallurgy	N. Sevryukov, B. Kuzmin & Y. Chelishchev.
4	Principle of Extrative Metallurgy	Terkel Rosenqvist, Mc Graw Hill

b) Others:

- Charts, Models & Transparencies.
- Interactive CDs.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI**

- A) SEMESTER : V
 B) SUBJECT TITLE : SECONDARY STEEL MAKING
 C) CODE : 238515 (38)
 D) BRANCH/DISCIPLINE : METALLURGICAL ENGINEERING
 E) RATIONALE :

This subject is taught to the students to gain knowledge of secondary process of steel making. It gives the knowledge of Argon Oxygen Deagassing (AOD), Vacuum Oxygen Degassing (VOD), ladle refining and degassing of steel.

F) TEACHING AND EXAMINATION SCHEME:

Course Code	Teaching Scheme (Hrs./week)				Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Total Hours	Theory			Practical		Total Marks	
					ESE	CT	TA	ESE	TA		
238515 (38)	4	-	-	-	100	20	10	-	-	130	4

G) DISTRIBUTION OF MARKS AND HOURS :

Chapter No.	Chapter Name	Hours	Marks
1	Introduction	04	04
2	Effect of Non Metallic Inclusion	10	12
3	Degassing of Steel	06	10
4	Secondary Steel Making	10	18
5	Production of Special Steel	06	10
6	Manufacture of Ferro Silicon	10	18
7	Ferro Manganese	10	18
8	Ferro Chrome	08	10
	Total	64	100

H) DETAILED COURSE CONTENTS.

Chapter-1 Introduction:

- Need of secondary process of steel making.

Chapter-2 Effect of non metallic inclusion(NMI):

- Types of NMI,
- Sources of NMI & their characteristics,
- problems associated with NMI,
- shape control of NMI.

Chapter-3 Degassing of steel:

- Seiverts law,
- Degassing, de oxidation, de sulpherisation, dephosphorisation,
- General techniques of vacuum degassing,
- Homogenisation technique.

Chapter-4 Secondary steel making:

- VOD, AOD and other process,
- RH, RH-DH processes,
- LRF (ladle refining furnace),
- Ladle metallurgy & injection technology,
- Use of computer in secondary steel making.

Chapter-5 Production of special steel:

- Stain less steel production.

Chapter-6 Production of Ferro- silicon:

- Classification & composition of Fe-Si alloys,
- Principal & operation of SAF furnace,
- Raw material for ferro silicon,
- Burdel preparation for ferro silicon.

Chapter-7 Production of Ferro-manganese:

- Classification & composition of Fe-Mn alloy,
- Production of ferro manganese in SAF furnace,
- Raw material,
- Uses of HC & LC ferro manganese.

Chapter-8 Production of Ferro-chrome

- Classification & composition of fe- cr alloy,
- Production of fe- cr,
- Benefication & application of chromite ore,

I) SUGGESTED INSTRUCTIONAL STRATEGIES:

- **Lecture Method:**
 - Teaching through chalk board O.H.P, LCD Projector.
 - Interaction with students through seminar.
- **Industrial Visits:**
 - Bhilai Steel Plant, Bhilai.
 - Bharat Aluminium Company Limited Korba.
 - Industrial Estate, Bhiali.
 - Sponge Iron Industries.
- **Expert Lecturer:**
 - Expert lecturer as to be arranged on above subject through guest faculty.
- **Demonstration:**
 - Cut section model, operation of corrosion equipment.
 - Models chart transparencies.

G) DISTRIBUTION OF MARKS AND HOURS :

(a) Reference Books

Sl. No.	Title	Author, Publisher, Edition & Year
1	Steel Making	Kudrin, Mir Publication, Moscow
2	M.S.T.S. (Making Shaping & Treating of Steel)	American Society For Steel
3	Principles of Secondary Processing & Casting of Liquid Steels,.	Ahindra Ghosh, Oxford & IBH
4	Secondary Steel Making, Principles & Applications, CRC Press	Ahindra Ghosh
5	Steel Making	Tupkery, Khanna Publication

(b) Others.

- Models, charts, transparencies ,Video CDs, LCD Projectors & O.H.P.
- Journals & Research Papers.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI**

A)	SEMESTER	:	V
B)	COURSE TITLE	:	INDUSTRIAL TRAINING PHASE II
C)	CODE	:	238524 (38)
D)	BRANCH/DISCIPLINE	:	METALLURGICAL ENGINEERING
E)	RATIONALE	:	

The purpose of industrial training is to offer wide range of practical exposures to latest practices, equipments and techniques used in the field. This training programme will help the student in acquiring hands on experiences of various practices and events required to perform in different job situations. Through the industrial training the students are given an opportunity to develop psychomotor skills and problem solving ability. The students will have to go for industrial training in the following sections:

1. Steel Melting
2. Continuous casting
3. Iron Production
4. Rolling Mill- Rail & Structural Mill, Wire Drawing.
5. Sponge Iron Making
6. Ore Handling Plants
7. Coke Ovens & Byproducts.
8. Foundry Technology.

The industrial Training has basically the following three components: -

1. Orientation Programme
2. Industrial Training in the Industry
3. Report Writing and Evaluation

Note:

During the orientation programme complete guidelines will be provided to the students regarding planning, implementation and evaluation of industrial training.

During the training student will have to maintain a daily dairy to record his observations and experiences at field and on the basis of daily dairy student has to prepare and submit Industrial Training Report.

For evaluation each student has to prepare and present a seminar paper related to experience gained during the industrial training. Each student will be evaluated on the basis of daily diary, training report, seminar presentation and viva voce.

F) TEACHING AND EXMINATION SCHEME:

Course Code	Teaching Scheme (Hrs./week)				Scheme of Examination					Credit L+(T+P)/2	
	L	T	P	Total Hours	Theory			Practical			Total Marks
					ESE	CT	TA	ESE	TA		
238524 (38)	-	-	1	1	-	-	-	80	20	100	1

The duration of industrial training will be of four weeks and organized after the end of Fourth semester examination. The evaluation of this training is done in fifth semester.
