

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Scheme of Teaching & Examination

B.E. VII Semester Metallurgical Engineering

| S. No | Board of Study | Subject Code | Subject | Periods per Week | | | Scheme of Exam | | | Total Marks | Credit L+ (T+P)/2 |
|--------------|---------------------------|--------------|---|------------------|----------|-----------|------------------|------------|------------|-------------|-------------------|
| | | | | L | T | P | Theory/practical | | | | |
| | | | | | | | ESE | CT | TA | | |
| 1 | Metallurgical Engineering | 338711(38) | Ferrous Extraction Metallurgy -II | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 2 | Metallurgical Engineering | 338712(38) | Non Ferrous Extraction Metallurgy | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 3 | Metallurgical Engineering | 338713(38) | Electrometallurgy and Corrosion | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 4 | Metallurgical Engineering | 338714(38) | Alloys Their Properties and Selection | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 5 | Refer Table – II | | Professional Elective – II | 4 | 1 | - | 80 | 20 | 20 | 120 | 5 |
| 6 | Metallurgical Engineering | 338721(38) | Ferrous Extraction Metallurgy - II Lab | - | - | 2 | 40 | - | 20 | 120 | 1 |
| 7 | Metallurgical Engineering | 338722(38) | Alloys and Their Properties and Selection Lab | - | - | 3 | 40 | - | 20 | 60 | 2 |
| 8 | Metallurgical Engineering | 338723(38) | Electrometallurgy and Corrosion Lab | - | - | 3 | 40 | - | 20 | 60 | 2 |
| 9 | Metallurgical Engineering | 338724 (38) | Minor Project | - | - | 4 | 100 | - | 40 | 140 | 2 |
| 10 | Management | 300725(46) | Innovative and Entrepreneurial Skills | - | - | 2 | - | - | 40 | 40 | 1 |
| 11 | Metallurgical Engineering | 338726(38) | **Practical Training Evaluation and Library | - | - | 1 | - | - | 40 | 40 | 1 |
| Total | | | | 20 | 5 | 15 | 620 | 100 | 280 | 1000 | 34 |

L - Lecture T - Tutorial P - Practical, ESE = End Semester Exam CT Class Test TA - Teacher's Assessment

**to be completed after VI sem and before the commencement of VII sem

| S.No. | Board of Study | Subject Code | Subject |
|-------|---------------------------|--------------|--|
| 1 | Metallurgical Engineering | 338751 (38) | Computer Application in Metallurgical Industries |
| 2 | Metallurgical Engineering | 338752 (38) | Design and application fo Engineering Materials |

Note: (1) - 1/4th of total strength of students subject to minimum of twenty students is required to offer in elective in the college in a particular academic session.

Note: (2) - Choice of elective code once made for an examination can not be changed in future examinations.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII

Subject: Ferrous Extraction Metallurgy II

Total Theory Periods: 50

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg

Code: 338711 (38)

Total Tut Periods: 12

UNIT - 1

A brief history of steel making industry in India. Raw Materials and refractories for steel making. 'raw material handling equipments. External treatment of hot metal. Acid Bessemer and basic Bessemer converter process. Modification of converter process.

UNIT - 2

Thermodynamics and kinetics of steel making Reactions, Laws of thermodynamics and application to the treatment of ferrous melts and slags. Reactions of carbon, silicon, manganese, phosphorous and sulphur. Steel furnace slags, properties, and slag control.

UNIT - 3

Fundamentals of open hearth steel making furnace, construction and refractories used, charge materials and fuels. Open hearth slag and refining reactions, Deoxidation and alloying. Development in OHF process, use of oxygen for intensification. Duplex process and active mixer. Electric Arc Furnace steel making, Alloy steel production in E.A. F.

UNIT – 4

Refining of ferrous – melt under oxygen jet. Mechanism of refining and kinetics. Basic oxygen furnace (BOF) STEEL MAKING, thermal balance in oxygen converter, process control in L. D. converter, treatment of high phosphorous iron in modified L. D. processes, Kaldo and Rotor process.

UNIT – 5

Ingot casting and continuous casting of steel, teeming practice and ingot structure and defects. Secondary steel making processes. Gases in steel and vacuum degassing. A O D, V O D, and E S R, processes. Review of secondary steel making process in various countries.

Name of the Text Books

1. Steel Making Technology – Kudrin
2. Tupkary R.H. : "Introduction to Modern Steel Making" Khanna Publishers, Delhi
3. Bodsworth : "The Physical Chemistry of Steel Making"

Name of Reference Books:

1. G. Oike : "Converter and open hearth steel manufacture", Mir Publishers.
4. Jackson A. : "Oxygen steel making for steel Makers", George newries Ltd., London.
5. A.I.M.E. : "Electric furnace steel Making", Vol. I and II.
6. Camp and Francis : "The Making, shaping and Treating of steel", (USS)

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII
Subject: Non - Ferrous Extraction Metallurgy
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg
Code: 338712 (38)
Total Tut Periods: 12

Unit-I

Trends of nonferrous metal production and consumption in India. Indian non-ferrous resources and their general mineralogical characteristics; Important ore beneficiation techniques. Recycled and partially processed materials. Winning of Metals from sulphide and oxide ores. Sulphide and Oxide ores of Pb. Zn Cu Ni. Selective floatation of sulphide minerals. Roasting of copper, lead, Zinc and nickel ores/concentrates Predominance Area diagrams. Calculation for determination of yield and composition of calcine. Equipments for Roasting. Flash and Fluo-solids roasters, Roasting prior to leaching. Roasting prior to smelting.

Unit-II:

Pyrometallurgy of copper from Roasted sulphide ores concentrates. Matte smelting in Blast Furnace. Reverberatory Furnace and Electric furnace. Magnetite formation Charge Calculation in Reverberatory Furnace. Recent development in shaft furnace TORCO process. Flash Furnace-INCO and outocumpu processes. Use of oxygen in Flash smelting. continuous production of copper by WORCRA. Noranda Mitsubishi processes Indian copper Industry. Pyrometallurgy of Nicel Extraction from sulphide ores, extraction from oxide ores.

Unit-III

Extraction of zinc from horizontal and vertical retort processes, imperial smelting process, production of other metals by I S P. Zinc from lead slag. Zinc production in India. Refining of zinc by distillation in refluxing units. Lead oxide from roasted sulphide ores/ concentrates (Dwight Lloyd sintering m/c) Treatment of sinter in lead blast furnace; base bullion production. Refining of lead bullion by Parkes process, dezincing and debismuthing. Modern developments in lead smelting; Production of Lead in India

Tin ores and flowsheet for tin extraction. Pyrometallurgical refining of tin. Recovery of secondary copper. Secondary lead and secondary Zinc and Tin (only flowsheets)

Unit-IV

Beneficiation of Beach sands Vacuum reduction and refining of reactive metals, Halide Metallurgy. Production of pure metals, melting of metal sponge Transport reactions. Extraction of Titanium from Beach sands. Uranium Thorium and Zirconium extraction in India-general flowsheet for Beryllium.

Unit-V

Bauxite sources and Bayer Process for production of Alumina. Factors affecting Bayer process. Other processes for Alumina Preparation from low-grade ores. Cryolite bath for Production cell for Aluminium. Hall-Heroult process Factors influencing electrolysis. Newer processes for Aluminium production. Indian Aluminium manufacture. Magnesium and Magnesium ores. Methods of Magnesium extraction. Pidgeon process Electrolytic process of Magnesium. Refining of Magnesium. General methods of producing ferro-alloys an introductory consideration only.

Name of Text Books :

Extraction of Non-ferrous Metals - Ray, Shridhar and Abraham –

Principles of Extractive Metallurgy - T. Rosenquist

Extractive Metallurgy of Copper paraganman press, 1980 – A.K. Biswas and W.G. Davenport

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII

Subject: Electrometallurgy and Corrosion

Total Theory Periods: 50

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.

Code: 338713 (38)

Total Tut Periods: 12

Unit – I Principles of Electrochemistry

Aqueous electrolytes, ionic conductivity; pH Electrolytic conduction Electrode Potential, Equilibrium decomposition and Redox potentials, cell mechanism and thermodynamics E.M.F. series polarization and over voltage current efficiency and energy efficiency of electrolytic processes calculations based on the above.

Unit – II Electroplating

Principles of Electroplating and factors affecting electro deposition of metals, Preplating operations Electro plating of copper, nickel, chromium, cadmium, zinc, tin and aluminium Principle of alloy position and brass plating Anodizing. Electroless plating and Electroforming A brief idea of air-pollution and control in these processes.

Unit – III Electrowinning and electro refining

Electrowinning of metals from aqueous solutions and fused salt electrolytes Hydrometallurgical technique for the extraction of copper, zinc and manganese fused salt process for aluminium and magnesium extraction Electro refining of copper nickel silver and gold.

Unit – IV Corrosion

Corrosion damage economics oil corrosion electrochemical mechanism of corrosion Forms of corrosion Uniform attack galvanic corrosion crevice corrosion pitting corrosion. Intergranular corrosion, erosion corrosion, stress corrosion cracking, hydrogen cracking, corrosion fatigue, cavitation corrosion, fretting corrosion and dezincification. Passivity – Definition characteristics of passivation, passivity in Iron chromium alloys.

Unit – V Corrosion prevention

Cathodic and anodic protection metallic and inorganic surface coating films and adsorption inhibitors. Corrosion rate measurement and analysis of corrosion failures.

Name of Text Books :

- Introduction to Electrometallurgy – Sharan and Narayan
- An Introduction to metallic Corrosion and Prevention - Raj Narain
- Corrosion Engineering – Fontana and Greene

Name of Ref. Books

- Introduction to Electrochemistry – S. Glasstone
- Chemical Metallurgy – J. J. Moore
- Electroplating and related Metal finishing. Pollutant and toxic materials Contrell – Marshal
- Modern Electroplating – Lowenheim
- Corrosion causes and Prevention – Speller
- Diectrochemical Engineering – C.L. Mantel

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII

Subject: Alloys their properties and Selection

Total Theory Periods: 50

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.

Code: 338714 (38)

Total Tut Periods: 12

Unit – I Function of Alloying elements in steel

Limitations of plain carbon steel, General effect of alloying elements, mode of combination of alloying elements, Effect of alloy elements on transformation temperature, effect of alloying elements on critical cooling rate, on hardenability and on tempering. Low alloy steels:- Low alloy steels such as high tensile structural steel, case carburizing steels, nitriding steels, ball bearing steels, spring steels, low alloy high strength structural steels.

Unit – II Study of high Ni steels, high speed steel, die steel, Hadfield,s steel and maraging steel.

Unit – III Cast Irons:- Structure and properties of white cast irons, gray cast iron, malleable cast iron, nodular cast iron and alloy cast irons. Study of Stainless steels, heat resistant high strength steels and ausformed steels.

Unit –IV Non ferrous alloys- Structure and properties of Brasses, bronzes, babbits. Structure and properties of titanium alloys, Aluminium alloys, Monels, brazing and soldering alloys.

Unit –V Metals at low temperatures:- Effect of low temperature on properties, Effect of low temperature on notched bar test, Metallurgical factors, mechanical factors. Magnetic steels and alloys. Alloys for electrical applications. Zirconium alloys in nuclear technology. Amorphous metals. Specifications of alloys:- I S I, A I S I and En standards (Basic concepts only).

Text Books

Physical metallurgy for engineers- by D.S. Clark and Warne.

Structures and Properties of alloys- by Robert M. Brick and Phillips.

Introduction to Physical metallurgy- by Sidney H. Avner.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII
Subject: Computer Application in Metallurgical industries
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.
Code: 338751 (38)
Total Tut Periods: 12

Unit – I

Basic Control System in industrial application, scope of computer application in the operations of a manufacturing firm. Product cycle, Automation and CAD/CAM. Microprocessors in instrumentation and control.

Unit – II

General concepts of Analog and digital signals and their interconversion. Types of information handling. General-purpose Digital Computers and their basic hardware components. Minicomputers, Microcomputers and Programmable Controllers. Applications round-up. Local Area Networks.

Unit – III

Computer Process Interfacing. Computer Process control. Process Control strategies. Distributed vs. Central Control. Computer-Aided Quality Control. Computer-Integrated Manufacturing Systems.

Unit – IV

Application of microcomputers to mechanical testing, selection of optimum cost steels and prediction of hardenability, computer analysis of engineering components. Statistical Analysis of metallurgical data.

Unit – V

Computerized heat treating. Microcomputers/Microprocessors in Metallurgical furnaces. Computer application in image analysis and corrosion testing. Use of computer in Linear programming problems.

Names of Text Books:

1. Groover and Zimmers, CAD/CAM: Computer-Aided Design and Manufacturing, Prentice-Hall of India, 1989.
2. Source-book on computers, American Society of Metal. 88.
3. Mathematical Control Machines – by Loskutov, Peace Publ. Moscow.

Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Semester: VII

Subject: Design and Application of Engineering Materials

Total Theory Periods: 50

Total Marks in End Semester Exam: 80

Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.

Code: 338752 (38)

Total Tut Periods: 12

Unit 1 General principles of materials selection and design based on requirements of function, property, processability and cost.

Unit 2 Quantitative methods of materials selection, normalization of properties, weighting factors, materials performance index.

Unit 3 Introduction to design codes, criteria for material qualification and acceptance for important applications.

Unit 4 Introduction and use of materials data bases, hand books etc. illustrative examples of materials selection

Unit 5 Materials for aircraft wings, cutting tools, gas turbine blades, liquid nitrogen containers, artificial hip replacement, automobile valve spring etc.

Texts/References:

N A Waterman and M F Ashby, The Materials Selector, Vols. I, II and III, Chapman and Hall, London, 1996.

Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Semester: VII

Subject: Ferrous Extraction Metallurgy II

Total Practical Periods: 28

Total Marks in End Semester Exam: 40

Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.

Code: 338721 (38)

Total Tut Periods: NIL

Experiment to be performed

1. Study of plant layout of an integrated iron & steel plant
2. Constructional detail of Blast furnace.
3. Designal features of LD converter
4. design & working of regenerators in open hearth furnace.
5. Study of Twin ;Hearth Furnace steel making.
6. constructional detail of Electric arc furnace.
7. Study of atmosphere control in EAF
8. Comparative study of Kaldo and LD steel making.
9. Comparative study of Arc and induction furnaces.
10. Study of ladle metallurgy (AOD, VOD etc.)

List of Equipments/Machine Required:

1. Charts
2. Models
3. Video clipping
4. Industrial Training
5. Tables
6. Photographs.

Recommended Books:

1. Lab manuals
2. The making Shaping and Treating of Steel
3. Electric furnace steel making volume – I and II

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII
Subject: Alloys their properties and Selection Lab
Total Practical Periods: 28
Total Marks in End Semester Exam: 40
Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.
Code: 338722 (38)
Total Tut Periods: NIL

Experiment to be performed

1. Al-alloys making (Y-alloy, duralumin)
2. Study of the structure and interpretation of results of Al-alloys.
3. Measurement of strength, Hardness and impact strength of Al-alloys.
4. Preparation of silumin alloys.
5. Study of the microstructure and interpretation.
6. Copper melting and making of brass.
7. Measurements of mechanical properties of copper and its alloys and correlation properties with microstructure.
8. Copper melting and Bronze making.
9. Metallographic studies of Brass
10. Metallographic studies of Bronze.
11. Study of its microstructure and interpretation. Correlation of mechanical properties and microstructure.
12. Babbit metals making.
13. Measurement of mechanical properties and correlation with microstructure of Babbit metals.
14. study of microstructure of cast iron and correlation with mechanical properties.
15. Study of microstructures of steels and correlating with mechanical properties.

List of Equipments/Machine Required:

1. Crucible
2. Heat Treatment furnace
3. Master alloys
4. Metallurgical Microscope
5. Polishing and etching materials/equipments.

Recommended Books:

1. Lab manuals
2. Structures and properties of alloys – by Robert M Brick and Phillips

Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Semester: VII
Subject: Electrometallurgy and Corrosion
Total Practical Periods: 40
Total Marks in End Semester Exam: 40
Minimum number of class test to be conducted: 2

Branch: Metallurgical Engg.
Code: 338723 (38)
Total Tut Periods: NIL

Experiment to be performed

1. Copper plating
2. Chromium plating
3. electroplating of cadmium
4. Electroplating of Zinc
5. Effect of acidity in electrometallurgy
6. Effect of electrode distance in electrometallurgy
7. Effect of circulation in electrometallurgy
8. Brass plating
9. Electrowinning of copper
10. Electrowinning of Zinc
11. Anodizing
12. Corrosion rate measurement (weight loss study)
13. Corrosion reaction and polarization study
14. Effect of Inhibitors on corrosion behavior of steel
15. Electropolishing

List of Equipments/Machine Required:

1. Voltmeter
2. Ammeter
3. Resistors
4. Potentiostat (Automated)
5. Required chemicals, CuSO₄, H₂SO₄, etc
6. PH measuring instrument
7. Required metals, copper, zinc, steel etc.
8. Digital weight balance.

Recommended Books:

1. **Lab manuals**
2. **Electroplating and related metal finishing, pollutant and toxic materials, Contrell Marshal**

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: VII
Subject: Innovative & Entrepreneurial Skill
Total Practical Periods: 28
Total Marks in End Semester Exam: ---
Minimum number of class test to be conducted: 2

Branch: Common to all branches
Code: 300725 (36)
Total Tut Periods: NIL

Unit I

Innovation: innovation- an abstract concept; creativity, innovation and imagination; types of innovation -classified according to products, processes or business organizations.

Unit II

Entrepreneurship: who is an entrepreneur? Entrepreneurship- A state of Mind, Emergence of entrepreneur; Role of Entrepreneur; A Doer not a Dreamer- Characteristics of an entrepreneur; Factors affecting entrepreneurial growth – Social, cultural, personality factors, psychological and Social Factors. Impact of Entrepreneurship for sustainable development.

Unit III

Difference between entrepreneur and entrepreneurship, Difference between entrepreneur and intra-preneur, Common Entrepreneurial competencies/Traits; Entrepreneurship stimulants, Obstacles inhibiting Entrepreneurship; Types of entrepreneurs, Functions of an entrepreneur.

Unit IV

Identification of Business Opportunities: Introduction, Sources of Business of Product Ideas, Steps in Identification of Business opportunity and its SWOT Analysis.

UNIT-V

Techno-Economic Feasibility of the project: Introduction, Techno- Economic feasibility of the Project, Feasibility Report, Considerations while preparing a Feasibility Report, Proforma of Feasibility Report, Role of Institutions and entrepreneurship.

Text and Reference Books:

1. Competing through Innovation-Bellon & Whittington, Prentice Hall of India
2. A Guide to Entrepreneurship – David Oates- JAICO Publishing House.
3. Entrepreneurship- Rober D Hisrich, Peters, Shepherd- TMH
4. Entrepreneurship in Action- Coulter, Prentice Hall of India
5. Entrepreneurship Management and Development – Ajith Kumar, HPH
6. Fundamentals of entrepreneurship- Mohanty, PHI
7. Patterns of Entrepreneurship- Jack M Kaplan, Wiley, student Edition.