Chhattisgarh Swami Vivekanand Technical University, Bhilai
Scheme of Teaching & Examination

B.E. VIII Semester Metallurgical Engineering

S. No	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Exam			Total Marks	Credit L+ (T+P)/2
							Theory/practical				
				L	T	P	ESE	CT	TA		
1	Metallurgical Engineering	338831(38)	Materials Characterization	4	1	-	80	20	20	120	5
2	Metallurgical Engineering	338832(38)	Secondary Steel Making Technology	4	1	-	80	20	20	120	5
3	Metallurgical Engineering	338833(38)	Experimental Techniques in Metallurgy	4	1	-	80	20	20	120	5
4	Refer Table – III		Professional Elective – III	4	1	-	80	20	20	120	5
5	Refer Table – IV		Open Elective – IV	4	-	-	80	20	20	120	4
5	Metallurgical Engineering	338861(38)	Materials Characterization Lab	-	-	2	40	-	20	60	1
6	Metallurgical Engineering	338862(38)	Advance Steel Making Hands on Training	-	-	2	40	-	20	60	1
7	Metallurgical Engineering	338863(38)	Experimental Techniques in Metallurgy Lab	-	-	2	40	-	20	60	1
8	Metallurgical Engineering	338864(38)	Major Project	-	-	7	100	-	80	180	4
9	Metallurgical Engineering	338865(38)	Report Writing and Seminar	-	-	2	-	-	40	40	1
			Library	-	-	1	-	-	-	-	-
Total				**20**	**4**	**16**	**620**	**100**	**280**	**1000**	**32**

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

Table -3

Professional Elective - III

S.No.	Board of Study	Subject Code	Subject
1	Metallurgical Engineering	338841(38)	Powder Metallurgy
2	Metallurgical Engineering	338842(38)	Light Metals and Alloys

Note: (1) - 1/4th of total strength of student's 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 cannot be changed in future examinations.

Table - IV

Open Elective –IV			
S.No.	Board of Studies	Code	Name of Subject
1	Management	300851(76)	Enterprise Resource Planning **(Except CSE & IT Branch)**
2	Information Technology	300852(33)	E-Commerce & strategic IT **(Except CSE & IT Branch)**
3	Management	300853(76)	Technology Management
4	Information Technology	300854(33)	Decision Support & Executive Information system
5	Computer Science & Engg.	300855(22)	Software Technology
6	Management	300856(76)	Knowledge Entrepreneurship
7	Management	300857(76)	Finance Management
8	Management	300858(76)	Project Planning, Management & Evaluation
9	Mechanical Engg.	300859(37)	Safety Engineering
10	Computer Science & Engg.	300801(22)	Bio Informatics
11	Mechanical Engg.	300802(37)	Energy Conservation & Management
12	Nanotechnology	300803(47)	Nanotechnology
13	Management	300804(76)	Intellectual Property Rights
14	Mechanical Engg.	300805(37)	Value Engineering
15	Civil Engg.	300806(20)	Disaster Management
16	Civil Engg.	300807(20)	Construction Management
17	Civil Engg.	300808(20)	Ecology and Sustainable Development
18	Chem. Engg.	300809(19)	Non Conventional Energy Sources
19	Electrical Engg.	300810(24)	Energy Auditing & Management (Except Electrical Engg. Branch)
20	Mechanical Engg.	300811(37)	Managing Innovation & Entrepreneurship
21	Information Technology	300812(33)	Biometrics
22	Information Technolgy	300813(33)	Information Theory & Coding
23	Computer Science & Engg.	300814(22)	Supply Chain Management
24	Computer Science & Engg.	300815(22)	Internet & Web Technology
25	Electrical Engg.	300816(24)	Electrical Estimation and Costing
26	Electrical& Electronics Engg.	300817(25)	Non Conventional Energy Sources
27	Computer Science & Engg.	300818(22)	Big Data and Hadoop

Note (1) 1/4th of total strength of students is required to offer an elective in thecollege in a particular academic session.
(2) - Choice of elective course once made for an examination cannot be changed

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G)

Semester: VIII **Branch: Metallurgical Engineering**
Subject: Material Characterization **Code: 338831(38)**
Total theory Periods: 40 **Total Tutorial Periods : 12**
Total marks in end semester examination: 80

COURSE OBJECTIVES

Material characterization gives an insight into the metal which helps in development and design of alloys.

UNIT-I

Chemical bonding, fundamentals of crystallography, mode of bonding, crystal types, density of packing, atomic stacking, inter-atomic voids, Optical principles of microscopy resolution, magnification, depth of focus electron diffraction, imaging (various contrasts), determination of crystal structure.

UNIT-II

X-rays introduction, absorption of x-rays, absorption edge, filters, XRD Principle, Bragg's law of diffraction, determination of inter-planar distances, Schematic diagram of rotating sample techniques, Powder diffraction method, calculation of intensity of diffracted beam, determination of structure factor for cubic system .Numerical, X- Ray Diffractometry such as phase analysis and structure analysis.

UNIT-III

SEM- Introduction- different modes of SEM operation, different components of SEM and its functions, electron guns (tungsten filament, field emission guns), emission current, brightness, lenses used in SEMs, condenser and objective lenses, effects of condenser lens strength, working distance and aperture size on demagnification of the beam, electron beam interaction, detectors.

UNIT-IV

TEM- Introduction, direct and indirect beam, image resolution, depth of field and depth of focus, bright and dark field imaging in TEM, electron diffraction, SADP, STEM mode of imaging, magnetic lenses, defects occurs in magnetic lenses and its minimization, TEM sample preparation

UNIT-V

UV-Vis, IR & FTIR Spectroscopy - D.S.C. and Thermo mechanical Analysis, Plasma Process Principles and Applications & techniques. Physicochemical Properties of Liquid metals and alloys such as Viscosity, surface tension and electrical conductivity.

REFERENCE BOOKS:

1. Experimental Techniques in Physical Metallurgy, V.T. Cherepin & A.K. Malik, I.I.T., Bombay.
2. Techniques of Metals Research Vol.-I, Vol.-II, Bunshah Inter Science Publication.
3. Thermal Analysis by Bernhard Wiindrelich Academic Press.
4. Image Analysis & Metallography. (Microstructural Science Vol.-17) ASTM 1989.
5. Elements of X-Ray Diffraction, B. D. Culity (Addison Wesley)
6. Physical Methods for Metal Characterization, Pej Flewitt (Institute of Physics Pub.)
7. Principle of TEM- Barry- Carter
8. SEM and X-Rat microanalysis- Joseph I. Goldstein

METHODOLOGY

- Lecture, PPT- Presentation, Class Discussions
- Students' self study
- Tutorial Classes

EXPECTED OUTCOME

The students will be able to operate sophisticated instruments and be able to conduct the experiments.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G)

Semester: VIII **Branch: Metallurgical Engineering**
Subject: Experimental Techniques in Metallurgy **Code: 338833(38)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class test to be conducted: 2

COURSE OBJECTIVES

To learn the basic principles of metallurgical instruments and apply basic scientific knowledge for conducting experiments for metallurgical research.

Unit-I

Microscopic examination; elements of optics, magnifying lens, components of microscope, microscopic techniques, quantitative microscopic analysis. Election Microscopy; Comparison with light microscope, elements of electron optics, electron lenses, design of electron microscope , arrangement for microscopy and diffraction, emission microscopes, application of electron microscope.

Unit –II

High temp technique – methods of obtaining high temp resistance furnace, f/cs for temp. above 1000°C, temp measurement, thermocouples, electrical circuits for resistance thermometers, automatic control of temp. control of the power, anticipating devices, temp programming.

Unit –III

Vacuum techniques – Flow conductance & impedance, speed of pump, design of pumps and systems, Rotary mech. Pumps, calculation of high vacuum systems, choice of pumps. Measuring gauges for low pressure, vacuum connections, typical vacuum system, vacuum system of an electron microscope.

Unit –IV

Thermal methods – thermal properties of metals and alloys, thermal analysis of phase transformation, calorimetric analysis Electrical methods – electrical properties of metals and alloys, measuring instruments, experimental techniques for resistance measurement. High speed measurements, induction methods.

Unit –V

Dilatometer: Substances, ordinary mech. & optical dilatometers, differential optical dilatometers, Elect. Dilato, treatment of dilato datas, measurement of vol effects of phase transformations, quantitative dilato phase analysis.

NAME OF TEXT BOOKS

(1) Experimental Tech in Phy. Met. by – A k Mallik & V T Chesepin
(2) Procedures in Experimental Met. by – A V Soybalt & J G Burke John Wiley & Sons. London (1953)

NAME OF REFERENCE BOOKS

1. Automation in magnetometric and dilato. Measurements V T Cherepin
2. Instrumentation in Scientific research by – K S Lion Mc Graw Hill, New York.

METHODOLOGY

- Lecture, PPT- Presentation, Class Discussions
- Students' self study
- Tutorial Classes
- Interactions with the respective Faculty
- Industry Visit

EXPECTED OUTCOME

To develop the skills for handling the equipment for material research.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G)

Semester: BE VIII **Branch: Metallurgical Engineering**
Subject: SECONDARY STEEL MAKING TECHNOLOGY **Code: 338832(38)**
Total theory Periods: 50 **Total Tutorial Periods: 12**
Total marks in end semester examination: 80

COURSE OBJECTIVE

To learn the secondary metallurgical processes of steel making. To design and optimize the process flow route to improve the quality of the product and efficiency of the process.

Unit – I

A review of the steel making process, problems with BOF steel making and justification for secondary steel making. The effect of impurities on the properties of steel; effect of sulphur, phosphorous, nitrogen and hydrogen. The stringent requirements wrt C, O, S, N and H in special steels. Steps at the steel making stage. Some basic laws: governing secondary metallurgy: Sivert's law and Stoke's law.

Unit – II

Function of the secondary metallurgy; advantages and prerequisites. General classification of secondary metallurgical techniques. Ladle Treatment Station. Stirring processes; top lancing with argon, basal injection of argon, electromagnetic stirring. Wire feeding and special injection processes.

Unit – III

Ladle Furnaces: basic technology, design, process, benefits and problems. Chemical Heating process

Unit – IV

Vacuum Arc Degassing (VAD) and Tank Degassing: basic technology, design, process, benefits and problems. Vacuum Oxygen Decarburization (VOD), vacuum ladle degassing

Unit – V

Recirculation Degassing- Ruhrstahl Heraeus (RH), Recirculation Degassing with oxygen top lance (RH-OB). Selection of process.

Text Books

1. Fundamentals of Steel Making – ET Turkdogan
2. Secondary Metallurgy- Fundamentals, Processes and Applications Gerd Stole ISBN
3. Secondary Steel Making for product Development: Proceeding of Conference, Institute of Metals 1985

METHODOLOGY

Learn the different technologies of secondary metallurgy presently available and the optimization for further improvement. The students will visit different plants to observe the working of the process themselves.

EXPECTED OUTCOME

The demand on the quality of steel presupposes adoption of advanced secondary metallurgical techniques. The engineers having a good knowledge of the subject will be a step ahead of the others in the field of steel making.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G)

Semester: BE VIII **Branch: Metallurgical Engineering**
Subject: Powder Metallurgy **Code: 338841(38)**
Total theory Periods: 40 **Total Tutorial Periods: 12**
Total marks in end semester examination: 80

COURSE OBJECTIVES

To know the fundamental concept of powder production, characterization of powder, compaction, sintering and literally understand mechanism of sintering that is how the powder material transform to an agglomerated one.

Unit – I

Powder Preparation Methods Introduction, Advantages and limitations of powder metallurgy, basic steps of powder metallurgy, characterization of metal powders, manufacturing of metal and composite powders, different methods of metal powder production.

Unit – II

Compaction of Metal powders: Theory of compaction and compatibility of metal powders, Die compaction, Isostatic pressing, powder forging, powder rolling and extrusion, Pressure-less compaction, Hot pressing and Hot Isostatic pressing

Unit - III

Sintering: Theory & mechanism of sintering of metal powder compacts, Process variables in sintering, Liquid phase sintering, Sintering furnaces, Sintering atmospheres,

Unit – IV

Applications of Powder Metallurgy, production of typical P/M components – porous products and bearing, tungsten filament and electrical contacts, magnetic materials, friction materials, hard metals and carbide tools.

Unit – V

Ceramics: Classification of ceramics, structure of ceramic and glassy materials, strengthening/toughening mechanism, ceramic powder preparation, forming processes. Applications & Some recent developments in the processing & applications of ceramics.

TEXT / REFERENCES

1. Powder met. An overview – I Jenkins & J.V. Wood
2. Powder Met. Science & Powder Technology – R.M. German.
3. Powder Metallurgy – A.K. sinha
4. Powder Metallurgy and related high temperature materials – P. Ramkrishnan.
5. Advance Technique in powder metallurgy – F. Clark
6. Introduction to ceramics, (second edition) Wiley & Sons – W.D. Kingery
7. Ceramic Fabrication process – W.D. Kingery.

METHODOLOGY

- Lecture, PPT- Presentation, Class Discussions
- Students' self study
- Tutorial Classes
- Industry Visit

EXPECTED OUTCOME

The students will be able to utilize concept of powder metallurgy to make the different porous product as per desired.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G)

Semester: VIII **Branch: Metallurgical Engineering**
Subject: Light Metals and alloys **Code: 338842(38)**
Total Theory Periods: 40 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class test to be conducted: 2

COURSE OBJECTIVES
To understand the processing of light metals and their uses.

Unit – I
Classification of light metal alloys, their properties, importance of strength / wt ratio in engineering applications. Detailed engineering applications, Indian / International specifications.

Unit – II
Melting methodology of light metal alloys used of melting / refining flows. Casting characteristics of light metal alloys (Ag., Mg, Te alloys). Light metal alloys foundry practices, master alloy used in melting.

Unit – III
Physical metallurgy of light metals alloys, rolling, sheet metal working, extrusion etc.

Unit – IV
Special Alloys: Duralumin, Al-Li, Mg-Li alloys – production and processing techniques & applications. Titanium alloys: Alloying elements and their effects, types of alloys, their processing, heat treatment, properties and selection.

Unit – V
Strategic applications of light metal alloys, air craft industries. Functional considerations. Defects analysis in cast and rolled products. Failure analysis of light metal alloys components.

Name of Text Books :
1. Non-ferrous Physical Metallurgy – R.J. Raudebaugh
2. Light Alloys – I..J.Polmear
3. Light Metals – C.M. Bickett.
4. Heat Treatment Processing & Properties of Non Ferrous Alloys – C. R. Brooks, ASM

METHODOLOGY
- Lecture, PPT- Presentation, Class Discussions
- Students' self study
- Tutorial Classes
- Industry Visit

EXPECTED OUTCOME
To become an expert in the field of light metals which are important for air craft industry.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G)

Semester: VIII **Branch: Metallurgical Engineering**
Subject: Material Characterization Lab **Code:338861(38)**
Total theory Periods: 40 **Total Tutorial Periods: 12**
Total marks in end semester examination: 80

COURSE OBJECTIVES
To learn the operation of advanced metallurgical instruments to find out the properties of important engineering materials.

1. To study the geometry of close packing in simple crystals
2. Study of optical microscope and image Analyzer.
3. Micrography and micro specimen preparation of metals and non metals.
4. Microstructure of cast iron
5. Microstructural study of Copper and its alloys
6. Microstructural study of different types of steel
7. Study of Scanning Electron Microscopy (SEM)
8. Study of Transmission Electron Microscopy (TEM)
9. Study of DTA and TGA
10. Study of DSC
11. Study of X-Ray Diffractometry (XRD)
12. Study of UV, IR and FTIR Spectroscopy

METHODOLOGY
- Practical operation/Class Discussions
- Students' self study
- Industry Visit

EXPECTED OUTCOME
The students will be able to characterize the materials by different technique and evaluate the properties of materials.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G)

Semester: VIII **Branch: Metallurgical Engineering**
Subject: Experimental Techniques in Metallurgy Lab **Code: 338863 (38)**
Total Practical Periods: 40 **Total Tut Periods: Nil**
Total Marks in End Semester Exam: 40

COURSE OBJECTIVES
To learn the operation of the sophisticated metallurgical equipment.

Experiment to be performed:

1. Measurement of temperature of a furnace using radiation pyrometer.
2. Study of microstructure of a metal at high temperature.
3. Measurement of hardness of micro-constituents, such as ferrite, pearlite, cementite etc.
4. Quantitative phase analysis, using an Image analyzer.
5. The effect of composition on electrical resistively of alloys.
6. Differential thermal analysis.
7. To calculate thermal expansion and volume changes associated with phase transformations, using a dilatometer.
8. To find out the wear rate of different materials using wear testing machine.
9. To carry out estimation of phases with the help of thermo magnetic curves.
10. Study of electron microscopic examination of metallic samples.

Equipments/Devices Required:
1. Metallurgical microscope
2. Furnaces.
3. Dilatometer.
4. Differential thermal analyzer
5. hardness tester.
6. image analyzer
7. Pyrometer.

BOOKS RECOMMENDED
1. Experimental techniques in physical metallurgy by – B T Cherepin a;nd A K Mallik
2. Principles of metallographic laboratory practic4e by – Kehl.

METHODOLOGY
- Practical operations/ Class Discussions
- Students' self study
- Industry Visit

EXPECTED OUTCOME
Will be able to handle the instruments and conduct different metallurgical experiments.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G)

Semester: VIII **Branch: Metallurgical Engineering**
Subject: ADVANCED STEEL HANDS ON TRAINING **Code: 338862(38)**
Total theory Periods: 40 **Total Tutorial Periods: nil**
Total marks in end semester examination: 40

COURSE OBJECTIVES

- To learn the basic principles of solidification of metals and foundry technology.
- To utilize the knowledge for industrial application
- Apply basic scientific principles for technical problem solving in foundry to increase Technical Skills

EXPERIMENTS TO BE CONDUCTED

1. To study the raw materials required for steel making; their characteristics, effect on quality and cost.
2. Handling of the raw materials, charging sequences, charge calculation, effective utilization
3. Making of the heat, the problems faced and their solutions
4. Heat teeming, Deoxidation and disposal
5. Secondary treatments and Composition adjustment.
6. Continuous casting: component of the machine
7. Continuous casting parameters, their effect on quality of products
8. Role of quality control in heat making and casting.
9. Processing of the products
10. Study of the models automation and computerization in steel making and continuous casting.

METHODOLOGY

- Class Discussions
- Students' self study
- Interactions with the respective Faculty
- Industry Visit

EXPECTED OUTCOME

The students will learn the actual methods of steel making and will be able to solve the problems associated.

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Name of Program: B.E. VIII **Branch: Common to All Branches**
Subject: Big Data and Hadoop **Code: 300818(22)**
Duration of period: 50 minutes
Total Theory Periods: 50 **Total tutorial periods: NIL**
Class Test: 02 **Assignments: 02**
Maximum Marks: 80 **Minimum Marks: 28**

COURSE OBJECTIVES:

1. To understand the fundamental concepts of big data analytics
2. To analyze the big data using intelligent techniques.
3. To develop various search methods and visualization techniques.
4. To explore various techniques for mining data streams.
5. To understand the applications using Map Reduce Concepts.

Course Contents:

UNIT I **CONCEPTS OF BIG DATA:** Concept of Big Data Platform – Evolution and Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools- Applications of big data.

UNIT II **MINING DATA STREAMS :**Introduction To Streams Concepts – characteristics, Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window, Role of high speed mass storage.

UNIT III **HADOOP:** History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Map Reduction Working - Anatomy of a Map Reduce Job run Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features.

UNIT IV **HADOOP ENVIRONMENT:** Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks Hadoop in the cloud.

UNIT V **FRAMEWORKS:** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper. Visualizations - Visual data analysis techniques, interaction techniques.

Course Outcomes:

1. To able to know about intelligent applications.
2. To use knowledge about vast data.
3. To know different big data modelling techniques.
4. Ability to work in Hadoop environment.

Text Books:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
3. Anand Rajaraman and Jeffrey David Ullman,“Mining of Massive Datasets”, Cambridge University Press, 2012.