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

Scheme of Teaching and Examination

B.E. (VI 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	**338651 (38)**	Furnace Technology & Instrumentation	4	-	-	80	20	20	120	4
2	Metallurgical Engineering	**338652 (38)**	Theory and Technology of Heat Treatment	3	1	-	80	20	20	120	4
3	Metallurgical Engineering	**338653 (38)**	Computer Programming and Applications in Metallurgical Industries	3	1	-	80	20	20	120	4
4	Metallurgical Engineering	**338654 (38)**	Metal Joining Processes	3	1	-	80	20	20	120	4
5	Metallurgical Engineering	**338655 (38)**	Steel Making	3	1	-	80	20	20	120	4
6	*ReferTable- I*		Professional Elective-I	4	1	-	80	20	20	120	5
7	Metallurgical Engineering	**338661 (38)**	Furnace Technology Lab	-	-	3	40	-	20	60	2
8	Metallurgical Engineering	**338662 (38)**	Computer Programming and Applications in Metallurgical Industries Lab	-	-	3	40	-	20	60	2
9	Metallurgical Engineering	**338663 (38)**	Metal Joining Lab	-	-	3	40	-	20	60	2
10	Metallurgical Engineering	**338664 (38)**	Theory and Technology of Heat Treatment Lab	-	-	3	40	-	20	60	2
11	Management	**300665(76)**	Managerial Skills	-	-	2	-	-	40	40	1
12			**Library**	-	-	1	-	-	-	-	-
Total				**20**	**5**	**15**	**640**	**120**	**240**	**1000**	**34**

L: Lecture **T:** Tutorial **P:** Practical
ESE: End Semester Examination **CT:** Class Test **TA:** Teachers' Assessment

Note: Industrial Training of eight weeks is mandatory for B.E. students. It is to be completed in two equal parts. The first part must have been completed in summer after IV semester The second part to be completed during summer after VI semester after which students have to submit a training report which will be evaluated by college teachers during B.E. VII semester

Table – 1: Professional Elective - I

S.No.	Board of Study	Subject Code	Subject
1	Metallurgical Engineering	338671 (38)	X-Ray Diffraction &Transmission Electron Microscopy
2	Metallurgical Engineering	338672 (38)	Metallurgy of Rare Metals
3	Metallurgical Engineering	338673 (38)	Composite Materials

Note:(1)- 1/4thof totalstrengthof student'ssubjecttominimumof twentystudents is requiredtooffer inelectiveinthe college inaparticularacademic session.
Note:(2)- Choiceof electivecodeoncemadefor anexaminationcannotbechangedinfutureexaminations.

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Furnace Technology & Instrumentation**	Code:	**338651(38)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**NIL**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE:

Concepts related to furnace design and efficiency. Solving problems on the heat balance. Knowing about various refractories used and their rationale of use in a given application.

Expected Outcomes:

- Students will be well versed with the furnace and its instrumentation techniques

They will have a confidence to predict the suitability of the various burners, refractories and other parts while designing a furnace.

UNIT I Concept of flame, types of flames, combustion process and related numerical. Combustion of fuels and problems based on air supplied, excess air and products of combustion.

UNIT II Natural, forced, induced and balanced draft. Chimney height, Heat losses in furnaces and related numerical

UNIT III Classification based on heating methods, application wise and temperature ranges. Batch furnaces, Continuous furnaces, Construction and working of furnaces like Cupola, Induction furnace, Arc furnace, Pit furnace, Rotary furnace, Muffle furnace, etc. Special furnaces- Plasma heating, Optical furnaces, Uses of Laser.

UNIT IV Heat saving devices; regenerators, recuperators, Temperature measuring devices; thermocouple, radiation and optical pyrometer. Selection of refractories in furnaces.

UNIT V Basic concept of measurement Functionalunits,Staticanddynamiccharacteristics ofmeasuringdevice accuracy precision Study of electric furnaces (resistance, induction, arc, dielectric heating) and heating elements. Temperature control - PID. Multi zone furnaces. Pressuremeasurement, Mechanical type Manometers, ElastictypeBourdon gauge/pressure spring BellowsandDiaphragm, RVP, Pirani& Penning Gauges.

REFERENCE BOOKS:

1. Elements of Fuels, Furnaces and Refractories, O. P. Gupta
2. Fuels, Furnaces and Refractories, J. D. Gilchrist
3. Fuels, Furnaces, Refractories and Pyrometry,-A.V.K. Suryanarayana, (B. S. Pub.)
4. Industrial Furnaces - Vol. I & II, W. Trinks and M. H. Mawhiney, (Wiley)
5. Principles of Industrial Instrumentation by D. Patranabis. TataMcGrawHill(2ndEd)

TEACHING METHODOLOGY:

- Explaining the concepts related to the design of furnace, use of proper burner and refractories inside.
- Numerical based on the heat balance diagram will be solved on the board.
- Proper use of PPT and videos will be done to further facilitate the students imagination.

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Theory and Technology of Heat Treatment**	Code:	**338652(38)**
Total Theory Periods:	**36**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE

Heat treatment has become integral parts of metal processing technique to impart the specific properties. In addition to the conventional process like quenching and tempering, many new processes have been developed to achieve the properties required for the practical uses. These processes to be learned to be able to design the heat treatment as required by the end use.

EXPECTED OUTCOME

The scope is wide open in all the metal processing and fabrication units including automobile and engineering sectors, ferrous and non-ferrous industries, design and consultancy services and of course the Academics and Research.

UNIT I Heat-treatment - its objectives and methods. Iron carbon equilibrium diagram. Mechanism of formation of Austenite and Pearlite. Effect of time on transformation – Kinetics of phase transformation. Concept of TTT Diagram.

UNIT II Bainite and Martensite transformation. Complete isothermal transformation. TTT diagram of eutectoid, hypo-eutectoid and hyper-eutectoid steels. Development of phases under isothermal transformation. Continuous cooling transformation diagram. Effect of carbon and alloying addition on Iron carbon and TTT Diagram.

UNIT III Annealing, normalizing, hardening and tempering of carbon and alloy steels. Metallurgical effects of tempering. Austempering and Martempering. Concept of hardenability; methods of measuring hardenability. Precipitation /age hardening, Recovery, recrystallization and grain growth.

UNIT IV Surface Hardening methods. Thermal – flame hardening, induction hardening, and advanced techniques like plasma, electron beam etc. Thermo-chemical processes – carburizing, nitriding, carbonitriding, ion implantation etc.

UNIT V Heat treatment Furnaces and atmospheres. Heat treatment of special steels; spring, stainless, tool steels. Heat treatment of Al, Cu and Ti alloys. Thermo Mechanical Treatments for production of high strength steels.

ESSENTIAL READING:

1. Physical Metallurgy Principles : Robert E Reed Hill
2. Physical Metallurgy : Sidney H Avner
3. Engineering Physical Metallurgy: Y Lakhtin
4. B. Zakharov, Heat Treatment of Metals, CBS Publishers.
5. Principles of Heat Treatment of Steels, ASM.
6. The Physical Metallurgy of Micro-alloyed Steel : T Gladman

SUPPLEMENTARY READING:

1. Principles of the Heat Treatment of Plain Carbon and Low Alloy Steels: C.R. Brooks.
2. ASM International.
3. Physical Metallurgy of Iron and steels, R. Kumar, Asia Publishing House.
4. Steels: Processing, Structure and Performance, G. Krauss, ASM International.

TEACHING METHODOLOGY:

To study the principles of heat treatment and find out their applications for different grades of steels as well as non-ferrous metals by experimental techniques.

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Computer Programming and Application in Metallurgical Industries**	Code:	**338653(38)**
Total Theory Periods:	**36**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE:

To skill the students with the basic programming languages which will help them in working out with various metallurgical processes like heat flow, thermodynamic calculations etc.

EXPECTED OUTCOME:

Students will learn to write programs for various processes which will simplify their task in tedious calculations

UNIT I General organization of computer, input/output device, complication and execution of programs. Character of Fortran language, constant, variable, logic and flowchart, programming input read, write and format statement Programming Arithmetic statements, use of built in arithmetic functions, E- fields.

UNIT II Fortranconstructs – if then-end if, if-then-else-end if, nested if, Arithmetic if, GOTO statement, computed GOTO Statement, while DO, Continue. Multiple DO loops.

UNIT III Declaration of one Dimensional Array, Input and output of 1-D Array using a DO loop, Searching and Sorting, Implied Do loops, 2-D Array, Functions and Subprograms.

UNIT IV Introductionof C Language, Variable, Constants, Operations, Expression Control Statement, Array, String and Functions using in C Language.

UNIT V Problem from various field of metallurgical Engineering

1. Thermodynamic Calculation
2. Heat transfer Calculation
3. Application to iron and Steel Production
4. Cooling of Pig Iron in transfer Ladle
5. Casting Calculation
6. Various Hardness Calculation table (Implement either in Fortran or C Language)

TEXT BOOKS:

1. Rajaraman "Computer Programming - Fortran"
2. Y. Kanitkar – Let Us C
3. Robert D Pehlke – Unit Process of Extractive metallurgy
4. Class Notes.

REFERENCE BOOKS:

1. K D Sharma "Fortran Programming'
2. Suresh Dua – Simply C

TEACHING METHODOLOGY:

Concepts to be delivered on board and enumerating the steps required for the basic structure of the programming.

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Metal Joining Processes**	Code:	**338654(38)**
Total Theory Periods:	**36**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE:

To expose the students towards various metal joining techniques in practice. To know their specific application, their advantages and disadvantages with respect to the metal properties both on microscopic and macroscopic level.

EXPECTED OUTCOME:

Students will get to know the various metal joining operations to be adopted for various metals to get a proper fabricated structure. They will have a practical exposure of these processes during the fabrication plant visit.

UNIT I **Metal Joining Operation:** Scope of metal joining, Techniques of metal joining; welding, brazing and soldering. Welding processes and their influence on the design, welding terms and characteristics, basic principles and requirement of welding processes, weld preparation and design of welding joints, welding symbols.

UNIT II Gas welding arc welding general, shielded metal arc welding, submerged arc welding gas tungsten arc welding, gas metal arc welding, plasma arc welding, stud welding, resistant welding, electro-slag welding, electron beam welding, problem based on welding.

UNIT III Forge welding, cold welding, diffusion welding, carbon arc welding, atomic hydrogen welding, friction welding, induction welding, flash welding, laser welding, thermit welding, explosive welding, ultrasonic welding.

UNIT IV Heat flow in welding temperature distribution, peak temperature, cooling rate, welding metallurgy, structure of weld metal, weld composition, the heat affected zone, weldability, fracture behavior, weldability test, welding defects and remedies.

UNIT V **Welding of specific alloys:** Welding of cast iron, welding of copper alloy, aluminium alloy, stainless steel welding of dissimilar metal, welding of heat resistant alloy, residual stresses and distribution, testing and inspection, brazing and soldering , metal surfacing design of welders, maintenance welding.

TEXT BOOKS:

1. The Science and practice of welding – A CDavies
2. Welding and welding technology – Richard L. Bittle
3. Welding process and technology – Raman and Eric N. simons
4. Modern metal joining technique – M Schwart
5. The metallurgy of welding – John Wiley

TEACHING METHODOLOGY:

Students will be imparted the concepts on board as well as through PPTs. An Industrial trip to nearby fabrication plant will be arranged to give them a feel of the real industrial practice involving metal joining operations.

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Steel Making**	Code:	**338655 (38)**
Total Theory Periods:	**36**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE

To learn the processes of steel making; the basic reactions, thermodynamics kinetics, heat and material balances. The students will also learn the theory as well as the shop floor techniques of steel making and problem faced.

EXPECTED OUTCOME

Steel is said to be back bone of a country's economy. Govt. is planning to make India the second largest producer of steel, after China, by 2020. This will require a fleet of 1 million good engineers and metallurgist, particularly steel makers. So a good opportunity exists for all good steel technologists.

UNIT I Steel scenario-Global and Indian. SWOT analysis in the Indian context of steel industry. Earlier steel making processes; Bessemer, OH, Kaldo, Rotor processes. Reasons for their extinction. Development of Twin Hearth process. Concept of mini and integrated steel plant. Electric Arc Furnace steel making.

UNIT II Development of BOF processes. Reactions of carbon, silicon, manganese, phosphorous and sulphur. Thermodynamics and kinetics of reactions, Laws of thermodynamics and application to the treatment of ferrous melts and slag. Role of Slag in BOF steel making and slag control.

UNIT III Basic oxygen furnace (BOF) and accessories, vessel and nozzle design. Material and heat balance. Technology of heat making and process control – shop floor practices.

UNIT IV Deoxidation and alloying – theory and practice, Secondary metallurgy – Stirring, Ladle Furnace, VAD and RH degassing. Teeming practices and solidification. Automation and modeling in BOF.

UNIT V Development of Continuous Casting process. Components of CC machines- Tundish, Mould, Secondary Cooling zone their design and functions. Heat transfer in CC. Automation in CC. Quality control of CC products.

THETEXTBOOKS

1.The Physical Chemistry of Steel Making:Bodsworth
2. Steel Making Technology–Kudrin
3.Iron making and steel making; theory and practice- Ahindra Ghosh and Amit Chatterjee

REFERENCEBOOKS:

1. Converter and open hearth steel manufacture, G.Oike,MirPublishers.
2. Oxygen steel making for steel Makers, JacksonA,GeorgeNewriesLtd.,London.
3. Electricfurnacesteel Making,A.I.M.E.:Vol.IandII.
4. TheMaking,shapingandTreatingofsteel,(USS)

TEACHING METHODOLOGY

Explaining the metal-slag-gas reactions, the design features of BOF vessels and oxygen lances, advancement in BOF technology, secondary steel making, process control and automation. The students will also visit the Industries for hands on training

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**X-Ray Diffraction & Transmission Electron Microscopy (Professional Elective – I)**	Code:	**338671 (38)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE:

To make students clear on the basics of the X-Ray diffraction and related phenomena. To make them clear on the importance of TEM as a very important materials characterization technique.

EXPECTED OUTCOME:

Students are expected to know the concepts involving X-Ray diffraction and Electron microscopy with clarity. They should be able to solve the numerical based on these.

UNIT I Nature of X-ray, white radiation, absorption of X-Ray, filters, fundamental principles of X-Ray Diffraction, Bragg`s law, diffraction directions. Diffraction methods, Diffraction Intensification Scattering by an electron, an atom & a Unit cell, structure factor calculations.

UNIT II Diffractometer: its block diagram central features & its use. JCPDS search manual and Data files Hanawalt method, use of powder diffraction files. Determination of crystal structures, grain size & chemical analysis by X-Ray diffraction, other application of X-Ray diffraction technique**.**

UNIT III TEM: Principle and operation. Electrons as source, properties of electron beam, elastic and inelastic scattering of electrons and its importance in electron microscopy, resolution, principles of transmission electron microscopy.

UNIT IV TEM:Construction, ray-diagram, working, sample preparation, contrast mechanisms, ring and spot diffraction patterns, detectors and imaging modes.

UNIT V Imaging in TEM: Bright field and dark field images, Selected area diffraction, Reciprocal lattice and Ewald sphere construction. Microanalysis (EDX, WDS, EBSD etc.)

NAME OF TEXT BOOKS:

1. Elements of XRD – B.D Cullity
2. Principle of TEM- Barry- Carter

TEACHING METHODOLOGY:

Mostly through board though sometime aided by the PPTs to help in a better understanding of the pictorial concepts.

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Composite Materials (Professional Elective – I)**	Code:	**338673 (38)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE:

To make students clear on the basics of the X-Ray diffraction and related phenomena. To make them clear on the importance of TEM as a very important materials characterization technique.

UNIT I Analysis of Fibre Reinforced Composites: Micro-mechanical models, Laminates, Hybrid composites, Short fibre composites, imitations of conventional engineering materials, Composites-type and their nature.

UNIT II Strength of Composites: Tensile strength, Statistics of fibres and fibre bundles, Progressive failures in composites, Tensile strength of laminates and its orientation dependence, Compression and shear strength of short fibre reinforced composites.

UNIT III Fracture and Toughness of Composites: Crack tip process in solids, Crack extension in composites; Matrix and fibre effects, Laminiates.

UNIT IV Fatigue Behaviour of Composites: Damage in composites, Fatigue of metal-matrix composites, Reinforced plastics, Effects of holes and notches, Materials factors affecting fatique of reinforced plastics, Fatigue of short fibre composites.

UNIT V Applications of Composites: Processing of polymeric, Metallic and ceramic matrix composites Aerospace, Automotive engineering, Chemical, Electrical, Structural bio and marine engineering, Sport goods, Domestic appliances.

RECOMMENDED BOOKS

1. Harris B., Engineering Composite Materials, Maney Publishing (1998)
2. Chawla K.K., Composite Materials, Springer (2008)
3. Aggarwal, B.D. and Broutman, Analysis of Fiubre-Composites, Wiley (2006)

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

Branch:	**Metallurgical Engineering**	Semester:	**VI**
Subject:	**Metallurgy of Rare Materials (Professional Elective – I)**	Code:	**338672 (38)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

COURSE OBJECTIVE

To learn the characteristics of rare metals, their uses, the ore beneficiation and extraction processes.

EXPECTED OUTCOME:

Rare metal metallurgists and engineers are really rare. In this advanced era of science and technology, the use of rare metal is mandatory for some critical applications. So the engineers with a good knowledge of rare metal will have a wide scope in research laboratories and manufacturers namely BARC, IREL in India and many others in other parts of the globe. In addition, the knowledge of mineral beneficiation and extraction techniques can be fruitfully utilized in any other non-ferrous industries.

UNIT I Rare metals, their characteristics and uses. Sources and occurrences. Indian and Global scenario. Principles of ore beneficiation and extraction relevant to rare metals.

UNIT II Principles of Extraction of refractory metals; Zirconium, Molybdenum & Tungsten

UNIT III Extraction of radio-active metals; Uranium, Polonium, Plutonium, Thorium

UNIT IV Metallurgy of rare earth metals and their extraction

UNIT V Metallurgy and extraction of metals used for alloying; Titanium, Niobium, Vanadium,Beryllium.

RECOMMENDED BOOKS

1. Extraction of Nonferrous Metals : HS Ray, R Sridhar, KP Abraham, Affiliated East-West Press Pvt Ltd, New Delhi
2. Metallurgy of Rare Metals: AN Zelikman, OE Krein, GV Samsonov, NASA

TEACHING METHODOLOGY:

Explaining the term ‘RARE’ and the uses of rare metals in advanced science and technology. The chemical nature of the metals the sources and occurrence. Principles of mineral beneficiation and extraction. Extraction processes of some important rare metals.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program:	**Bachelor of Engineering**	Semester:	**VI**
Branch:	**Metallurgical Engineering**		
Subject:	**Furnace Technology Laboratory**	Code:	**338661 (38)**
TotalLab Periods:	**36**	Batch Size:	**30**
Maximum marks in ESE:	**40**	Minimum marks in ESE:	**20**

LIST OF EXPERIMENTS:

1. Study different parts of a muffle furnace.
2. Study a chamber furnace and how it operates.
3. Study a Blast Furnace in details.
4. Study different pallets through heat treatment.
5. Study a HAC of a welded piece of different metals.
6. Study the detail refractory system of a blast furnace.
7. Study Optical and Radiation Pyrometer
8. Study thermocouple in different types of molten metals
9. Study the heating elements for the furnace design
10. Study Perini Gauge and Penning Gauge.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program:	**Bachelor of Engineering**	Semester:	**V**
Branch:	**Metallurgical Engineering**		
Subject:	**Computer Programming and Applicationsin Metallurgical Industries Laboratory**	Code:	**338662 (38)**
TotalLab Periods:	**36**	Batch Size:	**30**
Maximum marks in ESE:	**40**	Minimum marks in ESE:	**20**

EXPERIMENT TO BE PERFORMED

1. Simple Addition of two no using FORTRAN language
2. Calculate the area of circle by using Fortran
3. Find the largest from given two no by using Fortran
4. Find the largest from given three no by suing Fortran
5. Find the sum of first n natural no by suing Fortran
6. Find the factorial of any input n by using Fortran
7. Find the sum of series = 1+x+x2+x3……. N terms by suing Fortran
8. Red &I write the 1D subscript variable
9. Find the sum of all elements of 1D subscript variable
10. Find the largest& their position and arrange the elements of subscript variable in increasing order.
11. Read & Write 2d subscript variable
12. Find the sum of two 2d subscript variable
13. Calculate three roots of quadratic equation by sub programs
14. Calculate the area of circle by function
15. Numerical problem based on Metallurgical Ind.

LIST OF EQUIPMENTS/MACHINE REQUIRED:

PIII/PIV computer and FORTRAN software.

RECOMMENDED BOOKS:

1. Lab manual
2. Suresh Dua – Simply “C”

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program:	**Bachelor of Engineering**	Semester:	**VI**
Branch:	**Metallurgical Engineering**		
Subject:	**Metal Joining Laboratory**	Code:	**338663 (38)**
TotalLab Periods:	**36**	Batch Size:	**30**
Maximum marks in ESE:	**40**	Minimum marks in ESE:	**20**

EXPERIMENT TO BE PERFORMED

1. Gas welding of different alloys
2. Shielded metal arc welding
3. Gas metal arc welding
4. Gas tungsten arc welding
5. Thermit welding
6. Brazing
7. Soldering
8. Submerged arc welding.
9. Testing of welds

LIST OF EQUIPMENTS/MACHINE REQUIRED:

1. Gas welding equipment
2. Shielded metal arc welding equipment
3. Gas metal arc welding equipment
4. Gas tungsten arc welding
5. Brazing and soldering equipment
6. Thermit welding equipment

RECOMMENDED BOOKS:

1. The Metallurgy of welding by John Wiley

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program:	**Bachelor of Engineering**	Semester:	**VI**
Branch:	**Metallurgical Engineering**		
Subject:	**Theory and Technology of Heat Treatment Laboratory**	Code:	**338664 (38)**
TotalLab Periods:	**36**	Batch Size:	**30**
Maximum marks in ESE:	**40**	Minimum marks in ESE:	**20**

EXPERIMENTS TO BE CONDUCTED

1. Study the microstructures of mild steels of different carbon content
2. To calculate the proportion ferrite, pearlite and carbide in the above samples.
3. To observe changes in the microstructure by annealing, normalizing and quenching.
4. To correlate the heat treatment and microstructures with mechanical properties.
5. To study the microstructure of tool steel and stainless steel.
6. To study tempering behavior of plain carbon and alloy steels.
7. To study the microstructure of brass and aluminum alloys.
8. Case carburizing of steels. To study the microstructure and hardness before and after the treatment.
9. Determination of hardenability of plain carbon and alloy steels by Jominy end quenching.
10. To study precipitation hardening in aluminum alloys.

ESSENTIAL READING:

1. Physical Metallurgy Principles: Robert E Reed Hill
2. Engineering Physical Metallurgy: Y Lakhtin
3. B. Zakharov, Heat Treatment of Metals, CBS Publishers.
4. Principles of Heat Treatment of Steels, ASM.
5. Principles of Metallographic Laboratory Practice –G N Khel

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program: **Bachelor of Engineering**

Branch:	**Common to All Branches**	Semester:	**VI**
Subject:	**Managerial Skills**	Code:	**300665 (76)**
No. of Lectures:	**2/Week**	Tutorial Period:	**NIL**
Total Marks in ESE:	**NIL**	Marks in TA:	**40**

Minimum number of Class Tests to be conducted: **Two**

Objective:
The course is introduced to develop managerial skills tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Managerial skills are essential for overall professional development of an individual apart from gaining technical knowledge in the subject.

Course Objectives
Upon completion of this course, the student shall be able

- To define and explain the concept of managerial, written and oral communication skill;
- To understand the leadership skill;
- To develop self-appraisal and understand distinction between leader and manager;
- To develop positive attitude and thinking; and
- To understand managerial functions and develop creativity.

UNIT I **Managerial Communication Skills:** Importance of Business Writing: writing business letters, memorandum, minutes, and reports- informal and formal, legal aspects of business communication, oral communication- presentation, conversation skills, negotiations, and listening skills, how to structure speech and presentation, body language.

UNIT II **Managerial skills - Leadership**: Characteristics of leader, how to develop leadership; ethics and values of leadership, leaders who make difference, conduct of meetings, small group communications and Brain storming, Decision making, How to make right decision, Conflicts and cooperation, Dissatisfaction: Making them productive.

UNIT III **Proactive Manager:** How to become the real you: The journey of self-discovery, the path of self-discovery, Assertiveness: A skill to develop, Hero or developer, Difference between manager and leader, Managerial skill check list, team development, How to teach and train, time management, Stress management, Self-assessment.

UNIT IV **Attitudinal Change:** Concept of attitude through example, benefits of right attitude, how to develop habit of positive thinking, what is fear? How to win it? How to win over failure? How to overcome criticism? How to become real you? How to Motivate? How to build up self confidence?

UNIT V **Creativity**: Creativity as a managerial skill, Trying to get a grip on creativity. Overview of Management Concepts: Function of Management: Planning, organizing, staffing, controlling.

Course Outcome

- The students will be able to develop formal and informal, negotiation, written and oral communication skill;
- The students will be able to develop manage groups, resolve conflicts and leadership skill and decision making qualities;
- The students will be able to develop self-appraisal, teaching, training and managing stress and time;
- The students will be able develop positive thinking, motivating team members and winning race; and
- The students will be able to develop creativity and fundamental management functions.

Text Books:

1. Basic Managerial Skills for all by E.H. Mc Grawth, Prentice Hall India Pvt Ltd,2006
2. Basic Employability Skills by P. B. Deshmukh, BSP Books Pvt. Ltd., Hyderabad, 2014

Reference Books:

1. How to develop a pleasing personality by Atul John Rego, Better yourself bools, Mumbai,2006
2. The powerful Personality by Dr. Ujjawal Patni & Dr. Pratap Deshmukh, Fusion Books, 2006

How to Success by Brian Adams, Better Yourself books, Mumbai, 1969