**JNTU-GV COLLEGE OF ENGINERRINGVIZIANAGARAM**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM**

**DEPARTMENT OF METALLURGICAL ENGINEERING**

# I YEAR and II YEAR
# COURSE STRUCTURE & SYLLABUS

# UG – R23

# B. TECH – METALLURGICAL ENGINEERING

**B.Tech. – I Year I Semester**

| S.No. | Course Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | R23BS01 | Linear Algebra& Calculus | 3 | 0 | 0 | 3 |
| 2 | R23BS03T | Engineering Physics | 3 | 0 | 0 | 3 |
| 3 | R23ES07T | Introduction to Programming | 3 | 0 | 0 | 3 |
| 4 | R23ES03 | Engineering Graphics | 1 | 0 | 4 | 3 |
| 5 | R23ES04 | Basic Electrical & Electronics Engineering | 3 | 0 | 0 | 3 |
| 6 | R23BS03P | Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 7 | R23ES07P | Computer Programming Lab | 0 | 0 | 3 | 1.5 |
| 8 | R23ES05 | Electrical & Electronics Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 9 | R23MC02 | NSS/NCC/Scouts &Guides/Community Service | 0 | 0 | 1 | 0.5 |
| Total | | | | | | **19.5** |

**B.Tech. – I Year II Semester**

| S.No. | Course Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | R23BS02 | Differential Equations and Vector Calculus | 3 | 0 | 0 | 3 |
| 2 | R23BS04T | Engineering Chemistry | 3 | 0 | 0 | 3 |
| 3 | R23HS01T | Communicative English | 2 | 0 | 0 | 2 |
| 4 | R23ES01 | Basic Civil &Mechanical Engineering | 3 | 0 | 0 | 3 |
| 5 | R23PC01T | Mineral Processing and Metallurgical Analysis | 3 | 0 | 0 | 3 |
| 6 | R23HS01P | Communicative English Lab | 0 | 0 | 2 | 1 |
| 7 | R23BS04P | Engineering Chemistry Lab | 0 | 0 | 2 | 1 |
| 8 | R23ES06 | IT workshop | 0 | 0 | 2 | 1 |
| 9 | R23ES02 | Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 10 | R23PC01P | Mineral Processing and Metallurgical Analysis Lab | 0 | 0 | 3 | 1.5 |
| 11 | R23MC01 | Health and Wellness, Yoga and Sports | 0 | 0 | 1 | 0.5 |
| Total | | | | | | **20.5** |

**B.Tech. – II Year I Semester**

| S.No. | Course Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | R23BS03 | Transforms and Numerical Methods | 3 | 0 | 0 | 3 |
| 2 | R23HS02 | Universal Human Values-Understanding Harmony and Ethical Human conduct | 2 | 1 | 0 | 3 |
| 3 | R23ES08 | Heat and Mass Transfer | 2 | 0 | 0 | 2 |
| 4 | R23PC02T | Physical Metallurgy | 3 | 0 | 0 | 3 |
| 5 | R23PC03T | Principles of Extractive Metallurgy | 3 | 0 | 0 | 3 |
| 6 | R23ES09 | Mechanics of solids lab | 0 | 0 | 2 | 1 |
| 7 | R23PC03P | Extractive Metallurgy lab | 0 | 0 | 3 | 1.5 |
| 8 | R23PC02P | Physical Metallurgy lab | 0 | 0 | 3 | 1.5 |
| 9 | R23SC01 | Computer Aided Drafting and Modelling Lab | 0 | 1 | 2 | 2 |
| 10 | R23MC03 | Environmental Science | 2 | 0 | 0 | - |
| **Total** | | | | | | **20** |

**B.Tech. – II Year II Semester**

| S.No. | Course Code | Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | R23HS02 | Managerial Economics and Financial analysis | 2 | 0 | 0 | 2 |
| 2 | R23BS04 | Complex Variables, Probability and Statistics | 3 | 0 | 0 | 3 |
| 3 | R23PC03 | Metallurgical Thermodynamics and Kinetics | 3 | 0 | 0 | 3 |
| 4 | R23PC04T | Heat Treatment | 3 | 0 | 0 | 3 |
| 5 | R23PC05T | Corrosion Engineering | 3 | 0 | 0 | 3 |
| 6 | R23PC06 | Fuels lab | 0 | 0 | 2 | 1 |
| 7 | R23PC04P | Heat Treatment lab | 0 | 0 | 3 | 1.5 |
| 8 | R23PC05P | Corrosion Engineering lab | 0 | 0 | 3 | 1.5 |
| 9 | R23SC02 | Soft skills | 0 | 1 | 2 | 2 |
| 10 | R23ES10 | Design Thinking & Innovation | 1 | 0 | 2 | 2 |
| Total | | | | | | 22 |
| Mandatory Community Service Project Internship of 08 weeks duration during summer vacation | | | | | | |

**I Year-I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## LINEAR ALGEBRA& CALCULUS
**(Common for all branches)**

**Course Objectives:**
To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

**Course Outcomes:** At the end of the course, the student will be able to
- Develop matrix algebra techniques that is needed by engineers for practical applications.
- Familiarize with functions of several variables which is useful in optimization.
- Learn important tools of calculus in higher dimensions.
- Familiarize with double and triple integrals of functions of several variables in two and three dimensions.

**UNIT I :Matrices**
Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

**UNIT II: Linear Transformation and Orthogonal Transformation:**
Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

**UNIT III: Calculus**
**Mean Value Theorems:** Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

**UNIT IV:Partial differentiation and Applications (Multi variable calculus)**
Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**UNIT V: Multiple Integrals (Multi variable Calculus)**
Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**Textbooks:**
1. B.S.Grewal,HigherEngineeringMathematics,44/e,KhannaPublishers,2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

**Reference Books:**
1. R.K .Jainan S.R.K.Iyengar,Advanced Engineering Mathematics,5/e,AlphaScienceInternational Ltd.,2021 (9th reprint).
2. George B.Thomas, MauriceD.WeirandJoelHass,ThomasCalculus,14/e,PearsonPublishers,2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Greenberg, Advanced EngineeringMathematics,9$^{th}$edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand,2021

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**I Year-I Semester**

**Engineering Physics**

**COURSE OBJECTIVES**

1 Bridging the gap between the Physics in school at 10+2level and UG level engineering courses.

2 To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications

3 Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg'slaw

4 To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging microdevices.

5 Enlightenment of the concepts of Quantum Mechanics and to provide fundamentals of de Broglie matter waves, quantum mechanical wave equation and its application, the importance of free electron theory for metals.

6. To Understand the Physics of Semiconductors and their working mechanism, Concepts utilization of transport phenomenon of charge carriers in semiconductors.

**COURSEOUTCOMES**

CO1 **Explain** the need of coherent sources and the conditions for sustained interference (L2).**Identify** the applications of interference in engineering(L3). **Analyze** the differences between interference and diffraction with applications(L4). **Illustrate** the concept of polarization of light and its applications(L2). **Classify** ordinary refracted light and extraordinary refracted rays by their states of polarization (L2)

CO2 **Classify** various crystal systems(L2). **Identify** different planes in the crystal structure(L3). **Analyze** the crystalline structure by Bragg's X-ray diffractometer (L).

CO3 **Explain** the concept of dielectric constant and polarization in dielectric materials (L2). **Summarize** various types of polarization of dielectrics (L2). **Interpret** Lorentz field and Claussius-Mosotti relation in dielectrics(L2). **Classify** the magnetic materials based on susceptibility and their temperature dependence(L2).

CO4 **Describe** the dual nature of matter(L1). **Explain** the significance of wave function(L2). **Identify** the role of Schrodinger's time independent wave equation in studying particle in one-dimensional infinite potential well(L3). **Identify** the role of classical and quantum free electron theory in the study of electrical conductivity (L3).

CO5 **Classify** the crystalline solids(L2). **Outline** the properties of charge carriers in semi-conductors (L2). **Identify** the type of semiconductor using Hall effect (L2). **Apply** the concept of effective mass of electron(L3).

**Unit-I: Wave Optics** **12hrs**

**Interference:** Introduction **-** Principle of superposition–Interference of light- Interference in thin films (Reflection Geometry) & applications-Colors in thin films-Newton's Rings-Determination of wavelength and refractive index.

**Diffraction:** Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & Diffraction Grating (Qualitative).

**Polarization:** Introduction -Types of polarization - Polarization by reflection, and Double refraction - Nicol's Prism-Half wave and Quarter wave plates.

**Unit Outcomes:**

***The students will be able to***

- **Explain** the need of coherent sources and the conditions for sustained interference(L2)
- **Identify** engineering applications of interference(L3)
- **Illustrate** the concept of polarization of light and its applications(L2)
- **Classify** ordinary polarized light and extra ordinary polarized light(L2)

**Unit II: Crystallography** **8hrs**

**Crystallography**: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices –crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC – Miller indices– separation between successive (hkl) planes. Bragg's law-X-ray Diffractometer.

**Unit Outcomes:**

***The students will be able to***

- **Classify** various crystal systems(L2)
- **Identify** different planes in the crystal structure(L3)
- **Analyze** the crystalline structure by Bragg's X-ray diffractometer (L4)

**Unit-III: Dielectric and Magnetic Materials** **8hrs**

**Dielectric Materials:** Introduction- Dielectric polarization- Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative)-Lorentz internal field-Clausius-Mossotti equation.

**Magnetic Materials:** Introduction- Magnetic dipole moment- Magnetization-Magnetic susceptibility and permeability-Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials-Domain concept for Ferro magnetism (Qualitative)- Hysteresis -soft and hard magnetic materials.

**Unit Outcomes:**

***The students will be able to***

- **Explain** the concept of dielectric constant and polarization in dielectric materials(L2)
- **Summarize** various types of polarization of dielectrics(L2)
- **Interpret** Lorentz field and Claussius Mosotti relation in dielectrics(L2)
- **Classify** the magnetic materials based on susceptibility and their temperature dependence(L2)

**Unit-IV: Quantum Mechanics and Free electron theory** **10hrs**

**Quantum Mechanics:** Dual nature of matter–Heisenberg's Uncertainty Principle–Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

**Free Electron Theory:** Classical free electron theory (Qualitative with discussion of merits anddemerits)– Quantumfreeelectrontheory–electricalconductivitybasedonquantumfreeelectrontheory**-**Fermi-Diracdistribution and its temperature dependence.

**Unit Outcomes:**

***The students will be able to***

- **Explain** the concept of dual nature of matter(L2)
- **Understand** the significance of wave function(L2)
- **Interpret** the concepts of classical and quantum free electron theories(L2)

**Unit–V:Semi conductors** **10hrs**

**Semi conductors:** Formation of energy bands – classification of crystalline solids – Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Extrinsic semiconductors: density of charge carriers - Drift and diffusion currents – Einstein's equation - Hall effect and its Applications.

**Unit Outcomes:**

***The students will be able to***

- **Outline** the properties of charge carriers in semi conductors(L2)
- **Understand** the carrier transportation in semiconductors(L2)
- **Identify** the type of semi conductor using Hall effect(L2)

**Textbooks:**

1. "A Textbook of Engineering Physics"-M.N.Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S.Chand Publications, 11thEdition 2019.
2. "Engineering Physics"- D.K.Bhattacharya and Poonam Tandon, Oxford press(2015).
3. "Engineering Physics"-P.K.Palanisamy Sci Tech publications.

**Reference Books:**

1. "Fundamentals of Physics"-Halliday, Resnick and Walker, John Wiley & Sons.
2. "Engineering Physics"- M.R.Srinivasan, New Age international publishers(2009).
3. "Engineering Physics"-Shatendra Sharma, Jyotsna Sharma, PearsonEducation,2018.
4. "Engineering Physics"-Sanjay D. Jain, D.Sahasrabudhe and Girish, University Press.
5. "Semiconductor physics and devices: Basic principle" - A. Donald, Neamen, Mc GrawHill.
6. "Engineering Physics"- B.K.Pandey and S.Chaturvedi, Cengage Learning
7. "Solid state physics"–A.J.Dekker, Pan Macmillan publishers
8. "Introduction to Solid State Physics"-Charles Kittel, Wiley

**I Year-I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## INTRODUCTIONTOPROGRAMMING
## (Common to All branches of Engineering)

**Course Objectives:**

The objectives of this course are to acquire knowledge on the

- To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
- To enable practical usage of Control Structures and Implement different operations on arrays.
- To demonstrate the use of Strings and Functions.
- To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- To understand structures and unions and illustrate the file concepts and its operations.
- To impart the Knowledge Searching and Sorting Techniques.

**UNIT-I Introduction to Computer Problem Solving:**

Programs and Algorithms, Computer Problem-Solving Requirements, Phases of Problem-Solving, Problem-Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

**UNIT-II Introduction to C Programming:**

Introduction, Structure of a C Program, Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/Output Statements. Operators, Type Conversion, Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loops, nested loops, The Break and Continue Statements, and go to statements.

**UNIT-III Arrays:**

Introduction, Operations on Arrays, Arrays as Function Arguments, Two-Dimensional Arrays, Multidimensional Arrays

Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

**UNIT-IV Functions:**

Introduction Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes, Recursion.

**Strings:** String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

**UNIT-V**

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type—Enum variables, Using Typed ef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

**Note:** The syllabus is designed with C Language as the fundamental language of implementation**.**

Course Outcomes:

At the end of the Course, the Student should be able to:

i. Illustrate the Fundamental concepts of Computers and basics of computer programming and problem-solving approach.

ii. Understand the Control Structures, branching, and looping statements.

iii. Use of Arrays and Pointers in solving complex problems.

iv. Develop Modular program aspects and Strings fundamentals.

v. Demonstrate the ideas of User Defined Data types files. Solve real-world problems using the concept of Structures, Unions, and File operations.

Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg,3rd Edition, Cengage.
2. How to solve it by Computer, R.G.Dromey, 12thEdition,PearsonEducation.
3. Programming In CA-Practia1Approach.Ajay Mittal, 1st Edition Pearson
4. The C Programming Language, Dennis Richie And Brian Kernighan,2ndEdition, Pearson Education.

References:

1. Byron Gottfried, Schaum'sOutlineofProgrammingwithC,4thEdition, 2020, McGraw-Hill.
2. Computer Programming. Reema Thareja, 3rdEdition, 2023, Oxford University Press
3. Computing fundamentals and C Programming, Balagurusamy, E.,McGraw-HillEducation,2008
4. Programming In C, Ashok Kamthane, 2nd Edition, Pearson Publication.
5. Letus C, Yaswanth Kanetkar,16th Edition, BPB Publication.

Web References:

1. http://www.c4learn.com/
2. http://www.geeksforgeeks.org/c/
3. http://nptel.ac.in/courses/122104019/
4. http://www.learn-c.org/
5. https://www.tutorialspoint.com/cprogramming/

**IYear-ISemester**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 4 | 3 |

## ENGINEERING GRAPHICS
## (Common to All branches of Engineering)

**Course Objectives:**
The students completing the course are expected to:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

**Course Outcomes:** On completion of the course, the student should be able to:
CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO3: Understand and draw projection of solids in various positions in first quadrant.
CO4: Explain principles behind development of surfaces.
CO5: Prepare isometric and perspective sections of simple solids

**UNIT I**
**Introduction:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.
**Curves:** construction of ellipse, parabola and hyperbola by general method, Cycloids, Involutes, Normal and tangent to Curves.
**Scales:** Plain scales, diagonal scales and vernier scales.
**UNIT II**
**Orthographic Projections**: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.
**Projections of Straight Lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes
**Projections of Planes:** Regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

**UNIT III**
**Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

**UNIT IV**
**Sections of Solids:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.
**Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

**UNIT V**

**Conversion of Views**: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

**Computer graphics**: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

**Textbook:**

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

**Reference Books:**

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

**I Year-I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

# BASICELECTRICAL&ELECTRONICS ENGINEERING
## (Common to All branches of Engineering)

## PART A: BASIC ELECTRICAL ENGINEERING

**Course Objectives**

To expose to the field of electrical engineering, laws and principles of electrical engineering and to acquire fundamental knowledge in the relevant field.

**Course Outcomes:** After the completion of the course students will be able to

**CO1:** Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

**CO2:** Understand the problem-solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

**CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

**CO4:** Analyze different electrical circuits, performance of machines and measuring instruments.

**CO5:** Evaluate different circuit configurations, Machine performance and Power systems operation.

**UNIT I DC & AC Circuits**

**DC Circuits:** Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

**AC Circuits:** A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

**UNIT II Machines and Measuring Instruments**

**Machines:** Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

**Measuring Instruments:** Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

**UNIT III Energy Resources, Electricity Bill & Safety Measures**

**Energy Resources:** Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

**Electricity bill:** Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

**Equipment Safety Measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

**Textbooks:**

1. Basic Electrical Engineering, D.C.Kulshreshtha,TataMcGrawHill,2019,First Edition
2. Power System Engineering, P.V.Gupta, M.L.Soni, U.S.Bhatnagarand, A.Chakrabarti, Dhanpat Rai& Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**Reference Books:**

1. Basic Electrical Engineering, D.P.Kothariand I.J.Nagrath, McGrawHill,2019,FourthEdition
2. Principles of Power Systems, V.K.Mehtha, S.ChandTechnical Publishers,2020
3. Basic Electrical Engineering, T.K.Nagsarkarand M.S.Sukhija, Oxford UniversityPress,2017
4. Basic Electrical and Electronics Engineering, S.K.Bhatacharya, Person Publications, 2018,Second Edition.

**Web Resources:**

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

## PART B: BASIC ELECTRONICS ENGINEERING

**Course Objectives:**

To teach the fundamentals of semi-conductor devices and its applications, principles of digital electronics.

**Course Outcomes:** After the completion of the course students will be able to

**CO1:** Remember the fundamental concepts of semiconductor devices, rectifiers, electronic instrumentation systems, and number systems.

**CO2:** Understand the concepts associated with vacuum tubes, nanoelectronics, diodes, and various configurations and characteristics of transistors and digital electronics.

**CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to PN diodes, Zener diodes, transistors, and their properties, as well as basic theorems of Boolean algebra.

**CO4:** Analyze the characteristics of diodes, transistors, rectifiers, and amplifiers, and analyse the truth tables and functionality of logic gates.

**CO5:** Evaluate different circuit configurations using diodes, transistors, electronic instrumentation systems, simple combinational and sequential circuits, flipflops, registers, and counters.

### UNIT I SEMICONDUCTOR DEVICES

Introduction, Evolution of electronics -Vacuum tubes to nano electronics, Characteristics of PN Junction Diode, Zener Effect - Zener Diode and its Characteristics. Bipolar Junction Transistor -CB, CE, CC Configurations and Characteristics, Elementary Treatment of Small Signal CE Amplifier.

### UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response.

Electronic Instrumentation: Block diagram of an electronic instrumentation system.

### UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits– Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary treatment

only).

Textbooks:

1. R.L.Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R.P.Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill,2009

Reference Books:

1. R.S.Sedha, A Textbook of Electronic Devices and Circuits, S.Chand&Co,2010.
2. Santiram Kal, Basic Electronics-Devices, Circuits and IT Fundamentals, Prentice Hall, India,2002.
3. R.T.Paynter,IntroductoryElectronicDevices&Circuits-ConventionalFlowVersion,PearsonEducation, 2009.

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**I Year-I Semester**

**ENGINEERING PHYSICS LAB**
**(Common to All Branches of Engineering)**
(Any **TEN** of the following listed experiments)

(Out of which any **TWO** experiments may be conducted in virtual mode)

**List of Engineering Physics Experiments**

1. Determination of radius of curvature of a given plano convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using parallel plate capacitor.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photo electric effect.
8. Determination of energy gap of a semiconductor using PN junction diode.
9. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method.
10. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
11. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
12. V-I Characteristics of a PN junction diode
13. V-I Characteristics of Zener diode
14. To study the various types of crystal structures.

**References**:

1. "A Text Book of Practical Physics" - S. Balasubramanian, M.N. Srinivasan, S. ChandPublishers,2017.

***URL***:*www.vlab.co.in*

**I Year-I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

## COMPUTER PROGRAMMING LAB

**(Common to All branches of Engineering)**

**Course Objectives:**

The course aims to give students hands–on experience and train them on the concepts of the C- programming language.

**UNIT-I**

**WEEK1:**

**Objective:** Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

**Tutorial1:** Problem-solving using Computers.

**Lab1:** Familiarization with the programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.

ii) Exposure to Turbo C, gcc

iii) Writing simple programs using printf(), scanf()

**WEEK2:**

**Objective:** Getting familiar with how to formally describe a solution to a problem in a series of finite steps using textual and graphic notation.

Suggested Experiments/Activities:

**Tutorial 2:** Problem-solving using Algorithms and Flowcharts.

**Lab 1:** Converting algorithms/flow charts into C Source code. Developing the algorithms/flow charts for the following sample programs

i) Sum and average of 3 numbers

ii) Conversion of Fahrenheit to Celsius and vice-versa

iii) Simple interest calculation

**WEEK3:**

**Objective:** Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

**Tutorial 3:** Variable types and type conversions:

**Lab 3:** Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using Heron's formulae
iv) Distance traveled by an object

## UNIT-II

**WEEK4:**

**Objective:** Explore the full scope of expressions, type- compatibility of variables & constants and operators used in the expression, and how operator precedence works.

Suggested Experiments/Activities:

**Tutorial 4:** Operators and the precedence and as associativity:

**Lab 4:** Simple computational problems using the operator's precedence and associativity

i) Evaluate the following expressions.
   a. A+B*C+(D*E)+F*G
   b. A/B*C-B+A*D/3
   c. c.A+++B---A
   d. d.J=(i++)+(++i)

ii) Find the maximum of three numbers using the conditional operator

iii) Take marks of 5 subjects in integers, and find the total, average in float

**WEEK 5:**

**Objective:** Explore the full scope of different variants of–if construct, namely if-else, null—else ,if-elseif-else, switch, and nested-if, including in what scenario each can be used and how to use them. Explore all relational and logical operators while writing conditionals for–if construct.

Suggested Experiments/Activities:

**Tutorial 5:** Branching and logical expressions:

**Lab 5**: Problems involving if-then-else structures.

i) Write a C program to find the max and min off our numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using a switch case.
v) Write a C program to find whether the given year is a leap year.

**WEEK 6:**

**Objective:** Explore the full scope of iterative constructs, namely while loop, do-while loop, and for loop in addition to structured jump constructs like break and continue, including when each of these statements is more appropriate.

**Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops

**Lab6:** Iterative problems, e.g., the sum of series

i) Find the factorial of a given number using any loop.
ii) Find whether the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking whether a number is palindrome
v) Construct a pyramid of numbers.

## UNIT III

**WEEK7:**

**Objective:** Explore the full scope of the Arrays construct, namely defining and initializing 1-D and 2-D and, more generically, n-D arrays and referencing individual array elements from the defined array. Using integer1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

**Tutorial7:** 1 D Arrays: searching.

**Lab7:**1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.

ii) Perform linear search on the1D array.

iii) The reverse of a1D integer array

iv) Find 2's complement of the given binary number.

v) Eliminate duplicate elements in an array.

**WEEK8:**

**Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null characters and get comfortable with strings by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

**Tutorial 8:** 2D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

i) Addition of two matrices

ii) Multiplication two matrices

iii) Sort array elements using bubble sort

iv) Concatenate two strings with out built-in functions

v) Reverse string using built-in and without built-in string functions

## UNIT-IV

**WEEK9:**

**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation value initialization, resizing, changing, and reordering the contents of an array, and memory de-allocation using malloc(), calloc(), realloc() and free() functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

**Tutorial 9:** Pointers, structures, and dynamic memory allocation

**Lab9:** Pointers and structures, memory dereference.

i) Write a C program to find the sum of a1D array using malloc()

ii) Write a C program to find the total average of n students using structures

iii) Enter n students data using calloc() and display failed students list

iv) Read student name and marks from the command line and display the student details along with the total.

v) Write a C program to implement realloc()

**WEEK10:**

**Objective:** Experiment with C Structures, Unions, bit fields self-referential structures(Singly-linked lists),and nested structures

Suggested Experiments/Activities:

**Tutorial 10:**Bit fields, Self-Referential Structures, Linked lists

**Lab 10:** Bit fields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program.

iii) Write a C program to shift/rotate using bit fields.

iv) Write a C program to copy one structure variable to another structure of the same type.

## UNIT-V

**WEEK 11:**

**Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

**Tutorial11:** Functions, call by value, scope and extent,

**Lab11:** Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix.

iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 12:**

**Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

**Tutorial 12:** Recursion, the structure of recursive calls

**Lab 12:** Recursive functions

i) Write a recursive function to generate Fibonacci series.

ii) Write a recursive function to find the lcm of two numbers.

iii) Write a recursive function to find the factorial of a number.

iv) Write a C Program to implement Ackermann function using recursion.

v) Write a recursive function to find the sum of series.

**WEEK13:**

**Objective:** Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

**Tutorial13:** Call by reference, dangling pointers

**Lab13:** Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.

iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**WEEK 14:**

**Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

**Tutorial14:** File handling

**Lab14:** File operations

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

Course Outcomes:

**CO1:** Read, understand, and trace the execution of programs written in C language.

**CO2:** Select the proper control structure for solving the problem.

**CO3:** Develop C programs that utilize memory efficiently using programming constructs like pointers.

**CO4:** Develop, Debug, and Execute programs to demonstrate the applications of arrays, functions, and basic concepts of pointer sinC.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach,1st Edition, Pearson.

2. Byron Gottfried, Schaum's Outline of Programming with C, 4thEdition, 2020, McGraw Hill.

Reference Books:

1. Brian W.Kernighan and Dennis M.Ritchie, The C Programming Language, Prentice-Hall of India.

2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad,3rd Edition, CENGAGE.

**I Year-I Semester**

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## ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
**(Common to All branches of Engineering)**

**Course Objectives:**

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

**Course Outcomes:**

**CO1:** Understand the Electrical circuit design concept; Measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

**CO2:** Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.

**CO3:** Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.

**CO4: A**nalyse various characteristics of electrical circuits, electrical machines and measuring instruments.

**CO5:** Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

**Activities:**

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Breadboard, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, Multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, color coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, IC set. - Compare values of components like resistors, inductors, capacitors etc. with the measured values by using instruments

## PARTA: ELECTRICAL ENGINEERING LAB

**List of experiments:**

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheatstone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase watt meter

6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

**Reference Books:**

1. Basic Electrical Engineering, D.C.Kulshreshtha, Tata Mc GrawHill,2019, FirstEdition
2. Power System Engineering, P.V.Gupta, M.L.Soni, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**Note:** Minimum Six Experiments to be performed.

## PARTB: ELECTRONICS ENGINEERING LAB

**Course Objectives:**

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

**Course Outcomes:** At the end of the course, the student will be able to
CO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics of various electron devices.
CO4: Explain the operation of a digital circuit.
CO5: Realize the truth tables of various Flip flops.

**List of Experiments:**

1. Plot V-I characteristics of PN Junction diode A)Forward bias B)Reverse bias.
2. Plot V-I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers.
4. Plot Input & Output characteristics of BJT in CE and CB configurations.
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied.
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K & D flip flops using respective ICs.

Tools/Equipment Required: DC Power supplies, Multimeters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

**References:**

1. R.L.Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R.P.Jain,Modern Digital Electronics,4$^{th}$Edition,Tata McGraw Hill,2009
3. R.T.Paynter, Introductory Electronic Devices & Circuits–Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

**I Year-I Semester**

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## NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE
## (Common to All branches of Engineering)

**Course Objectives:**
The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

**Course Outcomes:** After completion of the course the students will be able to
**CO1:** Understand the importance of discipline, character and service motto.
**CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques.
**CO3:** Explore human relationships by analyzing social problems.
**CO4:** Determine to extend their help for the fellow beings and down trodden people.
**CO5:** Develop leadership skills and civic responsibilities.

**UNIT I Orientation**
General Orientation on NSS/NCC/Scouts & Guides/Community Service activities, career guidance.

**Activities:**

i) Conducting–ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students–future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics-award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings-any other contribution.

**UNIT II Nature & Care**
**Activities:**

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

**UNIT III Community Service**
**Activities:**

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes-Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

**Reference Books:**


1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021(ISBN978-81-952368-8-6)
2. *Red Book-National Cadet Corps*–Standing Instructions VolI & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis ML. and Cornwell DA, ―Introduction to Environmental Engineering, McGraw Hill New York 4/e2008
4. Masters G.M., Joseph K. and Nagendran R.―Introduction to Environmental Engineering and Science‖, Pearson Education, NewDelhi.2/e2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.


**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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**I Year-II Semester**

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## DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
**(Common for all branches)**

**Course Objectives:**

- To enlighten the learner, sin the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

**Course Outcomes:** At the end of the course, the student will be able to

- Solve the differential equations related to various engineering fields.
- Identify solution methods for partial differential equations that model physical processes.
- Interpret the physical meaning of different operators such as gradient, curl and divergence.
- Estimate the work done against a field, circulation and flux using vector calculus.

**UNIT I Differential equations of first order and first degree**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: orthogonal trajectories

Newton's Law of cooling – Law of natural growth and decay- Electrical circuits (RL & RC)

**UNIT II Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

**UNIT III Partial Differential Equations**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Charpt's method Homogeneous & Non-Homogeneous Linear Partial differential equations with constant coefficients.

**UNIT IV Vector differentiation**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

**UNIT V Vector integration**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

**Textbooks:**


1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S. Grewal, Higher EngineeringMathematics,44/e, Khanna publishers,2017.


**Reference Books:**


1. Dennis G. Zill and Warren Wright, Advanced Engineering Mathematics, Jones and Bartlett,2018.
2. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017

**I Year-II Semester**

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## ENGINEERING CHEMISTRY

(Civil, Mechanical and Metallurgical Engineering)

**Course Objectives:**

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hardwater
- To train the students on the principles and applications of electro chemistry, polymers, surface chemistry, and cement

.

**Course Outcomes:** At the end of the course, the students will be able to

**CO1:** Ensure the quality of a water sample.

**CO2:** Demonstrate the corrosion prevention methods and factors affecting corrosion.

**CO3:** Explain the preparation, properties, and applications of thermoplastic & thermosetting, elastomers & conducting polymers,
Explain calorific values, octane number, refining of petroleum and cracking of oils

**CO4:** Explain the setting and hardening of cement.

**CO5:** Apply the principle of Green Chemistry

**UNIT I Water Technology**

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen-Boiler troubles–Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial water treatment– Specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

**UNIT II Electrochemistry and Applications**

Electrodes–electrochemical cell, Nernst equation, cell potential calculations.
Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium ion batteries-working principle of the batteries including cell reactions.
Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion**,** cathodic and anodic protection, electroplating and electroless plating (Nickel and Copper).

**UNIT III Polymers and Fuel Chemistry**

Introduction to polymers, functionality of monomers,
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of polystyrene. PVC Nylon6,6andBakelite.
Elastomers–Preparation, properties and applications of BunaS, BunaN, Thiokol rubbers.

Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels-propane, methanol, ethanol and biofuel-biodiesel.

**UNIT IV Modern Engineering Materials**

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

Refractories-Classification, Properties, Factors affecting the refractory materials and Applications.

Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils– Viscosity, Viscosity Index, Flashpoint, Fire point, Cloud point, saponification and Applications.

Building materials-Portland Cement, constituents, Setting and Hardening of cement,

Reinforced concrete construction and advantages.

**UNIT V Green Chemistry and Technology**

Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of Green chemistry, toxicity of chemicals, material safety data sheet (MSDS), concept of zero Pollution technologies-Applications of green chemistry - Green solvents, green fuels and Propellants, bio catalysis.

**Textbooks:**

1. Jain and Jain, EngineeringChemistry,16/e, DhanpatRai,2013.
2. Sashi Chawla, Engineering chemistry, Dhanpat rai Publicating Co(Latest edition)
3. Hand book of Green chemistry and Technology by James Clarke and Duncan macqurrie, Blackwell Publishin.

**Reference Books:**

1. H.F.W.Taylor,CementChemistry,2/e,ThomasTelfordPublications,1997.
2. Textbook of Polymer Science, FredW.BillmayerJr,3rdEdition

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**I Year-II Semester**

## COMMUNICATIVE ENGLISH

(Common to All Branches of Engineering)

**Course Objectives:**

The main objective of introducing this course, communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry-ready.

**Course Outcomes**

- By the end of the course the students will have Learned how to understand the context, topic, and specific information from social or transactional dialogues.
- Remedially learn applying grammatical structures to formulate sentence sand use appropriate words and correct word forms.
- Using discourse markers to speak clearly on a specific topic in formal as well as informal discussions. (not required)
- Improved communicative competence in formal and informal contexts and for social and academic purposes.
- Critically comprehending and appreciating reading /listening texts and to write summaries.
- Writing coherent paragraphs essays, letters/e-mails and resume.

**Instructions**:

1. The reading texts can be given as podcasts to the students so that their listening skills can be enhanced.
2. While listening and reading to the text can be given as homework, the class work for the students can be to discuss and critically evaluate the texts based on the context, purpose or writing the text and understanding it from the author's as well as reader's point of view.
3. Reading as habit for both academic and non-academic (pleasure) purposes have to be inculcated in the students. So training has to be given in intensive and extensive reading strategies.
4. Writing for both academic (assignments, examinations, reports, e-mails/letters etc)
5. The writing tasks given in the class are to be self and peer evaluated by the students before they are finally graded by the faculty. Note: Please note that the texts given here are just contexts for teaching various language skills and sub skills. The students' ability to use language cannot be confined to comprehending or using the language related to the given texts (textbooks). The given texts can be used only for practice.
6. All the activities to develop language skills have to be integrated and interconnected, within each unit and across the units.

**UNIT I**

**Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)**

**Listening**: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

**Speaking**: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

**Reading**: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing**: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences. (That has to be part of the bridge course- 2 weeks before the actual academic

Programme starts)
**Grammar**: Parts of Speech, Basic Sentence Structures-forming questions
**Vocabulary**: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words

**UNIT-II**

Lesson: **NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)**
**Listening:** Answering a series of questions about main ideas and supporting ideas after Listening to audio texts.
**Speaking:** Discussion in pairs/small groups on specific topics followed by short structure talks.
**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
**Writing:** Structure of a paragraph - Paragraph writing (specific topics)
**Grammar:** Cohesive devices -linkers, use of articles and zero article prepositions.
**Vocabulary:** Homonyms, Homophones, Homographs.

**UNIT-III**

**Lesson: BIOGRAPHY: Steve Jobs.**
**Listening:** Listening for global comprehension and summarizing what is listened to.
**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed
**Reading:** Readingatextindetailbymakingbasicinferences-recognizingandinterpretingspecific Context clues; strategies to use text clues for comprehension.
**Writing:** Summarizing, Note-making, paraphrasing.
**Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations
**Vocabulary:** Compound words, Collocations

**UNIT- IV**

**Lesson: INSPIRATION: The Toys of Peace by** Saki
**Listening:** Making predictions while listening to conversations/ transactional dialogues Without video; listening with video.
**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/ Patterns/ relationships, communicate processes or display complicated data.
**Writing:** Letter Writing: Official Letters, Resumes
**Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice
**Vocabulary:** Words often confused, Jargons

**UNIT- V**
**Lesson: MOTIVATION:** The Power of Intrapersonal Communication (An Essay)
**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

**Speaking:** Formal oral presentations on topics from academic contexts
**Reading:** Reading comprehension.
**Writing:** Writing structured essays on specific topics.
**Grammar:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
**Vocabulary:** Technical Jargons

**Textbooks:**

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

**Reference Books:**

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

**Web Resources**:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

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**I Year-II Semester**

## BASIC CIVIL & MECHANICAL ENGINEERING
## (Common to All branches of Engineering)

**Course Objectives:**

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

**Course Outcomes:** On completion of the course, the student should be able to:

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on pre-fabricated technology.

### PART A: BASIC CIVIL ENGINEERING

**UNITI**

**Basics of Civil Engineering:** Role of Civil Engineers in Society- Various Disciplines of Civil Engineering-Structural Engineering-Geo-technical Engineering-Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline-Building Constructionand Planning-Construction Materials – Cement – Aggregate – Bricks - Cement concrete-Steel. Introduction to Pre fabricated construction Techniques.

**UNITII**

**Surveying:** Objectives of Surveying-Horizontal Measurements-Angular Measurements-Introduction to Bearings Levelling instruments used for levelling-Simple problems on levelling and bearings-Contour mapping.

**UNITIII**

**TransportationEngineering**ImportanceofTransportationinNation'seconomicdevelopment- Types of Highway Pavements- Flexible Pavements and Rigid Pavements-Simple Differences. Basics of Harbour, Tunnel, Airport and Railway Engineering

**Water Resources and Environmental Engineering**: Introduction, Sources of water- Quality of water-Specifications-Introduction to Hydrology–Rain water Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

**Textbooks:**

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mc graw Hill publications (India) Pvt.Ltd. Fourth Edition.

2. Introduction to Civil Engineering, S.S.Bhavi katti, New Age International Publishers.2022.First Edition.
3. Basic Civil Engineering, Satheesh Gopi,Pearson Publications,2009,FirstEdition.

**Reference Books:**

1. Surveying, Vol-IandVol-II, S.K.Duggal,TataMcGrawHillPublishers2019.FifthEdition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi.2016
3. Irrigation Engineering and Hydraulic Structures-Santosh Kumar Garg, Khanna Publishers, Delhi2023.38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications2019. 10thEdition.
5. Indian Standard DRINKINGWATER—SPECIFICATIONIS10500-2012.

## PART B: BASIC MECHANICAL ENGINEERING

**Course Objectives:** The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

**Course Outcomes:** On completion of the course, the student should be able to

CO1: Understand the different manufacturing processes.
CO2: Explain the basics of thermal engineering and its applications.
CO3: Describe the working of different mechanical power transmission systems and power plants.
CO4: Describe the basics of robotics and its applications.
CO5: Explain the basics of engineering materials and its applications

**UNIT I**

**Introduction to Mechanical Engineering:** Role of Mechanical Engineering in Industries and Society Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
**Engineering Materials –** Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

**UNIT II**

**Manufacturing Processes:** Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
**Thermal Engineering**– working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

**UNIT III**

**Power plants** – working principle of Steam, Diesel, Hydro, Nuclear power plants.
**Mechanical Power Transmission -** Belt Drives, Chain, Rope drives, Gear Drives and their applications.
**Introduction to Robotics -** Joints & links, configurations, and applications of robotics.

**(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)**

**Textbooks:**

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

**Reference Books:**

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata Mc graw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata Mcgraw Hill publications (India) Pvt. Ltd.

**IYear-II Semester**

| L | T | P | C |
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## MINERAL PROCESSING AND METALLURGICAL ANALYSIS

**Course objectives:**

1. To study the scope of ore dressing and to describe the various crushers used in ore dressing.
2. To explain the theory and principles of various sizing techniques. It also describes the movement of solids in fluids by explaining the effect of various parameters on the movement of solids.
3. The basic concepts involved in jigging and tabling will be detailed to understand the working of various jigging machines and other equipment involved with tabling.
4. To know the importance of various methods of Metallurgical chemical analysis.
5. To describe various instrumental analysis.

**UNIT I**

Scope and objective of ore dressing, Theory of liberation of minerals. Crushers: -Jaw, Gyratory, Cone, Rolls, and toothed roll crushers.
Types of grinding operations like batch and continuous dry and wet grinding, open circuit and closed circuit grinding. Grinding Mills: Ball mills, theory of ball mill operation, rod and tube mills. Comminution laws: - Rittinger's laws, Kick's law and Bond's law.

**UNIT II**

Sizing: Study of laboratory sizing techniques and reporting of sizing data. Industrial sizing units: Types of screen surfaces. Grizzlies, trommels, vibrating and shaking screens.
Classification of classifiers, study of settling cones, rake classifier, spiral classifier, and cyclones.
Heavy media separation: Principles, flow chart, different media used. Heavy media separation using heavy liquids and heavy suspensions.

**UNIT III**

Jigging: Theory of jigging. Jigging machines: hand jig, Harz jig, Denver jig, Baum jig, Hancock jig, James coal jig, and halkyn jig. Design considerations in a jig.
Flotation: Principles of flotation, Factors affecting flotation. Classification of collectors and frothers. Application of flotation process for Cu, Pb and Zn ores. Magnetic separation processes and electrostatic separation process.

**UNIT IV**

Scope of metallurgical analysis, classification of various methods used in metallurgical analysis. Determination of iron in iron ore, manganese in manganese ores, lime in limestone, fire-assay of precious metals.

**UNIT-V:**

Instrumental analysis: Importance of instrumental analysis –Comparison with standard wet chemical methods, absorptiometry, colorimetry and spectrophotometry.

**Course Outcomes:**

1. Able to understand the theory, principle and working of various ball mills used for size reduction.
2. Understand the principles and working of classifiers.
3. Interpret the principles and applications of flotation and other separation processes
4. Compare the results with different wet methods
5. Interpret the working of different components by instrumental analysis.

(Assessment: The student should be evaluated based on the assignments and objective tests. The student's analytical abilities (with special focus on academically weak students) should be tested periodically in classes by giving problems). Emphasis should be given by conducting tutorial classes at the end of each unit.)

**TEXTBOOK:**

1. Principles of Mineral Dressing by A.M. Gaudin.
2. S.K.Jain-Metallurgical analysis

**REFERENCES:**

1. Elements of Ore Dressing by A.F. Taggart
2. Mineral processing technology-.A. Wills
3. Ore dressing practices-S.K.Jain.
4. Vogel Al., A Text Book of Quantitative Inorganic Analysis Longman ELBS 1962.
5. Willard H.H.etal: Instrumental Methods of analysis Van Nostrand.

**I Year-II Semester**

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## COMMUNICATIVE ENGLISH LAB

(Common to All Branches of Engineering)

**Course Objectives:**

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning students will get trained in the basic communication skills and also make them ready to face job interviews.

**Course Outcomes:**

- Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
- Apply communication skills through various language learning activities.
- Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- Evaluate and exhibit professionalism in participating in debates and group discussions.
- Create effective resonate and prepare themselves to face interviews in future.

**List of Topics:**

1. Vowels & Consonants ( Not rules but use of them in various syllable structures)
2. Neutralization/Accent Rules (No rules again, required more practice)
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. (This can be part of theory course) Resume Writing, Cover letter, SOP
6. Group Discussions-methods & practice
7. Debates- Methods & Practice
8. PPT Presentations/ Poster Presentation
9. Interviews Skills

**Suggested Software:**

- Walden Infotech
- Young India Films

**Reference Books:**

1.Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.( This can be for theory and not for lab)
2. Samson T : Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill EducationIndia,2016
4. Jayashree, M Let's Hear them Speak: Developing Listening-Speaking skills in English.
. Sage Publications
5. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012. ( That is for reading and writing and can be used in theory classes but not in Lab)
6. T. Bala subramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed)
Trinity Press. (This is all theory and can be for MA English students but not for B.Tech students)

**Web Resources:**

**Spoken English:**

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw
12. https://www.linguahouse.com/en-GB
13. https://www.ted.com/watch/ted-ed

**Voice & Accent:**

1.. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

**I Year-II Semester**

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## ENGINEERING CHEMISTRY LAB

(Common to Civil, Mechanical and Metallurgical Engineering)

**Objectives**:

To verify the fundamental concepts with experiments

**Course Outcomes:**

At the end of the course, the students will be able to

- Determine the cell constant and conductance of solutions.
- Prepare advanced polymer materials.
- Determine the physical properties like surface tension, adsorption and viscosity.
- Estimate the Iron and Calcium in cement.
- Calculate the hardness of water.

**List of Experiments:**

1. Determination of Hardness of a groundwater sample.
2. Estimation of Dissolved Oxygen by Winkler's method
3. Determination of $KnO_4$ by using standard oxalic acid solution.
4. Preparation of a polymer Bakelite (Demo)
5. Determination of percentage of Iron in Cement sample by colorimetry
6. Estimation of Calcium by $K_2Cr_2O_7$
7. Preparation of nanomaterials by precipitation method.
8. Adsorption of acetic acid by charcoal.
9. Determination of percentage Moisture content in a coal sample
10. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
11. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
12. Determination of Calorific value of gases by Junker's gas Calorimeter
13. Preparation of Polyaniline Conducting polymer(demo)
14. Conductometric titration of strong acid and strong base.

**Reference:**


- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar.

**I Year-II Semester**

| L | T | P | C |
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## IT WORKSHOP
## (Common to all branches of Engineering)

**Course Objectives:**

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot for Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of the Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia, Antivirus tools and Office Tools such as Word processors, spreadsheets, and Presentation tools.

### PC Hardware & Software Installation

**Task1:** Identify the peripherals of a computer, components in a CPU, and functions. Draw the block diagram of the CPU Along with the configuration of each peripheral and submit to your instructor.

**Task2:** Every student should disassemble and assemble the PC back to working condition. La instructors should verify the work and follow it up with a Viva. Also, students must go through the video showing the PC assembling process. A video would be given as part of the course content.

**Task 3**: Students should install MS windows on their personal computer. The lab instructor should verify the installation and follow it with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have Windows installed. The system should be configured as dual boot (VMWare) with Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

**Task5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.

### Internet & World Wide Web

**Task 1:** Orientation & Connectivity Boot Camp: Students should connect to their Local Area Network and access the Internet. In the process, they configure the TCP/IP setting. Finally, students should demonstrate to the instructor how to access the websites and email. Without internet connectivity, instructors must simulate the WWW on the LAN.

**Task2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search tool bars, and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task3**: Search Engines & Netiquette: Students should know what search engines are and how to use these arch

engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and asked to configure their computers to be safe on the internet. They need to customize their browsers to block pop-ups ,and block active X downloads to avoid viruses and worms.

**LaTeX and WORD**

**Task 1 –** Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) Office or equivalent (FOSS) tool word: Importance of La Te X and MS office or equivalent (FOSS)tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task2:** Using LaTeX and Word to create a project certificate. Features to be covered :- Formatting Fonts in Word ,Drop Cap in Word ,Applying Text effects ,Using Character Spacing ,Borders ,and Colors ,Inserting Header and Footer ,Using Date and Time options in LaTeX and Word.

**Task 3:** Creating project abstract Features to be covered: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Contents, Newspaper columns, Images from files and clipart, Drawing toolbar and WordArt, Formatting Images, Textboxes, Paragraphs, and Mail Merge in word.

**EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of the MSOffice or equivalent (FOSS)tool Excel as a Spread sheet tool give the details of the four tasks and features that would be covered in each. Using Excel – Accessing an overview of tool bars, saving Excel files, Using help and resources.

**Task1:** Creating a Scheduler- Features to be covered: Gridlines, Format Cells, Summation, auto-fill, Formatting Text

**Task2:** Calculating GPA- Features to be covered:-Cell Referencing, Formulae in Excel–average, std. deviation, Charts,
Renaming and Inserting worksheets, Hyper linking, Count function,

**LOOKUP/LOOKUP**

**Task3**: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

**POWER POINT**

**Task1:** Students will be working on essential Power Point utilities and tools which help them create introductory Power Point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting–Images, Clip Art, Audio, Video, Objects, Tables and Charts.

**Task3:** Master Layouts (slide, template, ad notes), Types of views (basic, presentation, slides lotter, notes, etc),and Inserting– Background, textures, Design Templates, Hidden slides.

**AI TOOLS–Chat GPT**

**Task1:** Prompt Engineering: Experiment with different prompts to see how the model responds. Try asking questions,
Starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You area knowledge able AI. Please answer the following question: What is the capital of France?"

**Task2:** Creative Writing: Use the model as a writing assistant Provide the beginning of a story or a scene description, and
Let the model generate the rest of the content. This can be a fun way to brain storm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

**Course Outcomes:**

**CO1:** Perform Hardware trouble shooting.

**CO2:** Understand Hardware components and interdependencies.

**CO3:** Safeguard computer systems from viruses/worms.

**CO4:** Document/ Presentation preparation.

**CO5:** Perform calculations using spread sheets.

**Reference Books**:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream Tech, 2003
2. The Complete Computer Upgrade and Repair Book, Chery lA Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions Limited, Pearson Education, 2012, 2nd edition
4. PC Hardware – A Handbook, Kate J. Chase, PHI(Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfinson and Ken Quamme. – CISCO Press,
   Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan–CISCO Press, Pearson Education, 3rd edition

**I Year – II Semester**

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## ENGINEERING WORKSHOP
## (Common to All branches of Engineering)

**Course Objectives:**

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

**Course Outcomes:**

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for house wiring Practice

CO5: Construct the sheet metal jobs from GI sheets and preparation of pipe joints using plumbing

**SYLLABUS**

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of wood sand tools used in wood working and make following joints.
   a) Half– Lap joint b) Mortise and Ten on joint c) Corner Dove tail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dove tail fit c) Semi- circular fit d) Bicycle tire puncture and change of two- wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) God own lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds forgiven Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

**Textbooks:**

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghu wanshi, Dhanpath Rai & Co., 2015 & 2017.

**Reference Books:**

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**I Year-II Semester**

## MINERAL PROCESSING AND METALLURGICAL ANALYSIS LAB

(Learning objective: Design the sequence of operations in a logical order. The relevant tabular forms are to be prepared. Experiments are to be conducted taking the necessary precautions. The data should be recorded and the results need to be interpreted using the necessary mathematical expressions)

**List of Experiments**

1. Sampling of ore from the bulk by: Coning and quartering method, Riffle sampler methods
2. Sizing by Sieve analysis of crushed ore
3. Determining the reduction ratio of a jaw crusher.
4. Study of the variation of reduction ratio with process variables in Rolls crusher.
5. Study of the process variables on reduction ratio and particle size distribution in ball mill.
6. To find the grindability index of ores.
7. Verification of Laws of Comminution.
8. Determination of the efficiency of a magnetic separator.
9. Determination of the efficiency of a jig.
10. Study of the particle separation by fluid flow using wilfley table.
11. To study the concentration of metallic and non-metallic ores by Froth-Flotation process.
12. Estimation of Iron in Iron ore. - To determine the percentage of Iron in Iron Ore by KMnO4 method and K2Cr2O7 method.
13. Estimation of Copper in Brass by Electrolytic method.
14. Estimation of the concentration of KMnO4 in the solution using Digital Spectrophotometer.
15. Estimation of Sulphur, Phosphorus and Manganese in cast irons
16. Estimation of Mn, Cr, and Si in Ferro-Alloys

**Equipment:**

1. Riffle Sampler
2. Sieve Shaker with Sieves
3. Stokes' Apparatus
4. Jaw Crusher
5. Roll Crusher
6. Ball Mill
7. Grindability Index Apparatus
8. Magnetic Separator
9. Jig
10. Wilfly's Table
11. Pneumatic Separator
12. Froth – Floatation Equipment
13. Electronic digital balances – 2 No's
14. Optical emission spectrometer

15. Flame Photometer
(Assessment: The students performance should be evaluated at the end of each class based on the following parameters)

**Parameters-I.**
1. Observation book,
2. Record.
3. Conduct of the experiment successfully
4. Interpretation of the data
5. Drawing the graphs where ever necessary
6. Viva-voce

**Parameters-II.**

1. At the end of each cycle of experiments internal exams should be conducted in addition to the end examination

**I Year-II Semester**

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## HEALTH AND WELLNESS, YOGA AND SPORTS
## (Common to All branches of Engineering)

**Course Objectives:**

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

**Course Outcomes:** After completion of the course the student will be able to

**CO1**: Understand the importance of yoga and sports for Physical fitness and sound health.
**CO2:** Demonstrate an understanding of health-related fitness components. **CO3:** Compare and contrast various activities that help enhance their health. **CO4:** Assess current personal fitness levels.
**CO5:** Develop Positive Personality

**UNITI**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

**Activities:**

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

**UNITII**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

**Activities:**

Yoga practices– Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

**UNIT III**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Common wealth games.

**Activities:**

i) Participation in one major game and one individual sport viz., Athletics, Volley ball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-Kho, Table tennis, Cricket etc.
   Practicing general and specific warmup, aerobics
ii) Practicing cardio respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

**Reference Books:**

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V. Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J. Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon.--3rd ed. Human Kinetics, Inc. 2014

**General Guidelines:**

**1.** Institutes must assign lots in the Time table for the activities of Health/Sports/Yoga.
**2.** Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
**3.** Institutes are required to provide sports instructor/ yoga teacher to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totallingto90marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voice on the subject.

| II Year-I Semester | TRANSFORMS AND NUMERICAL METHODS (Common to ME & MET) | L | T | P | C |
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**Course Objectives:**

- To equip the students with the knowledge of Laplace Transforms.
- Provide fundamental concepts of Fourier series and Fourier Transforms.
- Introduce the concept of Solution of Algebraic & Transcendental Equations.
- Solving ordinary differential equations using Laplace transforms techniques.
- Teach the concept of Finite differences methods.

**UNIT-I: Laplace Transforms: 10 hrs**

Definition and Laplace transforms of some certain functions- Shifting theorems; Laplace transforms of derivatives and integrals –Unit step function- Dirac's delta function , periodic functions. Inverse Laplace transforms -Convolution theorem (without Proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace Transforms. .

**UNIT-II: Fourier series and Fourier Transforms: 10 hrs**

**Fourier series:** Introduction, Periodic functions, Fourier series of Periodic functions, Dirichlet's conditions, Even and Odd Functions, Change of interval, Half range Fourier sine and cosine series.

**Fourier Transforms:** Fourier integral theorem (without proof) -Fourier sine and cosine integrals- sine and cosine transforms-properties (article-22.5 in text book-I)- inverse transforms- Convolution theorem (without proof) finite Fourier Transforms.

**UNIT-III: Solution of Algebraic & Transcendental Equations: 8 hrs**

Introduction-Bisection method - Iterative method - Regula falsi method - Newton Raphson method

**UNIT-IV: Interpolation 10 hrs**

Finite differences -Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

**UNIT-V: Numerical differentiation, integration & Solution of Initial Value problems to Ordinary Differential Equations of first order: 10 hrs**

**Numerical Differentiation and Numerical integration:** Numerical differentiation using Newton's forward & backward interpolation formulae; Numerical Integration by trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

**Numerical Solutions of Ordinary differential equation:** Solution by Taylor's series, picard's method of successive approximations, Euler's method, modified' Euler's method and Runge-Kutta method of fourth order.

**Text Books**:

1. B. S. Grewal, Higher Engineering Mathematics,44/e, Khanna Publishers, 2017
2. S.S.Sastry, Introductory Methods of Numerical Analysis, 5/e, PHI publication, 2012.

**Reference Books**:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, Wiley publications, 2011.
2. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 6/e, Mc Graw Hill, 2010.
3. C. Ray Wylie and Louis C. Barrett, Advanced Engineering Mathematics, 6/e, McGraw-Hill Education 1995.

**Online Learning Resources:**

- https://archive.nptel.ac.in/courses/127/106/127106019/
- https://archive.nptel.ac.in/courses/111/107/111107105/
- https://nptel.ac.in/courses/122106033
- https://archive.nptel.ac.in/courses/122/106/122106033/
- http://digimat.in/nptel/courses/video/111106111/L01.html
- http://acl.digimat.in/nptel/courses/video/122106033/L38.html

**Course Outcomes:**

| COs | Statements | Blooms Level |
|---|---|---|
| CO1 | Understand the Laplace transform for solving differential equations | L2 |
| CO2 | Find or compute the Fourier series of periodic signals | L3 |
| CO3 | Apply numerical methods to solve Algebraic & Transcendental Equations | L3 |
| CO4 | Analyze interpolating polynomials using interpolation formula | L4 |
| CO5 | Solve ordinary differential equations using different numerical schemes | L6 |

| II Year-I Semester | UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT (Common to CE, EEE, ME, ECE, CSE, IT, MET) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**Course Objectives:**

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

**Course Outcomes:**

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

**Course Topics**

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

**UNIT I** Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

**UNIT II** Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

**UNIT III** Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

**UNIT IV** Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

**UNIT V** Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

**READINGS:**

**Textbook and Teachers Manual**

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**Reference Books**

1. *JeevanVidya: EkParichaya,* A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

**Mode of Conduct:**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

**Online Resources:**

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

| II B.Tech I-Semester | HEAT AND MASS TRANSFER | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

***Course Objective:***

1. *Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems.*
2. *Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems.*
3. *Explain basic laws for radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems.*
4. *Apply diffusive and convective mass transfer equations and correlations.*
5. *To understand the mechanisms of heat transfer under steady and transient conditions.*

**UNIT – I**

Principles of heat and mass transfer to basic engineering systems and the basic concepts and laws of the three modes of heat transfer conduction, convection, radiation and their combined effect. –General discussion about applications of heat transfer, Fundamentals of heat conduction - Steady and unsteady heat transfer , General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates, correlations for conjugate heat transfer, Fourier law of heat conduction. Thermal conductivity

**UNIT – II**

One dimensional steady state heat conduction heat transfer through homogenous slabs and hallow cylinders- critical radius of insulation
One Dimensional Transient Conduction Heat Transfer Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies Chart solutions of transient conduction systems

**UNIT – III**

Convective Heat Transfer-Free convection - Use of empirical relations for Vertical plates and pipes
Forced convection: External Flows and Internal Flows-Basic concepts
Aspects of Radiative Heat Transfer. Reflection, absorption, transmission of radiation. Black body radiation, Lambert's Law.

**UNIT – IV**

Fluid flow and its relevance to mass transfer. General mass transport equation. Modes of mass transfer. Film and boundary layer theories.

**UNIT – V**

Diffusion and its application in solid state, Steady diffusion. Pseudo-steady diffusion, Diffusion through porous solids, diffusion and chemical reactions

***Course Outcomes:***

*Students will be able*

1. *To understand the Principles of heat and mass transfer.*
2. *To apply the associated heat transfer correlations to solve problems.*
3. *To outline the to radiative heat transfer during.*
4. *To understand the concept of mass transfer equations and correlations*
5. *To understand the importance of diffusion in mass tranfer.*

**CO PO Mapping**

| | *PO1* | *PO2* | *PO3* | *PO4* | *PO5* | *PO6* | *PO7* | *PO8* | *PO9* | *PO10* | *PO11* | *PO12* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CO1* | √ | √ | | | | | | | | | | |
| *CO2* | √ | √ | | | | | | | | | | |
| *CO3* | √ | √ | | | | | | | | | | |
| *CO4* | √ | √ | | | | | | | | | | |
| *CO5* | √ | √ | | | | | | | | | | |

*(Assessment: The student should be evaluated based on the assignments and objective tests. The student's analytical abilities with special focus on academically weak students) should be tested periodically in classes by giving problems with respect to Phase diagrams and others. Unit tests are to be conducted at the end of each unit).*

**TEXTBOOK:**

1. Rate Processes in Metallurgy, A. K. Mohanty
2. Principles of Extractive Metallurgy, A. Ghosh and H. S. Ray
3. Elements of Heat and Mass Transfer, Prof. R. C. Patel

**REFERENCES:**

1. Fundamentals of Heat and Mass Transfer, Inpropera and Dewitt
2. Rate Phenomena in Process Metallurgy, J. H. Szekely and N. J. Themelis
3. Fundamentals of Momentum, Heat and Mass Transfer, J. R. Welty, C. E. Wicks
4. Chemical Engineering, J. M. Coulson and J. F. Richardson (Pub.- Mc. Hill ELBS)
5. Engineering in Process Metallurgy, RLL Guthrie (Pub.- Oxford).
6. Heat Transfer, Yunus Cengel

| II B.Tech I-Semester | PHYSICAL METALLURGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

***Course Objective:***

1. *To understand the basic crystal structures of various materials which forms the basis for the subsequent study of properties of materials.*
2. *To understand the constitution and necessity of alloy formation.*
3. *The chapter outlines the various experimental methods of construction of phase diagrams.*
4. *The unit intended to describe various phase diagrams and phase transformations.*
5. *To provide the detailed explanation of phase transformations in steels.*

**UNIT – I**

Structure of Metals, classification of metals, metallic bond-crystal structure of metals, coordination number, relationship between lattice parameter and atomic radius, packing factor and density calculations, interstitials, polymorphism, plane and directional indices, transformation of indices.

**UNIT – II**

Crystallography ,Constitution of Alloys: Necessity of alloying; Hume-Rothery's rules types of solid solutions, Intermediate alloy phases, electro-chemical compounds, size factor, compounds and electron compounds.

**UNIT – III**

Equilibrium Diagrams: Experimental methods for construction of equilibrium diagrams, Isomorphous alloy systems, eutectic, partial eutectic systems and other systems.

Solidification: Types of Nucleation, determination of the size of critical nucleus, equilibrium cooling and heating of alloys, lever rule, coring, miscibility gaps. Simple problems using lever rule.

**UNIT – IV**

Transformation in solid-state, allotropy, order-disorder transformation, eutectoid, peritectoid reactions and complex phase diagrams, relation between equilibrium diagrams and physical properties of alloys. Study of important binary phase diagrams like Fe-Fe3 C, Cu-Zn, Cu-Sn, and Al-Cu.

**UNIT – V**

Phase transformations in steels: pearlitic, martensitic and bainitic transformations, cooling curves, Isothermal transformation diagrams, transformations on continuous cooling, Concept of diffusion Fick's first law and second law.

***Course Outcomes:***

*Students will be able*

1. *To understand the geometry and crystallography of crystalline materials; Identify planes and directions in crystal systems.*
2. *To apply the associated Hume Rothery rules for the formation of alloys.*
3. *To outline the solidification behaviour of materials during cooling.*
4. *To understand the concept of phase diagram in recognizing the phase changes*
5. *To understand the importance of isothermal diagrams.*

**CO PO Mapping**

| | *PO1* | *PO2* | *PO3* | *PO4* | *PO5* | *PO6* | *PO7* | *PO8* | *PO9* | *PO10* | *PO11* | *PO12* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CO1* | √ | √ | | | | | | | | | | |
| *CO2* | √ | √ | | | | | | | | | | |
| *CO3* | √ | √ | | | | | | | | | | |
| *CO4* | √ | √ | | | | | | | | | | |
| *CO5* | √ | √ | | | | | | | | | | |

*(Assessment: The student should be evaluated based on the assignments and objective tests. The student's analytical abilities with special focus on academically weak students) should be tested periodically in classes by giving problems with respect to Phase diagrams and others. Unit tests are to be conducted at the end of each unit).*

**TEXTBOOK:**

a. Introduction to Physical Metallurgy – S.H. Avner- McGraw-Hill publishers
b. Physical Metallurgy – Vijayendra Singh, Standard Publishers Distributors, 2005

**REFERENCES:**

1. Physical Metallurgy principles-Reed Hill – CENGAGE Learning Publishers
2. Engineering Physical Metallurgy and Heat Treatment – Y. Laktin.
3. Elements of Physical Metallurgy – A.Guy
4. Metallographic laboratory practice – Kehl
5. Principles of Physical Metallurgy – Smith. M.
6. Introduction to Metallurgy – A.H. Cottrell
7. Metallurgy for Engineers-Clark and Varney.
8. Physical Foundations of Materials Science – G. Gottstein
9. The Science and Engineering of Materials – Askeland et. al.
10. Physical Metallurgy – William F Hasford – CRC Press
11. Callister's Materials Science and Engineering, Adapted by R.Balasubramaniam, secondedition, Wiley, 2015

| II Year - I Semester | PRINCIPLES OF EXTRACTIVE METALLURGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course objectives:**

1. *The unit aims to discuss unit processes during the metal extraction*
2. *Deals with different types of roasting processes*
3. *The unit out lines different reduction processes and also discusses the Ellingham diagrams*
4. *The main objective is to describe the principles of leaching and associated hydrometallurgy*
5. *The main objective is to describe the principles of electro metallurgy and electro winning, to describe the methods of refining*

**UNIT-I**

**Introduction:** Classification of ores, advantages and disadvantages of unit processes in extractive metallurgy, Calcination.

**UNIT-II**

**Roasting:** Types of roasting: Oxidizing, sulphatising and chloridizing, Simple equations/reactions. Roasting furnace: Multiple hearth roaster, flash roasting, fluidized bed roasting, blast roasting. Sintering and pelletisation

**UNIT-III**

**Smelting, smelting furnaces and slags:** Principles of reduction and matte smelting with examples. Reverberatory, BF and electric smelting. Flash smelting. Classification, properties importance of Ellingham diagrams for oxides and sulphides and ellinghams limitations.

**UNIT-IV**

**Hydrometallurgy:** Advantages and disadvantages, Flowchart, Principles and types of leaching, Solution purification by ion and solvent exchange. Metal recovery from leach solution by cementation.

**UNIT-V**

Classification of electrometallurgy, Advantages and disadvantages electrometallurgy. Electrolytic cell-Anodic and cathodic reactions. General discussions on the electrowinnig of metals.

Principles of Refining: Fire refining, Distillation, liquation, electro-refining and zone refining.

**Course outcomes:**

The students should be able to

1. Understand Basic principles of Extractive metallurgy
2. Understand siginificance of roasting
3. Know Ellingham diagram and its significance
4. Know the Principles of hydrometallurgy, properties of good solvent leaching and precipitation
5. Learn principles of electrometallurgy, different types of techniques

(Assessment: The student should be evaluated based on the assignments and objective tests. Emphasis should be given by conducting tutorial classes (with special focus on academically weak students) at the end of each unit).

**CO PO Mapping**

| | *PO1* | *PO2* | *PO3* | *PO4* | *PO5* | *PO6* | *PO7* | *PO8* | *PO9* | *PO10* | *PO11* | *PO12* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CO1* | √ | √ | | | | | | | | | | |
| *CO2* | √ | √ | | | | | | | | | | |
| *CO3* | √ | √ | | | | | | | | | | |
| *CO4* | √ | √ | | | | | | | | | | |
| *CO5* | √ | √ | | | | | | | | | | |

*(Assessment: The student should be evaluated based on the assignments and objective tests. The student's analytical abilities (with special focus on academically weak students) should be tested periodically in classes by giving problems). Emphasis should be given by conducting tutorial classes at the end of each unit.)*

**Text Books:**

1. Non-ferrous extractive metallurgy: H.SRay,K.P.AbrahamandR.Sreedhar
2. Principles of extractive metallurgy - Goshand Ray–new Age Publishers

**Reference Books:**

1. Principles of Extractive Metallurgy – F.Habashi – CRCPress

| II- Year I-Semester | MECHANICS OF SOLIDS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**Course Objective:** To impart practical exposure on the strength of materials and their properties evaluation. To impart practical knowledge on the evaluation of material properties through various destructive testing procedures.

1. Direct tension test
2. Bending test on
   a) Simple supported
   b) Cantilever beam
3. Torsion test
4. Test on springs
5. Compression test on cube
6. Compression test on helical spring.
7. Use of electrical resistance strain gauges
8. Punch shear test
9. Rockwell Hardness Test

**Course Outcomes:**

Upon successful completion of this course, the students will be able to:

1. Solve the ultimate stress of mild steel and bending stress for simply supported and cantilever beam. (BL-2)
2. Solve the compressive stress on cube of different materials (BL-2)
3. Solve the Modulus of rigidity of spring materials (BL-2)
4. Find torsion and punch shear test. (BL-1)
5. Analyze the hardness of engineering materials. (BL-4)

**CO-PO Mapping:**

| S.NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO2 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO3 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO4 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO5 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |

*(Assessment: The student's performance should be evaluated at the end of each class based on the following )*

*Parameters - I.*

1. *observation book,*
2. *Record.*
3. *Conduct of the experiment successfully*
4. *Interpretation of the data*
5. *Drawing the graphs where ever necessary*
6. *Viva-voce.*

*Parameters - II.*

*At the end of each cycle of experiments internal exams should be conducted in addition to theend examination)*

| II Year - I Semester | EXTRACTIVE METALLURGY LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**Course objectives:** The basic objective of the course is to provide hands on practice on various types of unit process industrially important nonferrous metals

**List of experiments:**

1. To find the efficiency of electrolytic cell for Cu refining
2. To find the effect of time on leaching of an oxide ore
3. To find the effect of temperature on leaching of an oxide ore
4. To conduct cementation of Copper ore
5. Electro wining of a nonferrous metal
6. To determine the effect of temperature on calcination of lime stone
7. To find the effect of time on calcination of lime stone
8. To find the weight loss on calcination of lime stone
9. To find the effect of time on roasting of a sulphide ore
10. To find the effect of temperature on roasting of a sulphide ore

**List of equipment:**

1. Muffle Furnace
2. Oxygen Cylinder
3. Digital electronic balance
4. Ceramic crucible
5. Electrochemical cell

*(Assessment: The student's performance should be evaluated at the end of each class based on the following)*

*Parameters - I.*

1. *observation book,*
2. *Record.*
3. *Conduct of the experiment successfully*
4. *Interpretation of the data*
5. *Drawing the graphs where ever necessary*
6. *Viva-voce.*

*Parameters - II.*

*At the end of each cycle of experiments internal exams should be conducted in addition to theend examination)*

| II B.Tech I-Semester | PHYSICAL METALLURGY LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

*(Learning objective: Design the sequence of operations in a logical order. Experiments are to be conducted taking the necessary precautions. The microstructures should be observed at various magnifications and the structure should be interpreted and conclusions should be presented.)*

**LIST OF EXPERIMENTS**

1. Preparation and study of Crystal models.
2. Study of Specimen cutting machine Specimen mounting press Grinding and polishing Equipment
3. Study of various Metallurgical Microscopes and use of leveling press
4. Metallographic preparation of ferrous specimens for Microscopic examination
5. Preparation of non-ferrous specimens for Metallographic examination
6. Preparation and Metallographic study of pure metals like Iron, Copper, Aluminium, etc..
7. Measurement of lattice parameters of various crystal structures and calculation ofpacking factors and size of vacancies.
8. Identification of Microstructures of steels
9. ASTM Grain size measurement
10. Second Phase Analysis using Image Analysis

**Equipment:**

1. Specimen Cutting Machine
2. Specimen Mounting Press
3. Belt Grinding Machine
4. Disc Polishing Machines
5. Metallurgical Microscopes
6. Specimen Leveller.
7. Image analyser
8. Standard samples with their microstructure

*(Assessment: The student's performance should be evaluated at the end of each class based on the Following)*

*Parameters - I.*

1. *observation book,*
2. *Record.*
3. *Conduct of the experiment successfully*
4. *Interpretation of the data*
5. *Drawing the graphs where ever necessary*
6. *Viva-voce.*

*Parameters - II.*

*At the end of each cycle of experiments internal exams should be conducted in addition to theend examination)*

| II Year-I Semester | COMPUTER AIDED DRAFTING AND MODELING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**Course Objective**:
The student will acquire knowledge
1. To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.
2. To introduce various commands in AutoCAD to draw the geometric entities and to create 2D wire frame models.
3. To introduce various commands in AutoCAD to draw the geometric entities and to create 3D wire frame models.
4. To create geometrical model of simple solids, machines & machine parts
5. To interpret view points and view ports, view point coordinates and views displayed and develop computer aided solid models with isometric and orthographic projections.

**COMPUTER AIDED DRAFTING**:
1. Generation of points, lines, curves, polygons, dimensioning. Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files
2. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands in 2D modeling
3. Object selection commands – edit, zoom, cross hatching, pattern filling, utility commands in 3D modeling.
4. Development of part drawings for various components in the form of orthographic representation of dimensioning and tolerances using wire frame and surface modeling.
5. Development of part drawings for various components in the form of isometric representation of dimensioning and tolerances using wire frame and surface modeling.
6. View point coordinates and view ports displayed, examples to exercise different options like save, restore, delete , joint , single option.
7. **COMPUTER AIDED SOLID MODELING**: Development of part drawings for various components in the form of isometric representation.

**PART MODELING**: Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.
8. Development of part drawings for various components in the form of orthographic projections.
9. Modeling of simple solids,
10. Modeling of Machines & Machine Parts.**Assembly drawings**: (Any four of the following using solid model software) Generation of various Parts/assemblies: like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder.

**Course outcomes:**

Upon successful completion of this course, the students will be able to:

1. Understand skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling. (BL-2)
2. Utilize various commands in AutoCAD to draw the geometric entities and to create 2D wire frame models. (BL-3)
3. Interpret various commands in AutoCAD to draw the geometric entities and to create 3D wire frame models. (BL-3)
4. Construct geometrical model of simple solids, machines & machine parts. (BL-3)
5. Understand view points and view ports, view point coordinates and views displayed and develop computer aided solid models with isometric and orthographic projections. (BL-2)

**CO-PO Mapping:**

| S.NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO2 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO3 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO4 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |
| CO5 | √ | √ | √ | √ | √ | | | √ | √ | √ | √ | √ |

| II Year-I Semester | ENVIRONMENTAL SCIENCE (Common to CE, EEE, ME, ECE, CSE, IT, MET) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | - |

**Course Objectives:**

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

**UNIT I** **7h**

**Multidisciplinary Nature of Environmental Studies: –** Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Water resources – Mineral resources- Food resources–Land resources and Energy resources - Use and over exploitation, case studies.

**UNIT II** **7h**

**Ecosystems:** Concept of an ecosystem. – Structure and function of an ecosystem (Producers, consumers and decomposers), Energy flow in the ecosystem and ecological pyramids – Introduction, types, characteristic features of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Biodiversity and its Conservation:** Introduction - Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT III** **6h**

**Environmental Pollution:** Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

**Solid Waste Management:** Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**UNIT IV** **6h**

**Social Issues and the Environment:** From Unsustainable to Sustainable development – Water conservation, rain water harvesting, watershed management – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

**UNIT V** **6h**

**Human Population and the Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**Field Work:** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

**Textbooks**:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

**References:**

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

| II Year-II Semester | MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to CE, EEE, ECE, CSE, IT & MET) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**Course Objectives:**

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

**Course Outcomes:**

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

**UNIT - I Managerial Economics 6h**

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

**UNIT - II Production and Cost Analysis 4h**

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour-Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

**UNIT - III Business Organizations and Markets 4h**

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

**UNIT - IV Capital Budgeting 8h**

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

**UNIT - V Financial Accounting and Analysis 10h**

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

**Textbooks:**

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

**Reference Books:**

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

**Online Learning Resources:**

https://www.slideshare.net/123ps/managerial-economics-ppt https://www.slideshare.net/rossanz/production-and-cost-45827016 https://www.slideshare.net/darkyla/business-organizations-19917607 https://www.slideshare.net/balarajbl/market-and-classification-of-market https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396 https://www.slideshare.net/ashu1983/financial-accounting

| II Year-II Semester | COMPLEX VARIABLES, PROBABILITY AND STATISTICS (Common to ME & MET) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

**UNIT – I: Functions of a complex variable and Complex integration: 10 hrs**

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.

Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

**UNIT – II: Series expansions and Residue Theorem: 10 hrs**

Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series.

Types of Singularities: Isolated – Essential –Pole of order m– Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_c f(\cos\theta, \sin\theta)d\theta$.

**UNIT – III: Probability and Distributions: 10 hrs**

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV: Sampling Theory: 10 hrs**

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t, $\chi^2$ and F-distributions- point and interval estimations – maximum error of estimate.

**UNIT – V: Tests of Hypothesis: 8 hrs**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

**Text Books:**


1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers.
2. Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.


**Reference Books:**


1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9/e, Mc- Graw Hill, 2013.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8/e, Cengage.
4. Shron L.Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8/e, Pearson 2007.
5. Sheldon, M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4/e, Academic Foundation, 2011.


**Online Learning Sources:**

- https://archive.nptel.ac.in/courses/111/103/111103070/
- https://biet.ac.in/pdfs/PROBABILITY%20AND%20STATISTICS%20&%20COMPLEX%20VARIABLES.pdf
- https://archive.nptel.ac.in/courses/111/105/111105090/
- http://acl.digimat.in/nptel/courses/video/111102160/L23.html
- https://onlinecourses.nptel.ac.in/noc21_ma57/preview

**Course Outcomes:**

| COs | Statements | Blooms Level |
|---|---|---|
| CO1 | Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic | L3 |
| CO2 | Make use of the Cauchy residue theorem to evaluate certain integrals | L3 |
| CO3 | infer the statistical inferential methods based on small and large sampling tests | L4 |
| CO4 | Find the differentiation and integration of complex functions used in engineering problems | L5 |
| CO5 | Design the components of a classical hypothesis test | L6 |

| II B.Tech II-Semester | METALLURGICAL THERMODYNAMICS AND KINETICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

***Course Objective:***

*1. The student can understand the basic concepts of the properties of a system to help them to get aclear understanding of reversible and irreversible processes.*

*2. The student can understand the clear concept of enthalpy and internal energy. It also helps in understanding the classification of work.*

*3. To understand the concepts of free energy and entropy.*

*4. To know the concepts of activity and equilibrium constants.*

*5. To understand the kinetics of chemical processes and simultaneous reactions. It helps the studentto identify, formulate and solve engineering problems.*

**UNIT-I**

Objectives and limitations to thermodynamics, concepts of system and state, heterogeneous and homogeneous systems, extensive and intensive properties of system, thermodynamic variables, thermodynamic equilibrium, Reversible and irreversible processes.

**UNIT-II**

First and Second laws Law of thermodynamics: Nature of first law, relationship between heat and work, internal energy and the first law of thermodynamics, calculations of work, constant capacity, reversible adiabatic processes, reversible isothermal pressure or volume changes of an ideal gas, enthalpy change with temperature, Kirchhoff's equation. Second law of thermodynamics: Efficiency of a cyclic process, Carnot cycle, Carnot theorem, second law of thermodynamics, concept of entropy

**UNIT-III**

Third law of thermodynamics: Background of third law deductions from third law, applications of third law, and other methods of obtaining $\Delta S^0$ for a reaction. Free energy functions: Purposes of the new functions, definition of Helmholtz and Gibbs free energy change, meaning of thermodynamically possible process, determination of $\Delta G$ from thermal data useful relationships between free energies and other thermodynamic functions, Maxwell's equation and Gibbs-Helmholtzequation.

**UNIT-IV**

Fugacity, activity and equilibrium constant: Concepts of fugacity, activity and equilibrium constant variation of the equilibrium constant with temperature, Calculation of equilibrium constant from free energy changes, derivation of the Clausius – Clapeyron equation for single substance, Duhriges rule for the estimation of the vapour pressures of an element, Integration of Clausius – Clapeyronequation and Problems.

**UNIT –V**

Kinetics: Kinetics of chemical process, Molecularity, and order of a reaction, zero-order reactions, first-order, second-order reactions, Determination of order of reaction, collision theory, theory of absolute reaction rates, consecutive and simultaneous reactions, catalysis in chemical reactions.

***Course Outcomes:***

*Student will be able*

*1. To apply the concepts and properties of system in engineering problems.*

*2. To understand systems concept of manufacturing processes.*

*3. To understand the relationship between these functions and their applications in various thermodynamic processes.*

*4. To identify, formulate and solve engineering problems.*

*5. To understand kinetics, order of a reaction and rate constants.*

**CO PO Mapping**

| | *PO1* | *PO2* | *PO3* | *PO4* | *PO5* | *PO6* | *PO7* | *PO8* | *PO9* | *PO10* | *PO11* | *PO12* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CO1* | √ | √ | | | | | | | | | | |
| *CO2* | √ | √ | | | | | | | | | | |
| *CO3* | √ | √ | | | | | | | | | | |
| *CO4* | √ | √ | | | | | | | | | | |
| *CO5* | √ | √ | | | | | | | | | | |

**TEXTBOOK:**

1. Introduction to the thermodynamics of materials 5th Edition– D.R. Gaskell – CRC Press
2. Principles of metallurgical thermodynamics- S. K. Bose and S.K. Roy, University Press2014

**REFERENCES:**

1. Thermodynamics of solids-R.S.Swalin
2. Physical chemistry of metals-L.S.Darken & Gurry
3. Physical Metallurgy Principles – RH Reed hill.
4. Thermodynamics An Engineering Approach – Cengel – Mcgraw-Hill – 7th Edition
5. Fundamentals of thermodynamics-Sonntag et al
6. An Introduction to thermodynamics-Y.V.C.Rao
7. Chemical and Metallurgical thermodynamics – Prasad Krishnakanth – New AgePublications
8. Text Book of Materials and Metallurgical Thermodynamics: Ahindra Ghosh (PHI)

| II B.Tech II-Semester | HEAT TREATMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

***Course Objectives:***

1. *This unit deals with principles of heat treatment, and different hardenability methods.*
2. *To learn about different surface hardening methods.*
3. *This topic throws light on TTT Curves and the effect of alloying elements on Fe-Fe3C system.*
4. *This topic explains heat treatment of various types of tool, die steels and cast irons.*
5. *To understand the principles of heat treatment of various non-ferrous alloys.*

**UNIT-I**

**Principles Of Heat Treatment**: Austenitic Transformation, Pearlitic Transformation, Bainitic Transformation, Martensitic Transformation, Annealing, Normalizing, Hardening, , quenching media, size and mass effect, hardenability, tempering, austempering, deep freezing. Industrial Heat treatment furnaces and their design, atmosphere control vacuum heat treatment.

**UNIT-II**

Surface heat treatment, carburizing, cyaniding, flame and induction hardening, residual stresses, deepfreezing, thermo mechanical treatments: Low and High temperature thermo mechanical treatments, Aus forming, Iso forming, Cryo forming.

**UNIT-III**

**Effect of Alloy Elements in Heat Treatment**: Purpose of alloying, effect of alloying elements on ferrite, cementite, Fe- Fe3C system, tempering, and TTT Curves.

**UNIT-IV**

**Effect of Heat treatment on Alloy Steels**: Structural and constructional steels, maraging steels, tool and die steels. Corrosion and heat resistant steels, Hadfield steels.

**Effect of Heat treatment on Cast Irons**: White cast iron, grey cast iron, spheroidal graphite iron, malleable cast iron, alloy cast iron.

**UNIT-V**

**Heat treatment of Non-Ferrous Metals And Alloys**: Precipitation hardening, aging treatment, the study of copper and its alloys, aluminium and its alloys, nickel and its alloys.

**Course Outcomes:**

After completing the course, the student shall be able to:

1. *Modify the microstructure and properties using different heat treatments*
2. *Understand the various types of heat treatment mechanisms to improve the material properties.*
3. *Understand the role of alloying elements and heat treatment*
4. *Understand the effect of heat treatment on Alloy steels and castirons*
5. *Analyze and Understand the effect of heat treatment on Non –ferrous metals and Alloys*

**CO-PO Mapping**

| S.NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | √ | √ | | | | | | | | | | |
| CO2 | √ | √ | √ | | | | | | | | | |
| CO3 | √ | √ | | | | | | | | | | |
| CO4 | √ | √ | | | | | | | | | | |
| CO5 | √ | √ | | | | | | | | | | |

*(Assessment: The student should be evaluated based on the assignments and objective tests. The student's analytical abilities (with grinding focus on academically weak students) should be tested periodically in classes by giving problems). Emphasis should be given by conducting tutorial classes at the end of each unit.)*

**TEXTBOOK**

1. Heat Treatment Principle and Techniques-Rajan & Sharma
2. Heat treatment of metals- Vijayendra Singh, 2nd edition, Standard Publishers Distributors, 2006

**REFERENCES**

1.Heat Treatment of metals-Zakharv-Mir Publishers
2.Physical Metallurgy Lakhtin-Mir Publishers
3.Physical Metallurgy - Clark and Varney 4.Physical Metallurgy Principles - Reed Hill 5.Physical metallurgy-Raghavan
6.Materials Science and Engineering, Adapted by R.Balasubramaniam, second edition, Wiley, 2015

| II B.Tech II-Semester | CORROSION ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Course objectives:**

1. *To learn about electrochemical principles*
2. *To learn about the Polarization and electrochemical behavior of metals*
3. *To learn the principles and various types of corrosion.*
4. *To learn about various corrosion testing procedures and sequential procedure for laboratory andon-site corrosion investigations*
5. *To understand various protective methods of corrosion.*

**UNIT – I**

Electrochemical and thermodynamic principles, Nernst equation and electrode potentials of metals, EMF and galvanic series, merits and demerits; origin of Roubaix diagram and its importance to iron, aluminum and magnesium metals

**UNIT – II**

Exchange current density, polarization- concentration, activation and resistance, Tafel equation; passivity, electrochemical behavior of active/passive metals, theories of passivity

**UNIT – III**

Atmospheric, pitting, dealloying, stress corrosion cracking, inter granular corrosion, corrosion fatigue, erosion-corrosion, fretting corrosion and high temperature oxidation; hot corrosion; causes and remedial measures

**UNIT – IV**

Purpose of testing, laboratory, semi-plant and field tests, susceptibility tests for IGC, stress corrosion cracking and pitting, immersion and salt spray testing, impedance analysis, sequential procedure for laboratory and on-site corrosion investigations, corrosion auditing and corrosion map of India

**UNIT – V**

Corrosion prevention by design improvements, anodic and cathodic protection, metallic, non- metallic and inorganic coatings, mechanical and chemical methods and various corrosion inhibitors

**Course Outcomes:**

After completing the course, the student shall be able to:

1. *Understand the principles of electrochemistry and corrosion*
2. *Understand basics of kinetics of electrochemical corrosion, relevant theories and equations*
3. *origin and causes of high temperature oxidation through their kinetics, governing equations and remedies.*
4. *Different methods of corrosion testing, susceptibility tests, corrosion auditing and map of India.*
5. *Learn Various corrosion preventive methods*

**CO-PO Mapping**

| S.NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | √ | √ | | | | | | | | | | |
| **CO2** | √ | √ | | | | | | | | | | |
| **CO3** | √ | √ | | | | | | | | | | |
| **CO4** | √ | √ | | √ | | | √ | | | | | |
| **CO5** | | | √ | | | √ | | | | | | √ |

*(Assessment: The student should be evaluated based on the assignments and objective tests. The student's analytical abilities should by conducting concept tests. Emphasis should be given by conducting tutorial classes at the end of each unit.)*

**Text Books:**

1. Fontana M. G., Greene N.D., 'CorrosionEngineering',2nd Edition, McGrawHill,1983

**Reference Books:**

1. Raj Narayan, 'An Introduction to Metallic Corrosion and itsPrevention',1stEdition,

Oxford and IBH, 1983

2. Denny Jones, "Principles and Prevention of Corrosion", Prentice Hall of India,1996.

| II B.Tech II-Semester | FUELS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Course Objectives:** To impart practical exposure on the fuels and their properties evaluation. Also to impart practical knowledge on the evaluation of fuel properties through various destructive testing procedures.

1.To determine the calorific value of coal using Bomb Calorimeter.

2. To determine the calorific value of coke using Bomb Calorimeter.

3. Proximate Analysis of coal and coke

4. To find the Flash and Fire points of fuel oil by "PENSKY MARTINS" open and closed cup apparatus.

5. To find the viscosity of lubricant oil by using Red-wood-I Viscometer

6. To find the viscosity of lubricant oil by using Red-wood-II Viscometer

7. To find the viscosity of lubricant oil by using Saybolt Viscometer

8. To determine the effect of temperature on Kinematic Viscosity of glycerine

**Equipment:**

1. Muffle Furnaces $1000^0$C – 2 No's
2. Muffle Furnaces $300^0$C – 2 No's
3. Muffle Furnaces $120^0$C – 1 No's
4. Pensky-Martins Apparatus
5. Different grades of coal, Kbr press and Bomb calorimeter
6. Redwood viscometer

*(Assessment: The student's performance should be evaluated at the end of each class based on the following parameters:*

*Parameters-I.*

*1.observation book,*
*2.Record.*
*3.Conduct of the experiment successfully*
*4.Interpretation of the data*
*5.Drawing the graphs where ever necessary*
*6.Viva voce.*

*Parameters-II.*

*At the end of each cycle of experiments internal exams should be conducted in addition tothe end examination)*

| II B.Tech II-Semester | HEAT TREATMENT LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

*(Learning objective: Design the sequence of operations in a logical order. The relevant tabular formsare to be prepared. Experiments are to be conducted taking the necessary precautions. The data should be recorded and the results need to be interpreted using the necessary mathematical expressions. The graphs are to be drawn where ever required and the appropriate conclusions shouldbe presented.)*

**List of Experiments:**

1. Annealing of medium carbon steel and observation of microstructure.
2. Normalizing of medium carbon steel and observation of microstructure.
3. Hardening of medium carbon steel and observation of microstructure.
4. Study of tempering characteristics of water quenched steel.
5. Study of age hardening phenomena in duralumin.
6. Spheroidizing of given high carbon steel.
7. Determination of hardenability of medium carbon steel by Jominy end Quench Test.
8. To conduct Re-crystallization studies on cold-worked copper.

**Equipment:**

1. Muffle Furnaces $1000^0$C – 2 No's
2. Muffle Furnaces $300^0$C – 2 No's
3. Muffle Furnaces $120^0$C – 1 No's
4. Hardenability Apparatus
5. Optical Microscopes
6. Vickers Hardness Tester

*(Assessment: The student's performance should be evaluated at the end of each class based on thefollowing parameters:*

*Parameters-I.*

1. *observation book,*
2. *Record.*
3. *Conduct of the experiment successfully*
4. *Interpretation of the data*
5. *Drawing the graphs where ever necessary*
6. *Viva-voce.*

*Parameters-II.*

1. *At the end of each cycle of experiments internal exams should be conducted in addition tothe end examination)*

| II B.Tech II-Semester | CORROSION ENGINEERING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**(Course objective:** This lab course is designed to conduct the experiments on electro deposition, verification of Faraday's laws and evaluation of factors affecting on corrosion)

**List of experiments:**

1. Study the effect of concentration and temperature on conductivity of an aqueous electrolyte(NaCl)
2. Verification of Faraday's laws
3. Potentio dynamic polarization analysis
4. Impedance analysis.
5. Electroplating of copper/ nickel/chromium
6. To anodise the given aluminum sample and observation of microstructure
7. To understand the principles in galvanic cell corrosion using "Ferroxyl" indicating test solution.
8. To analyze the stress corrosion behavior of steel
9. To study the inter granular corrosion of Austenitic stainless steels
10. To conduct electro polishing of stainless steel using Nitric acid batch

**List of equipment:**

1.Potentio dynamic polarization unit
2.Stress corrosion analysis unit
3.Rectifier
4.Ammeters
5.Rheostats
6.D C Regulated Power Supply instrument
7. Electro polishing Equipment
8. Multimeters
9. Conductometers
10. Digital weighing balance

*Assessment: The student's performance should be evaluated at the end of each class based on the following parameters:*

*Parameters-I.*

1. *observation book,*
2. *Record.*
3. *Conduct of the experiment successfully*
4. *Interpretation of the data*
5. *Drawing the graphs where ever necessary*
6. *Viva-voce.*

*Paraneters-II.*

*At the end of each cycle of experiments internal exams should be conducted in addition to the end examination)*

| II Year-II Semester | SOFT SKILLS (Common to ME, ECE, MET) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 2 |

**Course Objectives:**

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To enhance healthy relationship and understanding within and outside an organization
- To function effectively with heterogeneous teams

**Course Outcomes**

- List out various elements of soft skills (L1, L2)
- Describe methods for building professional image (L1, L2)
- Apply critical thinking skills in problem solving (L3)
- Analyse the needs of an individual and team for well-being (L4)
- Assess the situation and take necessary decisions (L5)
- Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being (L6)

**UNIT I Soft Skills & Communication Skills 10h**

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

**Activities:**

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

**UNIT II Critical Thinking 8h**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection

**Activities:**

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

**UNIT III Problem Solving & Decision Making 10h**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

**Activities:**

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

**UNIT IV Emotional Intelligence & Stress Management 10h**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

**Activities:**

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

**UNIT V Corporate Etiquette 10h**

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges

**Activities**

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

**Prescribed Books:**

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

Reference Books

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

**Online Learning Resources:**

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

| II B.Tech II-Semester | DESIGN THINKING & INNOVATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 2 | 2 |

**Course Objectives:**

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

**UNIT – I Introduction to Design Thinking**

Introduction to elements and principles of Design, basics of design - dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

**UNIT - II Design Thinking Process**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

**UNIT - III Innovation**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

**UNIT - IV Product Design**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

**Activity:** Importance of modeling, how to set specifications, Explaining their own product design.

**UNIT – V Design Thinking in Business Processes**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

**Activity:** How to market our own product, about maintenance, Reliability and plan for startup.

**Textbooks:**

1. Change by design, Tim Brown, Harper Bollins (2009).
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.