JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR.

COLLEGE OF ENGINEERING (AUTONOMOUS)
ANANTHAPURAMU – 515002 (A.P) INDIA

B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

CHEMICAL ENGINEERING

I YEAR COURSE STRUCTURE AND SYLLABUS

B.TECH.-CHEMICAL ENGINEERING - COURSE STRUCTURE & SYLLABUS – R23
(Applicable from the academic year 2023-24 onwards)

INDUCTION PROGRAMME

S. No.	Course Name	Category	L-T-P-C
1	Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches --career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch—corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills—focus on Listening, Speaking, Reading ,Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

B. Tech. – I Year I Semester (Chemical Engineering)

S. No.	Subject Code	Subject	L/D	T	P	Credits
1	23A15201	Engineering Physics Common to CIVIL, MECH, CHEM	3	0	0	3
2	23A15101	Linear Algebra & Calculus Common to All Branches	3	0	0	3
3	23A12401	Basic Electrical and Electronics Engineering Common to CIVIL, MECH, CHEM	3	0	0	3
4	23A10301	Engineering Graphics Common to CIVIL, MECH, CHEM	1	0	4	3
5	23A10501	Introduction to Programming Common to All Branches	3	0	0	3
6	23A10503	IT Work Shop Common to CIVIL, MECH, CHEM	0	0	2	1
7	23A15202	Engineering Physics Lab Common to CIVIL, MECH, CHEM	0	0	2	1
8	23A12402	Electrical and Electronics Engineering Work Shop Common to CIVIL, MECH, CHEM	0	0	3	1.5
9	23A10502	Computer Programming Lab Common to All Branches	0	0	3	1.5
10	23A15902	NSS/NCC /SCOUTS and Guides/ Community Service Common to CIVIL, MECH, CHE)	-	-	1	0.5
		Total	13	0	15	20.5

B. Tech. – I Year II Semester

S. No.	Subject Code	Subject	L/D	T	P	Credits
1	23A25501	Communicative English Common to CE, ME, CHEM	2	0	0	2
2	23A25301	Engineering Chemistry Common to CE, ME, CHEM	3	0	0	3
3	23A25101	Differential Equations and Vector Calculus (Common to All Branches)	3	0	0	3
4	23A21301	Basic Civil and Mechanical Engineering Common to CE, ME, CHEM	3	0	0	3
5	23A20801	Introduction to Chemical Engineering	3	0	0	3
6	23A25502	Communicative English Lab Common to CE, ME, CHEM	0	0	2	1
7	23A25302	Engineering Chemistry Lab Common to CE, ME, CHEM	0	0	2	1
8	23A20301	Engineering Workshop Common to CE, ME, CHEM	0	0	3	1.5
9	23A20802	Elements of Chemical Engineering Lab	0	0	3	1.5
10	23A25901	Health and Wellness, Yoga and Sports Common to CE, ME, CHEM	-	-	1	0.5
		Total	14	0	11	19.5

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B. Tech. – I Year I Semester
(Common to Civil, Mechanical &Chemical Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A15201	**Engineering Physics**	3	0	0	3

PREAMBLE

There has been an exponential growth of knowledge in the recent past opening up new areas and challenges in the understanding of basic laws of nature. This helped to the discovery of new phenomena in macro, micro and nano scale device technologies. The laws of physics play a key role in the development of science, engineering and technology. Sound knowledge of physical principles is of paramount importance in understanding new discoveries, recent trends and latest developments in the field of engineering.

To keep in pace with the recent scientific advancements in the areas of emerging technologies, the syllabi has been thoroughly revised keeping in view of the basic needs of all 0branches of Engineering by including the topics like Physical Optics, Dielectric and Magnetic materials, Crystallography and X-ray Diffraction, Quantum Mechanics ,Free Electron Theory, Semiconductors and superconductors.

	COURSEOBJECTIVES
1	Bridging the gap between the Physics in school at 10+2 level 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's law – Learning the structural analysis through X-ray diffraction techniques.
4	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.
5	To Understand the Physics of Semiconductors and their working mechanism, Concepts utilization of transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.
6.	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging microdevices.

COURSE OUTCOMES	
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	**Interpret** various crystal systems (L2) and **analyze** the characterization of materials by XRD(L4). **Identify** the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique (L3). **Analysis** of structure of the crystals by Laue's method (L2).
CO3	**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).
CO4	**Classify** the crystalline solids (L2). **Outline** the properties of charge carriers in semiconductors(L2). **Identify** the type of semiconductor using Hall effect (L2). **Classify** superconductors based on Meissner's effect (L2). **Explain** Meissner's effect, BCS theory & Josephson effect in superconductors(L2)**.**
CO5	**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 (L2).

Unit- I: Wave Optics (12hrs)

1. **Interference**- Principle of superposition – Interference of light – Conditions for sustained interference – Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.
2. **Diffraction**- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).
3. **Polarization**- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism-Halfwave and Quarter wave plates.

Unit II: Crystallography and X-ray diffraction (8hrs)

1. **Crystallography**: Space lattice, Basis, Unit Cell and lattice parameters – Crystal systems Bravais Lattices — Coordination number - Packing fraction of SC, BCC & FCC - Miller indices – Separation between successive (h kl) planes.
2. **X-ray diffraction:** Bragg's law - X-ray Diffractometer–Crystal structure determination by Laue's method.

Unit- III: Quantum Mechanics and Free Electron Theory (9hrs)

1. **Quantum Mechanics**: Dual nature of matter – Heisenberg's Uncertainty Principle - Schrodinger's time independent and dependent wave equation – Significance and properties of wave function – Particle in a one-dimensional infinite potential well.
2. **Free Electron Theory**-Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Fermi – Dirac distribution – Fermi energy – Failures of free electron theory.

Unit– IV: Semiconductors and Superconductors (8hrs)

1. **Semiconductors:** Formation of energy bands – classification of crystalline solids -Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.
2. **Superconductors**: Introduction – Properties of superconductors – Meissner effect– Type I and Type II superconductors – AC and DC Josephson effects – BCS theory (qualitative treatment)–High Tc superconductors – Applications of superconductors.

Unit–V: Dielectric and Magnetic Materials (8hrs)

1. **Dielectric Materials**- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations - Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) -Lorentz field – Clausius – Mossotti equation – Dielectric loss.
2. **Magnetic Materials** – Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Atomic origin of magnetism – Classification of magnetic materials: Día, Para, Ferro, Ferri & Anti ferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis –Soft and Hard magnetic materials.

Textbooks:
1. Engineering Physics by M.N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy S. Chand Publications, 11th Edition 2019.
2. Engineering Physics" by D. K. Bhattacharya and Poonam Tandon, Oxford press (2018).

Reference Books:
1. "Engineering Physics"-B. K. Pandey and S. Chaturvedi, Cengage Learning.
2. "Fundamentals of Physics"-Halliday ,Resnick and Walker ,John Wiley & Sons.
3. "Fundamentals of Physics with Applications", Arthurs Amarjit Schaum Series.
4. "Engineering Physics"-Shatendra Sharma, Jyotsna Sharma, Pearson Education,2018.
5. "Engineering Physics"-Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
6. "Semiconductor physics and devices: Basic principle"-A. Donald, Neamen ,Mc Graw Hill.
7. "Solid state physics"–A.J. Dekker, Pan Macmillan publishers
8. "Introduction to Solid State Physics"-Charles Kittel, Wiley

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		1								
CO2	3	3	2	1								
CO3	3	2										
CO4	3	3	3	2	1							
CO5	3	3	2	2	1							

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B. Tech. – I Year I Semester
(Common to All branches of Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A15101	**Linear Algebra & Calculus**	3	0	0	3

Course Objectives: To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real - world problems and their applications.

Cour0se Outcomes: At the end of the course, the student will be able to

CO1: Develop and use of matrix algebra techniques that are needed by engineers for practical applications.

CO2: Utilize mean value theorems to real life problems.

CO3: Familiarize with functions of several variables which is useful in optimization.

CO4: Learn important tools of calculus in higher dimensions.

CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

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, consistency of linear system of equations Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II: Eigen values, Eigenvectors 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 similarity transformation, Lagrange's reduction and Orthogonal Transformation, types of complex matrices (Hermitian skew Hermitian & unitary)

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. Radius of curvature, centre of curvature and circle of curvature.

UNIT IV: Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers, Differentiation under the integral sign (Leibnitz's rule)

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) Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2) Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1) Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2) Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3) Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4) Advanced Engineering Mathematics, Michael Greenberg, Pearson publishers, 9th edition
5) Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021).

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Subject Code	Title of the Subject	L	T	P	C
23A12401	**Basic Electrical & Electronics Engineering**	3	0	0	3

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:
CO1: Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments (L1)
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 (L2)
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 (L3)
CO4: Analyse different electrical circuits, performance of machines and measuring instruments (L4)
CO5: Evaluate different circuit configurations, Machine performance and Power systems operation (L5)

Syllabus:

UNIT I: DC & AC CIRCUITS
1. **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.
2. **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, Analysis of R-L, R-C, R-L-C Series circuits, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II: MACHINES AND MEASURING INSTRUMENTS
1. **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.

2. **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
1. **Energy Resources:** Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.
2. **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.
3. **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.

Learning Resources:

Textbooks:
1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
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

Reference Books:
1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S. Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nag Sarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, 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 semiconductor devices and its applications, principles of digital electronics.
Course Objectives: At the end of the course, the student will be able to
CO1: Understand the principle of working of diodes, transistors and their characteristics.
CO2: Understand the fundamental concepts of various semiconductor devices in electronic circuits and instruments.
CO3: Apply the concepts of diodes in rectifiers and regulated power supplies
CO4: Explain the concepts of various number systems and the functionality of logic gates with Boolean functions.
CO5: Understand the simple combinational circuits and sequential circuits.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1			2	1	2				2
CO2	3	2	2	1		3	2				1	2
CO3	2	1	2			2	1					2
CO4	3	1	1			2	1	2				2
CO5	2	1	2			2	1					2

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 V-I Characteristics, Elementary Treatment of Small Signal CE Amplifier.

UNIT II: BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

1. **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.
2. **Amplifiers:** Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response.
3. **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. Santi ram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill, 2009

Reference Books:

1. R. L. Boyles tad& Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

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B. Tech. – I Year I Semester
(Common to Civil, Mechanical& Chemical Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A10301	**Engineering Graphics**	3	0	0	3

Course Objectives:
• 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
• TodeveloptheimaginativeskillsofthestudentsrequiredtounderstandSectionofsolidsandDevelopment of surfaces.
• To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.
Course Outcomes:
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:
1. **Introduction:** Lines, Lettering and Dimensioning, Geometrical Constructions and constructing regular polygons by general methods.
2. **Curves:** construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.
3 **Scales:** Plain scales, diagonal scales and vernier scales.

UNIT II:
1. **Orthographic Projections:** Reference plane, importance of reference lines or Plane, Projections of a point situated in anyone of the four quadrants.
2. **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.

3. **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 there refence planes

UNIT III:
Projections of Solids: Types of solids: Polyhedral 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 there reference planes ,Projection of Solids with axis inclined to one reference plane and parallel to another plane.

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

UNITV:
1. **Conversion of Views: conversion** of isometric views to orthographic views ; Conversion of orthographic views to isometric views.
2. **Computer graphics**: Creating 2D&3D drawings of objects including PCB and Transformations using AutoCAD (*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 Mc Graw Hill,2013.
2. Engineering Drawing, M. B. Shahand B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata Mc Graw Hill,2017.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	☐				☐						☐	
CO2						☐						
CO3						☐						
CO4		☐										
CO5						☐						

B. Tech. – I Year I Semester
(Common to All branches of Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A10501	**Introduction to Programming**	3	0	0	3

Course Objectives:
• To introduce students to the fundamentals of computer programming.
• To provide hands-on experience with coding and debugging.
• To foster logical thinking and problem-solving skills using programming.
• To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
• To encourage collaborative learning and teamwork in coding projects.
Course Outcomes: A student after completion of the course will be able to
CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2: Analyse a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language.
CO4: Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	1	1	1									1	1	1	
CO2	1	2	1										1	1	
CO3	2	2	1										1	1	
CO4	2	1	1										1	1	
CO5	2	2	1										1	1	

UNITI: Introduction to Programming and Problem Solving
History of Computers, Basic organization of a computer: ALU, input-output units, memory, program
counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts
(Using Día Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types,
Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.
Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving
strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNITII: Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while)
Break and continue.

UNITIII: Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to
Strings.

UNIT IV: Pointers & User Defined Data types

Pointers, dereferencing and address operators, pointer and address arithmetic, Dynamic memory
allocation, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT V: Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and
Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope
and Lifetime of Variables, Command line arguments,
Basics of File Handling: why files, file opening and closing a data file, reading and
writing a data file, processing data files.

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

Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-
   Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balaguru samy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

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B. Tech. – I Year I Semester
(Common to Civil, Mechanical &Chemical Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A10503	IT Work Shop	0	0	2	1

Course Objectives:
To introduce the internal parts of a computer, peripherals ,I/Oports, connecting cables
TodemonstrateconfiguringthesystemasDualbootbothWindowsandotherOperatingSystemsViz. Linux, BOSS
To teach basic command line interface commands on Linux.
To teach the usage of Internet for productivity and self-paced life-long learning
To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.
Course Outcomes:
CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies. CO3: Safeguard computer systems from viruses/worms.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1												
CO2															
CO3		1												2	
CO4			2		2									2	
CO5	1													2	

PC Hardware & Software Installation:

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

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through thevideowhichshowstheprocessofassemblingaPC.AvideowouldbegivenaspartofthecourseContent.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up 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 both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMW are) with both 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 get connected 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. If there are no internet connectivity preparations need to bema Deby the instructors to simulate the WWW on the LAN.

Task 2: 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 - is 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 the search 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 would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1: Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) officer equivalent (FOSS) tool word: Importance of LaTeX 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.

Task 2: 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 option in both 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 Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office 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, overview of tool bars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA-. Features to be covered: -Cell Referencing, Formulae in excel –average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/V LOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

POWERPOINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic 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.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc.), and Inserting– Background, textures, Design Templates, Hidden slides.

AI TOOLS –Chat GPT

Task1: Prompt Engineering: Experiment with different types of 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 are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or adscription of a scene, and let the model generate the rest of the content. This can be a fun way to brains term 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."

Task 3: 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?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dreamtech,2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dreamtech,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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS) ANANTHAPURAMU– 515002 (A.P)
INDIA
B. Tech. – I Year I Semester
(Common to Civil, Mechanical &Chemical Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A15202	**Engineering Physics Lab**	0	0	2	1

Course Objectives:
Understands the concepts of interference, diffraction and their applications.
Understand the role of optical fibre parameters in communication.
Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
Illustrates the magnetic and dielectric materials applications.
Apply the principles of semiconductors in various electronic devices.

(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'srings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Determination of dispersive power of prism.
4. Verification of Brewster's law
5. Determination of the resistivity of semiconductor by four probe methods.
6. Determination of energy gap of a semiconductor using p-n junction diode.
7. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
8. Determinationofdielectricconstantusingcharginganddischargingmethod.
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method.
11. Determination of wavelength of Laser light using diffraction grating.
12. Estimation of Planck's constant using photo electric effect.
13. Determination of temperature coefficients of thermistor.
14. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
15. DeterminationofrigiditymodulusofthematerialofthegivenwireusingTorsionalpendulum.

16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. DeterminationofFrequencyofelectricallymaintainedtuningforkbyMelde'sexperiment.

Course Outcomes: The students will be able to
Operate optical instruments like microscope and spectrometer (L2)
Estimate the wavelength of different colours using diffraction grating and resolving power (L2)
Plot the intensity of the magnetic field of circular coil carrying current with distance (L3)
Determine the resistivity of the given semiconductor using four probe methods (L3)
Identify the type of semiconductor i.e., n-type or p-type using hall effect(L3)
Calculate the band gap of a given semiconductor(L3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2								
CO2	3	2		2								
CO3	3	1		2								
CO4	3	3		3	2							
CO5	3											

References: 1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- SChandPublishers,2017.

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

B. Tech. – I Year I Semester
(Common to Civil, Mechanical &Chemical Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A12402	**Electrical and Electronics Engineering Work Shop**	0	0	3	1.5

PART A: ELECTRICAL ENGINEERING LAB

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 (L2)
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 (L3)
CO3: Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor (L3)
CO4: Analyse various characteristics of electrical circuits, electrical machines and measuring instruments (L4)
CO5: Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring (L5)

List of Experiments:
1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Learning Resources:
Reference books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
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

PART B: 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 and 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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1	2	1					1	
CO2	2		2	2	1				1		2	
CO3	2	2		3	1						1	
CO4		2	1	2	2	1						

List of Experiments:

1. Determine and Demonstrate V-I characteristics of PN Junction diode:
   (a) Forward bias (b) Reverse bias.
2. Determine and Demonstrate V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Determine and Demonstrate Input& Output characteristics of BJT in CE & 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, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

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

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

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INDIA
B. Tech. – I Year I Semester
(Common to All Branches)

Subject Code	Title of the Subject	L	T	P	C
23A10502	**Computer Programming Lab**	0	0	3	1.5

Course Objectives:
The course aims to give students hands – on experience and train them on the concepts of the
C- programming language.
Course Outcomes:
CO1: Read, understand, and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs
like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays,
functions, basic concepts of pointers in C.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1									1	1	1	
CO2	1	2	1										1	1	
CO3	2	2	1										1	1	
CO4	2	1	1										1	1	
CO5	2	2	1										1	1	

UNITI:
WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing
the first program.
Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with 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 ()

WEEK 2

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

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 2: Converting algorithms/flow charts into C Source code.
Developing the algorithms / flowcharts 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

WEEK 3

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 travelled by an object

UNIT II:

WEEK 4

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' 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.   A+++B---A
           d.   J= (i++) + (++i)
   ii) Find the maximum of three numbers using 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-else if*-else, switch and nested-if including in what scenario each one of them 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 of four 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 switch case.
  v)   Write a C program to find the given year is a leap year or not.

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 to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series
  i)   Find the factorial of given number using any loop.
  ii) Find the given number is a prime or not.
  iii) Compute sine and cos series
  iv) Checking a number palindrome
  v)   Construct a pyramid of numbers.

UNIT III:

WEEK 7:

Objective: Explore the full scope of 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 integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search
  i)   Find the min and max of a 1-D integer array.
  ii) Perform linear search on1D array.
  iii) The reverse of a 1D integer array
  iv) Find 2's complement of the given binary number.
  v)   Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string 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: 2 D 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 without built-in functions

v) Reverse a 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
Lab 9: Pointers and structures, memory dereference.
   i) Write a C program to find the sum of a 1D 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 ()

WEEK 10:

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

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10: Bitfields, 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 bitfields.
   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:

Tutorial 11: Functions, call by value, scope and extent,
Lab 11: 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.

WEEK 13:

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

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers
Lab 13: 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.

WEEK14:

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:

Tutorial 14: File handling
Lab 14: 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.

Textbooks:
1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, 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, CENGAGE

B. Tech. – I Year I Semester

(Common to Civil, Mechanical &Chemical Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A15902	**NSS/NCC/Scouts & Guides / Community Service**	0	0	1	0.5

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 analysing social problems

CO4: Determine to extend their help for the fellow beings and down trodden people

CO5: Develop leadership skills and civic responsibilities.

SYLLABUS

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 orientation 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 talents how 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) Organizing 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 Campaign 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 PopulationEducation.

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 (ISBN 978-81-952368-8-6)

2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi

3. Davis M. L. and Cornwell D. A., *Introduction to Environmental Engineering*,McGraw Hill, New York 4/e 2008

4. Masters G. M., Joseph K. and Nagendran R. *Introduction to EnvironmentalEngineering and Science*, Pearson Education, New Delhi. 2/e 2007

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 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, totaling to 90 marks.

☐ A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

vi) .

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS)ANANTHAPURAMU – 515 002 (A.P) INDIA

I B. TECH (R23) – II SEMESTER
(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A25501	COMMUNICATIVE ENGLISH	2	0	0	2

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

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

CO2: Apply grammatical structures to formulate sentences and correct word forms.

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.

CO4: Evaluate reading/listening texts and to write summaries based on global **c**omprehension of these texts.

CO5: Create a coherent paragraph, essay, and resume.

SYLLABUS
UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening:	Identifying the topic, the context and specific pieces of information by listeningto 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 ofinformation.
Writing:	Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts ofSentences.
Grammar:	Parts of Speech, Basic Sentence Structures-Forming questions
Vocabulary:	Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II: Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting
                 ideas afterlistening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed
                 by shortstructuredtalks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help
                 to linkthe ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)

UNIT III

Lesson: BIOGRAPHY: Elon Musk

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: Reading a text in detail by making basic inferences - ecognizing and
                 interpreting specific context clues; strategies to use text clues for
                 comprehension.
Writing: Summarizing, Note-making, paraphrasing**Grammar:** Verbs   -   tenses;
subject-verb agreement; **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 andinformal) - 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: Academic Writing (Letter Writing, Letter writing, creative writing, critical thinking)
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 andusage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Textbooks:
1.   Pathfinder: *Communicative English for Undergraduate Students*, 1ˢᵗ
        Edition,OrientBlack Swan, 2023 (Units 1,2 & 3)
2.   *Empowering with Language* 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 UniversityPress, 2019.
4.   Lewis, Norman. *Word Power Made Easy- The Complete Handbook for Building aSuperior 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

I B. TECH (R23) – II SEMESTER

(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A25301	**ENGINEERING CHEMISTRY**	**3**	**0**	**0**	**3**

Course Objectives:

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

	COURSE OUTCOMES
CO1	List the differences between temporary and permanent hardness of water, Explain the principles of reverse osmosis and electro dialysis. Compare quality of drinking water with BIS and WHO standards. Illustrate problems associated with hard water - scale and sludge. Explain the working principles of different Industrial water treatment processes
CO2	Apply Nernst equation for calculating electrode and cell potentials, Apply Pilling Bed worth rule for corrosion and corrosion prevention, Demonstrate the corrosion prevention methods and factors affecting corrosion, Compare different batteries and their applications
CO3	Explain different types of polymers and their applications, Solve the numerical problems based on Calorific value, select suitable fuels for IC engines, Explain calorific values, octane number, refining of petroleum and cracking of oils
CO4	Explain the constituents of Composites and its classification, Identify the factors affecting the refractory material, Illustrate the functions and properties of lubricants, demonstrate the phases and reactivity of concrete formation, Identify the constituents of Portland cement, Enumerate the reactions at setting and hardening of the cement
CO5	Summarize the concepts of colloids, micelle and nanomaterial's, Explain the synthesis of colloids with examples, Outline the preparation of nanomaterial's and metal oxides Identify the application of colloids and nanomaterial's in medicine, sensors and catalysis

Mapping between Course Outcomes and Programme Outcomes

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

UNIT I Water Technology (8 hrs)

Soft and hard water, 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 electro dialysis.

Learning outcomes:
The student will be able to
- **list** the differences between temporary and permanent hardness of water (L1)
- **Explain** the principles of reverse osmosis and electro dialysis. (L2)
- **Compare** quality of drinking water with BIS and WHO standards. (L2)
- **Illustrate** problems associated with hard water - scale and sludge. (L2)
- **explain** the working principles of different Industrial water treatment processes (L2)

UNIT II Electrochemistry and Applications (10 hrs)

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

Learning Outcomes:
At the end of this unit, the students will be able to

- **apply** Nernst equation for calculating electrode and cell potentials (L3)
- **apply** Pilling Bed worth rule for corrosion and corrosion prevention (L3)
- **demonstrate** the corrosion prevention methods and factors affecting corrosion (L2)
- **compare** different batteries, Fuel Cells and their applications (L2)

UNIT III Polymers and Fuel Chemistry (10 hrs)

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization, Poly dispersity index (PDI)- significance
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene, PVC Nylon 6, 6 and Bakelite.
Elastomers – Preparation, properties and applications of Buna S, Buna N, 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 bio fuel-bio diesel.

Learning Outcomes:
At the end of this unit, the students will be able to

- **explain** different types of polymers and their applications (L2)
- **Solve** the numerical problems based on Calorific value(L3)
- **Discuss** the different types of Fuels and their applications (L2)
- **explain** calorific values, octane number, refining of petroleum(L2)

UNIT IV Modern Engineering Materials (10 hrs)

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, Flash point, Fire point, Cloud point, saponification and Applications.
Building materials- Portland cement, constituents, Setting and Hardening of cement.

Learning Outcomes:

At the end of this unit, the students will be able to

- **explain** the constituents of Composites and its classification (L2)
- **identify** the factors affecting the refractory material(L3)
- **illustrate** the functions and properties of lubricants (L2)
- **demonstrate** the phases and reactivity of concrete formation (L2)
- **identify** the constituents of Portland cement (L3)
- **enumerate** the reactions at setting and hardening of the cement (L3)

UNIT V Surface Chemistry and Nanomaterials (10 hrs)

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (Braggs Method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterial's by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (no derivation) applications of colloids and nano material's – catalysis, medicine, sensors, etc.

Learning Outcomes:
At the end of this unit, the students will be able to

- **summarize** the concepts of colloids, micelle and nanomaterials (L2)
- **explain** the synthesis of colloids with examples (L2)
- **outline** the preparation of nanomaterials and metal oxides (L2)
- **identify** the application of colloids and nanomaterials in medicine, sensors and catalysis (L2)

Textbooks:

 1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.

 2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

 1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
 2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth- Heineman, 1992.
 3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Learning Outcomes:

 At the end of the course, the students will be able to
 - **demonstrate** the differences between temporary and permanent hardness of water (L2)
 - **explain** the preparation, properties, and applications of thermoplastics &thermos setting, elastomers & conducting polymers. (L2)
 - **explain** calorific values, octane number, refining of petroleum and cracking of oils (L2)
 - **explain** the setting and hardening of cement and concrete phase (L2)
 - **summarize** the concepts of colloids, micelle and nanomaterials (L2).

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I B. TECH (R23) – II SEMESTER

(23A25101) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All Branches of Engineering)

Subject Code	Title of the Subject	L	T	P	C
23A25101	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**	**3**	**0**	**0**	**3**

Course Objectives:

- To enlighten the learners in 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

CO1: Solve the differential equations related to various engineering fields.

CO2: Identify solution methods for partial differential equations that model physical processes.

CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO4: 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: Newton's Law of cooling – Law of natural growth and decay orthogonal Trajectories, Electrical circuits.

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,Equations reducible to Linear Differential equations with constant coefficients (Caushy's equation, Lagendre's equation) 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. Homogeneous Linear Partial differential equations with constant coefficients, Non-linear partial differential equations (Standard forms)

UNIT IV   Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, physical interpretation, examples and 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) physical interpretation and related problems.

Textbooks:

1) Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2) Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1) Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2) Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3) Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4) Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint)

I B. TECH (R23) – II SEMESTER

(23A21301) BASIC CIVIL AND MECHANICAL ENGINEERING
(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A21301	BASIC CIVIL AND MECHANICAL ENGINEERING	3	0	0	3

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, anglesand 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 socialresponsibilities of water conservation will be appreciated.

CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledgeon prefabricated technology.

PART A: BASIC CIVIL ENGINEERING

UNIT I

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 Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II

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

UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development-Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway EngineerigWater Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications-Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

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.
CO4: Describe the working of different power plants.
CO5: Describe the basics of robotics 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, Cengagelearning 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 MPandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.

4. G. Shanmugam and M.S. Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	☐				☐						☐	
CO2	☐						☐				☐	
CO3	☐						☐				☐	
CO4	☐				☐						☐	
CO5	☐										☐	

I B. TECH (R23) – II SEMESTER

(23A20801) INTRODUCTION TO CHEMICAL ENGINEERING

Subject Code	Title of the Subject	L	T	P	C
23A20801	INTRODUCTION TO CHEMICAL ENGINEERING	3	0	0	3

Course Objectives:

1. To teach the importance of Chemical Engineering in industries and everyday life
2. To learn the role of various Unit Operations and Unit Processes in Chemical industries.

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

CO1: Understand the role of Chemical Engineers in everyday life and the importance of Chemical Engineering subject.
CO2: Learn about material & energy balance calculations and fluid flow. CO3:
Understand the concept of heat transfer & thermodynamics.
CO4: Understand the principles of mass transfer
CO5: Learn the importance of mechanical operations and chemical reaction engineering

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	2	3	3	-	1	-	3	1	2	2
CO2	3	2	1	-	-	-	-	-	-	1	-	3	1	2	2
CO3	3	2	1	-	-	-	-	-	-	1	-	3	1	2	2
CO4	3	1	1	-	-	-	-	-	-	1	-	3	1	2	2
CO5	3	2	1	-	-	2	3	3	-	1	-	3	1	2	2

Unit-I

Chemical Engineering Concepts: Chemical Engineering in everyday life, scaling up or down, Understanding the difference between Chemist & Chemical Engineer, versatility of a Chemical Engineer, Applications of Chemical Engineering.

Processes and Process Variables: Unit operations, Unit processes, Batch process, Continuous process, Mass and volume, flow rate, pressure, temperature, chemical composition.
case studies (manufacture of Ammonia, Sulphuric acid & Pencilin)

Unit-II

Introduction to Engineering Calculations: Units and Dimensions, Conversion of units, System of units,force and weight, Numerical calculations and estimation, Dimensional homogeneity and dimensionless quantities, process data representation and analysis.
Fluid Flow: Fluid, nature & types of fluid, Newtonian & Non-Newtonian, Compressible & incompressiblefluids, viscosity, different flow regimes, Flow meters, fluid handling machinery (pumps, fans, blowers)

Unit-III

Introduction to Process Heat Transfer: Historical background and application areas of

heat transfer, physical origin and rate equations for conduction, convection and radiation, concept of thermal resistance,simultaneous heat transfer mechanisms.

Relationship of heat transfer to thermodynamics: Relation to first and second laws of thermodynamics, units and dimensions, analysis of heat transfer problems, relevance of heat transfer in chemical engineering

Unit-IV

Mass transfer: classification of mass transfer operations, molecular diffusion, choice of separation processes, basic principles & applications of absorption, distillation, adsorption, extraction.

Unit-V:

Mechanical operations: principles of Size reduction, types of crushers & grinders, filtration, agitation and mixing.

Overview of Reaction Engineering: Classification of reactions, variables affecting the rate of reaction, concentration & temperature dependency of reaction rate, Kinetics of homogeneous reactions, Types of reactors, and catalysis.

TEXT BOOK:

1. Introduction to Chemical Engineering by S. Pushpavanam, PHI, 2012.

2. Introduction to Chemical Engineering by S. K. Ghosal, S. K. Sanyal and S. Dutta, TMH Publications, 1993.

REFERENCES:

1. Unit operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, McGraw Hill 7th Ed. 2005
2. Incropera's Principles of Heat and Mass Transfer by Incropera, Dewitt, Bergman and Lavine, Global Edition, Wiley India Edition
3. Elementary Principles of Chemical Processes Richard M. Felder and Ronald W.Rousseau, Third Edition, John Wiley & Sons, INC.

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I B. TECH (R23) – II SEMESTER

(23A25502) COMMUNICATIVE ENGLISH LAB
(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A25502	**COMMUNICATIVE ENGLISH LAB**	**0**	**0**	**2**	**1**

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. The students will get trained in the basic communication skills and also make them ready to face job interviews**.**

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis **o**n LSRWskills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for betterlistening and speaking comprehension.

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.CO5: Create

effective resume and prepare themselves to face interviews in future.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules/Syllable division
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP(Statement of Purpose)
7. Group Discussions-Methods & Practice
8. Debates - Methods & Practice
9. PPT Presentations/Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films
- K-Van Solutions

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant : *English Conversation Practice*, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J.Sethi & P.V.Dhamija. *A Course in Phonetics and Spoken English*,(2nd Ed) Kindle, 2013

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

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

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COLLEGE OF ENGINEERING (AUTONOMOUS)ANANTHAPURAMU –515 002 (A.P) INDIA

I B. TECH (R23) – II SEMESTER

(23A25302) ENGINEERING CHEMISTRY LAB
(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A25302	**ENGINEERING CHEMISTRY LAB**	**0**	**0**	**2**	**1**

Course Objectives:

- To verify the fundamental concepts with experiments

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

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer materials.

CO3: Determine the physical properties like surface tension, adsorption and viscosity.

CO4: Estimate the Iron and Calcium in cement.

CO5: Calculate the hardness of water.

Mapping between Course Outcomes and Programme Outcomes

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

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Determination of Hardness of a drinking water sample.
3. Estimation of Dissolved Oxygen by Winkler's method.
4. Determination of Strength of an acid in Pb-Acid battery.
5. Preparation of a polymer (Bakelite).
6. Determination of percentage of Iron in Cement sample by colorimetry.
7. Estimation of Calcium in port land Cement.
8. Preparation of nanomaterials by precipitation method.
9. Adsorption of acetic acid by charcoal.
10. Determination of percentage Moisture content in a coal sample.
11. Determination of Viscosity of lubricating oil by Redwood Viscometer 1.
12. Determination of Viscosity of lubricating oil by Redwood Viscometer 2.
13. Determination of Calorific value of gases by Junker's gas Calorimeter.

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

- **determine** the Strength of solutions, Dissolved oxygen (L3)

- **prepare** advanced polymer materials (L2)

- **determine** the physical properties like surface tension, adsorption and viscosity (L3)

- **estimate** the Iron and Calcium in cement (L3)
- **calculate** the hardness of water (L4)

Reference:

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

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I B. TECH (R23) – II SEMESTER

(23A20301) ENGINEERING WORKSHOP
(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A20301	**ENGINEERING WORKSHOP**	**0**	**0**	**3**	**1.5**

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical housewiring 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: Demonstration and Practice of plumbing and welding.

SYLLABUS

Demonstration: Safety practices and precautions to be observed in workshop.

1. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint   b) Mortise and Tenon joint   c) Corner Dovetail joint or Bridle joint d) Demonstration of Power tools
2. **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
3. **Fitting:** Familiarity with different types of tools used in fitting and do the followingfitting exercises.
   a)   V-fit   b) Dovetail fit   c) Semi-circular fit   d) Bicycle tire puncture and change of two-wheeler tyre
4. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series   b) Two-way switch   c) Godown lighting
      d) Tube light   e) Three phase motor   f) Soldering of wires

5. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
6. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
7. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameter

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. Raghuwanshi, 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.

<u>**Mapping between Course Outcomes and Programme Outcomes**</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					✓	✓	✓		✓			
CO2					✓						✓	✓
CO3						✓					✓	✓
CO4						✓			✓		✓	✓
CO5						✓			✓		✓	✓

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS)ANANTHAPURAMU –515 002 (A.P) INDIA

I B. TECH (R23) – II SEMESTER

(23A20802) ELEMENTS OF CHEMICAL ENGINEERING LAB

Subject Code	Title of the Subject	L	T	P	C
23A20802	ELEMENTS OF CHEMICAL ENGINEERING LAB	0	0	3	1.5

Course Objectives: To get primary understanding on chemical process equipment andinstrumentation for the measurement of various process parameters

Course Outcomes:

CO1: To learn about water analysis
CO2: To understand flow regimes and know about flow meters
CO3: Understand modes of heat transfer and measurement of temperatureCO4: Learn size reduction principles
CO5: Learn mass transfer and reaction engineering principles

Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2	-	2	3	3	1	3	2	-	3	1	3	2
CO2	3	3	1	-	2	-	2	1	3	2	-	3	1	3	2
CO3	3	3	1	-	2	1	-	1	3	2	-	3	1	3	2
CO4	3	3	1	-	2	1	-	1	3	2	-	3	1	3	2
CO5	3	3	1	-	2	1	-	1	3	2	-	3	1	3	2

LIST OF EXPERIMENTS

1. Determination of pH, conductivity & TDS of water sample

2. Preparation of Soap

3. Preparation of solutions with different concentrations

4. Study of flow regimes using Reynold's apparatus

5. Determination of viscosity of an oil

6. Studies on flow measurement using Rotameter

7. Understanding different modes of heat transfer

8. Determination of average particle diameter using standard screens

9. Diffusion of acetone in air

10. Determination of activation energy of a reaction using batch reactor

11. Measurement of temperature using thermometer/thermocouple

12. Determination of humidity of air using wet & dry bulb thermometer.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS)ANANTHAPURAMU –515 002 (A.P) INDIA

I B. TECH (R23) – II SEMESTER

(23A25901) HEALTH AND WELLNESS YOGA AND SPORTS
(Common to CIVIL, MECH & CHEM)

Subject Code	Title of the Subject	L	T	P	C
23A25901	HEALTH AND WELLNESS YOGA AND SPORTS	0	0	1	0.5

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 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

SYLLABUS

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship

betweendiet 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 balanced diet for all age groups

UNIT II

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 Commonwealth games.

Activities:
   i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. - Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory 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 slots in the Timetable 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:
1. Evaluated for a total of 100 marks.
2. 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 to90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

B.Tech – II Year I Semester (R23) Course Structure

S. No.	Course Code	Title	L/D	T	P	Credits
1	23A35106	Numerical Methods and Laplace Transforms	3	0	0	3
2	23A39901	Universal Human Values – Understanding Harmony and Ethical Human Conduct (Common to CE,ME,CHEM)	2	1	0	3
3	23A35301	Organic Chemistry	3	0	0	3
4	23A30801	Chemical Process Calculations	3	0	0	3
5	23A30802	Momentum Transfer	3	0	0	3
6	23A30803	Mechanical Operations	3	0	0	3
7	23A35302	Organic Chemistry lab	0	0	2	1
8	23A30804	Mechanical Operations lab	0	0	3	1.5
9	23A30502	Python programming (Skill Enhancement Course) (Common toME, ECE, CSE,Chem)	0	1	2	2
10	23A39902	Environmental Science (Audit Course) (Common to All Branches)	2	0	0	-
		Total	**19**	**2**	**7**	**22.5**

B.Tech – II Year II Semester (R23) Course Structure

S. No.	Category	Title	L	T	P	Credits
1	23A45401a 23A45401b 23A45401c	Managerial Economics and Financial Analysis Organizational Behavior Business Environment (Common to CE,CHEM)	2	0	0	2
2	23A40801	Chemical Engineering Thermodynamics-I	3	0	0	3
3	23A40802	Process Heat Transfer	3	0	0	3
4	23A40803	Instrumentation & Process Control	3	0	0	3
5	23A40804	Momentum Transfer Lab	0	0	2	1.0
6	23A40805	Process Heat Transfer lab	0	0	2	1.0
7	23A40806	Instrumentation & Process Control lab	0	0	3	1.5
8	23A45501	Soft Skills (Skill Oriented Course) (Common to CE,ME, ECE,CHEM)	0	1	2	2
9	23A49901	Design Thinking & Innovation (Common to All Branches)	1	0	2	2
		Total	**12**	**1**	**11**	**18.5**
23A49903-Mandatory Community Service Project Internship of **08 weeks** duration during summer vacation						

Department of Chemical Engineering
II B.Tech I Semester (R23)

Subject Code	Title of the Subject	L	T	P	C
23A35106	**Numerical Methods & Laplace Transforms**	**3**	**0**	**0**	**3**

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Apply numerical methods to solve algebraic and transcendental equations	L2, L3
CO2	Derive interpolating polynomials using interpolation formulae	L3, L5
CO3	Solve differential and integral equations numerically	L3
CO4	Understand the use of Laplace transform in system modeling, digital signal processing, process control, solving Boundary Value Problems.	L2, L3
CO5	Apply Fourier series and Fourier transform in communication theory and signal analysis, image processing and filters, data processing and analysis, solving partial differential equations for problems on gravity.	L3,L5

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

1-Slightly,   2-Moderately, 3-Substantially.

UNIT I :   Solution of Algebraic & Transcendental Equations

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method System of Algebraic equations: Gauss Elimination, Jacoby and Gauss Siedal method.

UNIT II   Interpolation

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

UNIT III Solution of Initial value problems to Ordinary differential equations Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

UNIT IV Laplace Transforms

Introduction- Definition – conditions for existence – transforms of elementary functions - properties of Laplace transforms- Laplace transform of Periodic function - special functions –derivatives- integrals – multiplication by t – division by t – Evaluation of integrals by Laplace transforms

UNIT V Inverse Laplace transforms

Inverse Laplace transform-Elementary functions – Method of Partial fractions - Convolution theorem-Applications to ordinary differential equations.

Textbooks:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.

2. B. S. Grewal , Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition.

2. R.K. Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science InternationalLtd.,2021 5th Edition(9th reprint).

3. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)

4. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. http://nptel.ac.in/courses/111105090

Subject Code	Title of the Subject	L	T	P	C
23A39901	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT (Common to CE, ME, CHEM)	**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 behavior and mutually enriching interaction with Nature.

COURSE OUTCOMES: At the end of the course, students will be able to	**Blooms Level**
CO1	Define the terms like Natural Acceptance, Happiness and Prosperity	L1, L2
CO2	Identify one's self, and one's surroundings (family, society nature)	L1, L2
CO3	Apply what they have learnt to their own self in different day-to-day settings in real life	L3
CO4	Relate human values with human relationship and human society.	L4
CO5	Justify the need for universal human values and harmonious existence	L5
CO6	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 Beautifu*l - 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%202023.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

Subject Code	Title of the Subject	L	T	P	C
23A35301	**Organic Chemistry**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:
This course aims to provide the student to:
- Understand the Mechanism of organic chemical reaction is essential to synthesis new organic compounds in drug and pharmaceutical industries. In order to study their kinetics of reactions to regulate the process for optimization of production of drugs and pharmaceutical, the principles of organic chemistry are essential.
- Explain the electronic behaviour of organic molecules, their special and geometrical arrangement of functional groups.
- Conduct the most common reactions like addition, substitution, oxidation, reduction etc., on large scale.
- Carry out processes industrially for the manufacture of drugs and pharmaceuticals, Comprehension on basic reactions, reagents and their applications is needed.

COURSE OUTCOMES:
After completion of the course student shall be able to :
- CO1: Illustrate the electronic behaviour of organic molecules, their special and geometrical arrangement of functional groups. L3
- CO2: Conduct the most common reactions like addition, substitution, oxidation, reduction etc., on large scale.L3
- CO3:Analyze the mechanism of organic chemical reaction which are essential to synthesis new organic compounds in drug and pharmaceutical industries. L4
- CO4:Explain the reaction mechanisms for different types of reactions. L2
- CO5:Carry out a chemical processes industrially for the manufacture of drugs and pharmaceuticals, Comprehension on basic reactions, reagents and their applications.L3

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2				2					1	
CO2	3	2				2					1	
CO3	3	2				2					1	
CO4	3	2				2					1	
CO5	3	2				2					1	

UNIT I: Electronic effects   (10h)
Polar effects – Inductive effect, electrometic effect, resonance (mesomeric), hyper conjugation, steric hindrance and tautomerism. Energy, structural and electronic criteria for aromaticity, aromaticity in benzenoid, non-benzenoid compounds and anti-aromaticity.

UNIT II: Isomerism   (12h)
Stereo isomerism; Optical isomerism; Symmetry and chirality; Optical isomerism in lactic acid and tartaric acid; RS Nomenclature, Sequence rules; Enantiomers, diastereomers; Geometrical Isomerism; E-Z system of nomenclature, conformational analysis of Propane, n-butane and monosubstituted cyclohexane with energy diagram.

UNIT III: Reagents of Synthetic importance (12h)

Preparation and applications : a .Aluminum Chloride, b.N- Bromosuccinamide (NBS), c.Diazomethane, d.Dicyclohexylcarbodiimide(DCC), e.Potassiumtertiarybutoxide

f.Grignard reagent(R-Mg-X) and g.1,4-Diazabicyclo[2.2.2]octane(DABCO)

UNIT IV: Basic Reaction mechanism and Name Reactions (10h)

i) Introduction of reaction mechanism: First order Nucleophillic Substitution reaction(SN^1) ,Second order Nucleophillic substitution Reaction(SN^2) – Reaction mechanism of Haloalkanes into alcohol

ii) Synthesis, Reaction mechanism and applications of:

a) Friedel-Craft reaction b) Riemer- Teimenn Reaction c) Beckmann rearrangement.

d) Aldol condensation e) Perkin Reaction f) Benzoin condensation

UNIT V: Reactions with mechanism in Organic Synthesis (12h)

i) Protection of functional groups: Hydroxyl, Carbonyl and amino groups

ii) Oxidation: Oxidation of alcohols and carbonyl compounds with Chromium oxide, lithium aluminium oxide.

iii) Reduction: Reduction of double and triple bonds and carbonyl compounds with lithium aluminium hydride, sodium borohydirde.

Text Books:

1. Text book of Organic Chemistry – 6th edition, Morrsion and Boyd Pearson Education,2018.
2. Organic Reaction Mechanisms by – 4th edition, V.K. Ahulwalia and R. Karashar, Narosa
3. Publishing House,2011.
4. Vogels Text Book of Qualitative Organic Analysis. 6thedition, Pearson Education,2023.
5. Stereochemistry of Organic Compounds, D. Nasipuri, 2nd edition (New Age International), 2018

References:

1. Reaction mechanism – Peter Sykes., Pearson, 6th Edition, 2024
2. Text book of Organic Chemistry – P.L. Soni., Chand Company, 29th edition, 2020
3. Organic Chemistry Vol- I-IL. Finar, Pearson, 6th edition, 2002.
4. Reactions and Reagents – O.P. Agrawal., Goel publishing house, 6th edition,2023.
5. A Text Books of Organic Chemistry- Bahl and ArunBahl, S. Chand Company, 22nd edition,2016

Subject Code	Title of the Subject	L	T	P	C
23A30801	**Chemical Process Calculations**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce chemical process calculations
- To impart concepts of vapour pressure and calculation of percent saturation of a given vapor-gas mixture.
- To emphasize the importance of basis of calculation and develop a systematic methodology to carry out material balances on chemical processes/equipment without and with reactions including recycle, purge and bypass.
- To convey different thermal effects associated with processes involving chemical reactions and phase changes
- To present how to calculate mass and energy balances involving combustion of fuels.

UNIT- I

Stoichiometric & Composition relations: Stoichiometric relation, basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales.

Behaviour of Ideal gases: Kinetic theory of gases, application of ideal gas law, gaseous mixtures.

UNIT -II

Vapor pressure: Liquefaction and liquid state, vaporization, boiling point, effect of temperature on vapor pressure, Antoine equation, vapour pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult's law, Non-volatile solutes.

Humidity and Saturation: Partial saturation, Humidity- Absolute Humidity, Vaporization process, Molal humidity, Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts, adiabatic vaporization.

UNIT- III

Material balances:

Tie substance, Yield, conversion, limiting reactant, excess reactant, processes involving reactions, Material balances with the help of Stoichiometric equations, Material balances involving drying, dissolution, & crystallization. Material balance calculations for processes involving recycle, bypass and purge.

UNIT -IV

Energy balances:

Thermo physics: Energy, energy balances, heat capacity of gases, liquid and mixture solutions. Kopp's rule, latent heats, heat of fusion and heat of vaporization, Trouton's rule, Kistyakowsky equation for non-polar liquids enthalpy and its evaluation.

Thermo chemistry: Calculation and applications of heat of reaction, combustion, formation and neutralization, Kirchoff's equation, enthalpy concentration change.

UNIT- V
Combustion Calculations: Introduction, fuels, calorific value of fuels, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations, incomplete combustion.
Flame Temperature Calculations: Calculation of theoretical and actual flame temperatures.

TEXT BOOKS:
1. Elementary Principles of Chemical Processes – Richard M.Felder, Ronald W.Rousseau, 4th Edition, John Wiley & Sons, 2018
2.Chemical process principles, Part -I, Material and Energy Balance, Hougen O A, Watson K.M. and Ragatz R.A. 2nd Edition, John Wiley and Sons, New York, 1963.

REFERENCES:
1. Basic principles and calculations in chemical engineering by David. M. Himmelblau, 7th Ed. PHI, 2013
2. Stoichiometry by B.I. Bhatt and S.M. Vora, 3rd Ed., Tata McGraw Hill publishing company, Ltd. New Delhi, 1996.

Data Tables: Use of steam tables, humidity chart under data tables permitted in the Examination hall
Course outcomes:
At the end of the course, student will be able to:

1. Understand & perform stoichiometry and composition related calculations, apply ideal gas equation.

2. Look up or estimate vapour pressure data for substances, make humidity and saturation related calculations for vapour gas mixtures.

3. Perform material balances on non-reactive and reactive systems.

4. Perform energy balances on non-reactive and reactive systems.

5. Make combustion calculations for fuels, calculate flame temperature.

Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	-	-	-	2	2	1	1
CO2	3	2	3	3	2	-	-	-	2	2	1	1
CO3	3	2	3	3	2	-	-	-	2	2	1	1
CO4	3	2	3	3	3	-	-	-	2	2	1	1
CO5	3	2	3	3	3	-	-	-	2	2	1	1

Subject Code	Title of the Subject	L	T	P	C
23A30802	**Momentum Transfer**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce the basic concepts of static and dynamic behaviour of fluids
- To disseminate different flow regimes and identification of types of fluids along with necessary equations to represent their behaviour
- To derive Bernoulli's theorem and explain its application to fluid flow problems
- To introduce the concept of friction factor and its estimation for different types of flow through pipes and fittings.
- To expose flow measuring devices such as head and area meters.
- To explain fluid moving machinery and its selection for a given flow problem.

UNIT- I

Nature of fluids, hydrostatic equilibrium, applications of fluid statics.
Fluid flow phenomena-Laminar flow, Shear rate, Shear stress, Rheological properties of fluids, Turbulence, Boundary layers.
Basic equation of fluid flow –Mass balance in a flowing fluid; continuity equation, differential momentum balance; equations of motion, Macroscopic momentum balances, Bernoulli equation.

UNIT- II

Incompressible Flow in pipes and channels- shear stress and skin friction in pipes, laminar flow in pipes and channels, turbulent flow in pipes and channels, friction from changes in velocity or direction.

UNIT- III

Dimensional analysis: Buckingham π Theorem and Rayleigh's method.
Flow of compressible fluids- Definitions and basic equations, Processes of compressible flow, Isentropic flow through nozzles, adiabatic frictional flow, and isothermal frictional flow.

UNIT -IV

Flow past immersed bodies, Drag and Drag coefficient, friction in flow through beds of solids, Kozeny-Carman, Blake-Plummer and Ergun equations, and motion of particles through fluids.
Fluidization: Conditions for fluidization, Minimum fluidization velocity, Types of fluidization, Expansion of fluidized beds, Applications of fluidization, Continuous fluidization: Slurry and pneumatic transport.

UNIT- V

Transportation and Metering of fluids: Pipes, fittings and valves, Fluid- moving machinery, Fans, blowers, and compressors.
Measurement of flowing fluids: Variable head meters- Orifice meter, Venturi meter, Pitot tube; Area meter- Rotameter.

TEXT BOOK:

Unit Operations of Chemical Engineering by W.L. McCabe, J.C.Smith & Peter Harriot, McGraw Hill, 7th Ed, 2007

REFERENCES:

1. Transport processes and unit operations by Christie J. Geankoplis, 3rd Ed, PTR Prentice Hall, 1993
2. Unit operations of chemical engineering, Vol-1 –Chattopadhya, Khanna publishers, 1996
3. Coulson and Richardson's Chemical Engineering, J.M.Coulson, J.F.Richardson, Vol-I, Pergamon Press,1990

Course Outcomes:

At the end of the course the student will be able to:

1. Apply the knowledge of hydrostatic equilibrium and fluid statics.
2. Compute head loss and power requirement for flow in pipes.
3. Use dimensional analysis for scaling experimental results, analyse flow of compressible fluids through closed conduits.
4. Make use of equations to find pressure drop for fluid flowing through bed of particles.
5. Select suitable metering equipment and fluid moving machinery for chemical process industries.

Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

Subject Code	Title of the Subject	L	T	P	C
23A30803	**Mechanical Operations**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:
- To introduce to the concepts of characterization of solids
- To discuss different types of mixers for mixing of solids
- To impart knowledge on screening, size reduction and equipment for size reduction
- To give exposure to Laws of crushing
- To explain the phenomenon of particle settling in fluids and transportation of solids
- To disseminate knowledge on different techniques of particle separation from fluid
- To estimate the power consumption in agitation and mixing of liquids

UNIT- I
Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate masses, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids.

UNIT- II
Size reduction: Principles of computer simulation of milling operations, size reduction equipment-crushers, grinders, ultra-fine grinders, cutting machines, Equipment operation.
Laws of crushing: Kick's law, Bond's law, Rittinger's law
Screening: Industrial screening equipment, Effectiveness of the screen, differential & cumulative analysis.

UNIT -III
Filtration: cake filters, centrifugal filters, cyclone separators, electro-static precipitators.
Principles of cake filtration, Clarifying filters, vacuum filtration, filter aids, liquid clarification, gas cleaning, principles of clarification. Introduction to cross flow filtration.

UNIT- IV
Separations based on motion of particles through fluids: gravity settling processes and centrifugal settling processes, float and sink method, differential settling, coagulation, Flotation-separation of ores, flotation agents

UNIT- V
Agitation and mixing of liquids: Agitation of liquids, circulation velocities, power consumption in agitated vessels. Blending and mixing of liquids, suspension of solid particles, dispersion operations.
Introduction to transportation of solid particulate mass: Belt, screw, apron conveyers, bucket elevators, pneumatic conveying.

TEXT BOOK:
Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, McGraw Hill 7th ed. 2001.

REFERENCES:
1. Chemical Engineer's Handbook, J.H. Perry, 7th ed. McGraw Hill, 1987
2. Introduction to Chemical Engineering, J.T.Banchero & W.L. Badger., TMH, 1997.

Course Outcomes:

At the end of the course the student will be able to

1. Know the significance and usage of different particulate characterization parameters, and equipment to estimate them.
2. Describe and calculate size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment
3. Analyse filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage.
4. Describe processes for separating particles from fluids based on their motion.
5. Estimate power consumption in agitation and mixing of liquids, select equipment for transporting solid particles.

Articulation matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	1	2	2	1	-	1	1
CO2	3	3	2	2	2	1	2	1	1		1	1
CO3	3	3	3	3	3	1	2	2	2	1	1	2
CO4	3	3	2	3	2	1	2	2	1	-	1	1
CO5	3	3	2	2	3	1	2	1	1	-	1	1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) ANANTHAPURAMU– 515002 (A.P) INDIA
Department of Chemical Engineering
II B.Tech I Semester (R23)

Subject Code	Title of the Subject	L	T	P	C
23A35302	**Organic Chemistry Lab**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:
- To explain detailed organic structure analysis
- To elucidate he planning and implementation of advanced organic reactions
- To understand the major concepts and theoretical principles underlying all the experiments

COURSE OUTCOME:
After completion of the course student shall be able to
- Understand the mechanism of organic chemical reaction to synthesis new organic compounds in drug and pharmaceutical industries. L2
- Carry out a process industrially for the manufacture of drugs and pharmaceuticals. L6

ORGANIC CHEMISTRY LAB:
1. Criteria of Purity of Solid and Liquid:
   a. Determination of Melting Point and Boiling Point.
   b. Elemental analysis of organic compounds: Nitrogen, Sulphur, and Halogens.
2. Systematic Qualitative analysis of organic compounds: Alcohols, Phenols, Aldehydes, Ketones, amines
3. Preparation and melting point determination of Aspirin
4. Preparation and melting point determination of Paracetamol
5. Preparation and melting point determination of Acetanilide
6. Preparation and melting point determination of Sulphonation(Benzene to Benzene sulphonoic acid)
7. Preparation of derivatives, recrystallization and melting point of Aldehydes and Amines.
8. Beckmann Rearrangement (Preparation of Benzanilide from Benzophenoneoxime).
9. Determination of strength of a Glycine Solution (volumetric).
10. Estimation of Paracetamol (Volumetric).

TEXT BOOKS:
1. Text book of Organic Chemistry – 6ᵗʰ edition, Morrsion and Boyd Pearson Education,2018.
2. Organic Reaction Mechanisms by – 4ᵗʰ edition, V.K Ahulwalia and R Karashar, Narosa
3. Publishing House,2011.
4. Vogels Text Book of Qualitative Organic Analysis. 6ᵗʰedition, Pearson Education,2023.
5. Stereochemistry of Organic Compounds, D. Nasipuri, 2ⁿᵈ edition (New Age International), 2018

REFERENCES:
1. Reaction mechanism – Peter Sykes., Pearson, 6ᵗʰ Edition, 2024
2. Text book of Organic Chemistry – P.L. Soni., Chand Company, 29ᵗʰ edition, 2020
3. Organic Chemistry Vol- I-IL. Finar, Pearson, 6th edition, 2002.
4. Reactions and Reagents – O.P. Agrawal., Goel publishing house, 6ᵗʰ edition,2023.
5. A Text Books of Organic Chemistry- Bahl and ArunBahl, S. Chand Company, 22nd edition,2016.

Subject Code	Title of the Subject	L	T	P	C
23A30804	**Mechanical Operations Lab**	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES: The course will equip students with the practical knowledge of different mechanical unit operations & operational conditions of different equipment.

List of Experiments:

1. To determine the time of grinding in a ball mill for producing a product with 80 % passing a given screen.
Major equipment - Ball mill Apparatus, Sieve shaker, Different sizes of sieves, weighing balance.

2. To verify the laws of crushing using any size reduction equipment like crushing rolls or vibrating mills and to find out the working index of the material.
   Major equipment – Jaw Crusher, Sieve shaker, Different sizes of sieves, Weighing Balance, Energy meter.

3. To find the effectiveness of hand screening and vibrating screen of a given sample.
   Major equipment - Vibrating Sieve shaker, Different sizes of sieves, Weighing Balance.

4. To achieve beneficiation of a ore using froth flotation technique.
   Major equipment - Froth flotation cell

5. To obtain batch sedimentation data and to calculate the minimum thickener area under given conditions.
   Major equipment- Sedimentation apparatus

6. To determine the specific cake resistance and filter medium resistance of a slurry in plate and frame filter press.
   Major equipment - Plate and frame filter press.

7. To separate a mixture of particles by Jigging.
   Major equipment - Jigging apparatus

8. To calculate separation efficiency of particles in a mixture using cyclone separator.
   Major equipment - Cyclone separator

9. To determine reduction ratio of a given sample in a pulverizer.
   Major equipment - Pulverizer
    1. Filtration Studies using
         a. Plate and Frame Filter Press
         b. Rotary Drum Filter
         c. Batch Centrifuge

11. To Perform mixing studies using Ribbon Mixer.

12. To determine reduction ratio of a given sample in .a grinder Major equipment - Grinder

Subject Code	Title of the Subject	L	T	P	C
23A30502	**Python Programming (Skill Enhancement Course) (Common to ME,ECE, CSE, Chem)**	0	1	2	2

Course Objectives: The main objectives of the course are to
- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes: After completion of the course, students will be able to
- Classify data structures of Python(L4)
- Apply Python programming concepts to solve a variety of computational problems(L3)
- Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs(L3)
- Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas(L2)
- Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)
- Propose new solutions to computation al problems(L6)

UNTI-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.
Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.
Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:
1. Write a program to find the largest element among three Numbers
2. Write a Program to display all prime numbers with in an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bitwise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods , Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:
7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the sub string is present in a given string or not.
11. Write a program to perform the given operations on a list:
     i. Addition   ii. Insertion   iii.slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple () Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip( ) Function, Sets, Set Methods, Frozenset.
Sample Experiments:
13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (Nocontrolflow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT-IV: Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os .path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.
<Sample Experiments:
18. Write a program to sort words in a file and put them in another file. The output file Should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functiona Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contain complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use ofndim, shape, size,dtype.
27. Python program to demonstrate basic slicing, integer and Boole an indexing.
28. Python program to find min, max ,sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a)   Apply head () function to the pandas data frame
    b)   Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in mat plotlib

Reference Books:

1.   Gowri shankar S, Veena A.,Introduction to Python Programming,CRCPress.
2.   Python Programming, SSridhar, JIndumathi, VMHariharan ,2nd Edition, Pearson, 2024
3.   Introduction to Programming Using Python, Y.Daniel Liang ,Pearson.

Online Learning Resources/VirtualLabs:

1.   https://www.coursera.org/learn/python-for-applied-data-science-ai
2.   https://www.coursera.org/learn/python?specialization=python#syllabus
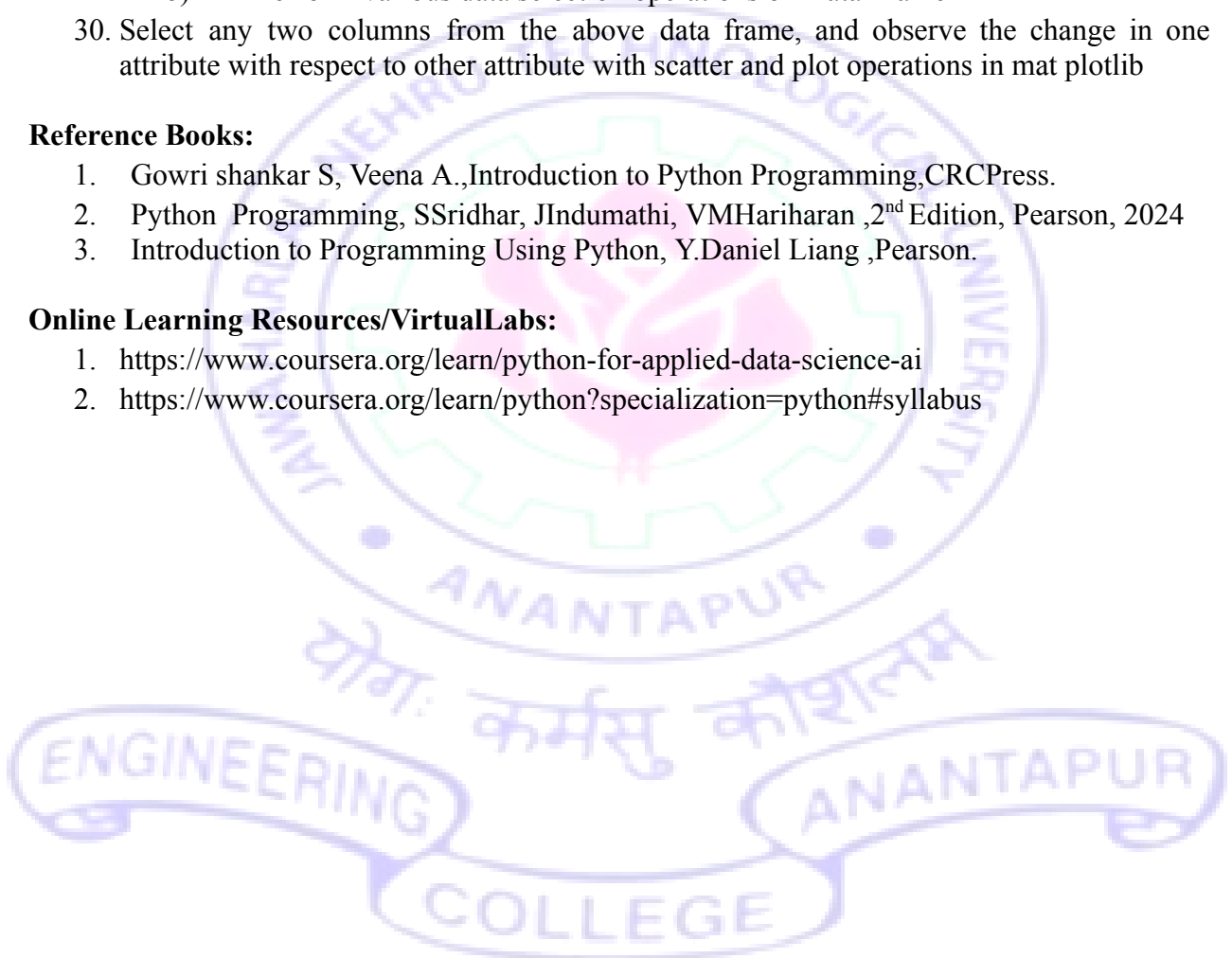
Subject Code	Title of the Subject	L	T	P	C
23A39902	**Environmental Science (Audit Course)** **(Common to All Branches)**	**2**	**0**	**0**	**0**

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:
NATURAL RESOURCES:
Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources, Non-conventional energy sources; Implications of energy use on the environment.
Forest resources – Use and over – exploitation, deforestation, **Water resources** – Use and over utilization of surface and ground water– **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources

Introduction to sustainable development: Sustainable Development Goals (SDGs) - targets and indicators, challenges and strategies for SDGs.

UNIT – II:
ECOSYSTEMS: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession. Introduction, types, characteristic features, structure and function of Forest, Grassland, Desert and aquatic ecosystems.

BIODIVERSITY AND ITS CONSERVATION : genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
UNIT – III:
ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of Air, Water, Soil, Marine, Noise, Thermal and Nuclear Pollutions.

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution.

UNIT – IV:
Climate Change: Impacts, Adaptation and Mitigation:
Understanding climate change: Natural variations in climate; Structure of atmosphere; **Anthropogenic climate change from greenhouse gas emissions**– past, present and future; Projections of global climate change
Impacts, vulnerability and adaptation to climate change. Observed impacts of climate change on ocean and land systems.

Mitigation of climate change: Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; Energy efficiency measures; Renewable energy sources; Carbon capture and storage.

UNIT – V: **Environmental Management**

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

Environmental management system: ISO 14001, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme.

TEXT BOOKS:
1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha, Universities Press, 2013.
2. Environmental Studies by Palani Swamy, 2nd Edition, Pearson education, 2014
3. Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES:
1. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
2. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Pubilishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited

Course Outcomes:

At the end of the course the student will be able to
- **CO1:** Gain knowledge on natural resources that sustain life and govern economy
- **CO2:** Understand various causes of pollution and solid waste management and related preventive measures.
- **CO3:** Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.
- **CO4:** Gain knowledge on climate change, adaptation and mitigation.
- **CO5:** Adopt sustainability as a practice in life, society, and industry

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	3	1	1	-	-	1
CO2	-	-	-	-	-	1	3	1	1	-	-	1
CO3	-	-	-	-	-	1	3	1	1	-	-	1
CO4	-	-	-	-	-	1	3	1	1	-	-	1
CO5	-	-	-	-	-	1	3	1	1	-	-	1

Subject Code	Title of the Subject	L	T	P	C
23A45401a	**Managerial Economics And Financial Analysis (Common to CE, Chem)**	**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(L1)
- 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 (L6)

UNIT - I   Managerial Economics
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
Introduction – meaning, functions - Production Function– Least-cost combination – Short run and long run Production Function- Isoquants and Isocosts, Cost & Break-Even Analysis - Cost concepts - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)

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

UNIT - IV   Capital Budgeting
Introduction –Meaning, Capital Budgeting– Features, Proposals, Methods and Evaluation - 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

Introduction –- 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 & sons. 2014
2. Aryasri, *Business Economics and Financial Analysis*, 4/e, MGH. 2008

Reference Books:
1. Ahuja H, *Managerial Economics,* S Chand. 2022
2. S.A. Siddiqui and A.S. Siddiqui, *Managerial Economics and Financial Analysis*, New Age International. Third edition 2022
3. Joseph G. Nellis and David Parker, *Principles of Business Economics*, Pearson, 2/e, New Delhi. 2002
4. Domnick Salvatore, *Managerial Economics in a Global Economy*, Cengage. 2004

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
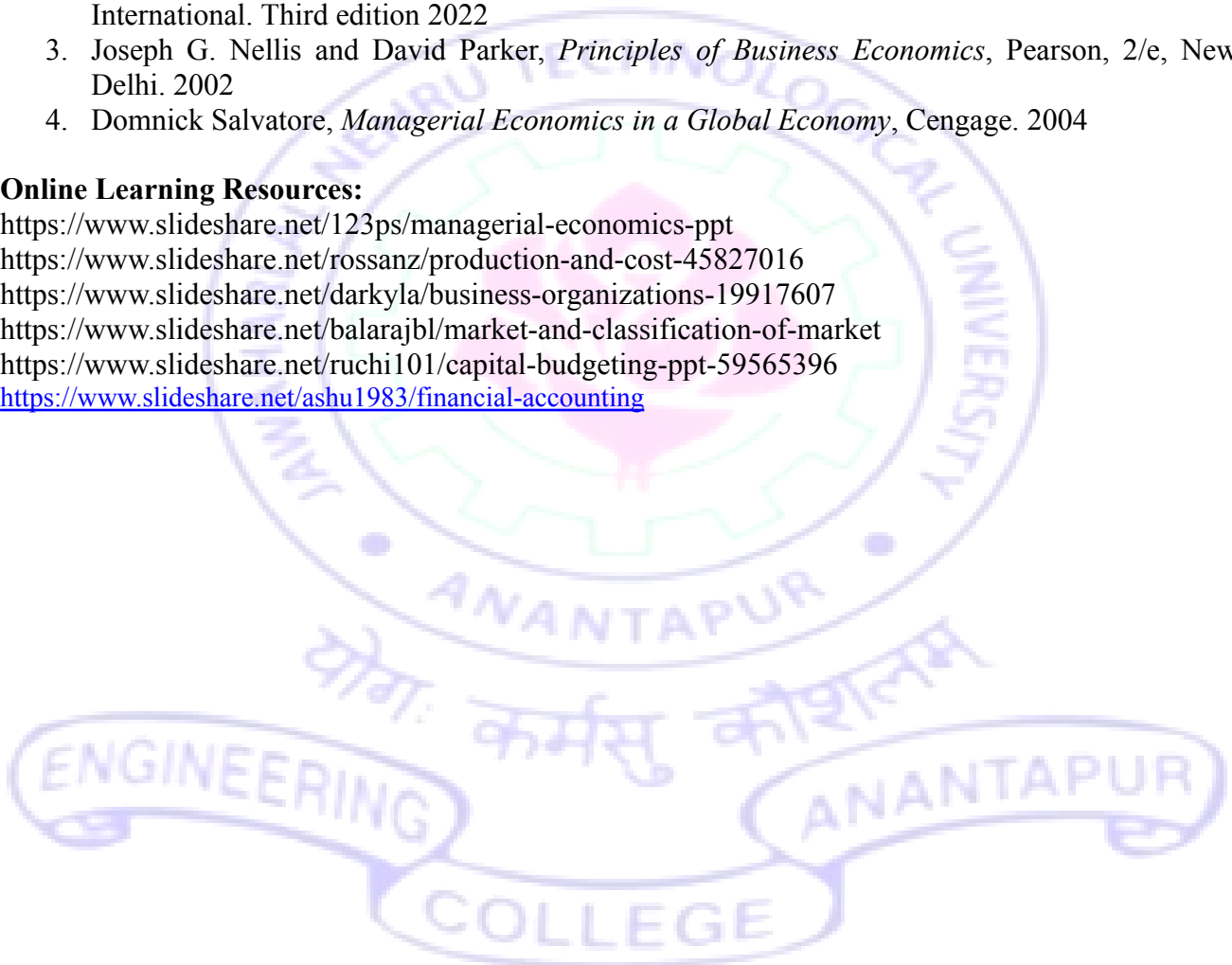
Subject Code	Title of the Subject	L	T	P	C
23A45401b	**Organisational Behaviour** (Common to CE, Chem)	**2**	**0**	**0**	**2**

Course Objectives:

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes:

- Define the Organizational Behavior, its nature and scope (L1)
- Understand the nature and concept of Organizational behavior (L2)
- Apply theories of motivation to analyze the performance problems (L3)
- Analyze the different theories of leadership (L4)
- Evaluate group dynamics (L5)
- Develop as powerful leader (L3,L6)

UNIT - I   Introduction to Organizational Behavior

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning – Personality

UNIT - II   Motivation

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregory's theory X and theory Y– Adam's equity theory

UNIT - III   Organizational Culture & Leadership

Meaning definition - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader

UNIT - IV   Group Dynamics

Introduction – Meaning, definition - Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building

UNIT - V   Organizational Change and Development

Introduction –Meaning, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management

Textbooks:
1. Fred Luthans, Organizational *Behavior*, McGraw-Hill, 12 Th edition. 2011
2. P Subba Rao, *Organizational Behavior*, Himalaya Publishing House. 2010

Reference Books:
1. McShane, *Organizational Behavior*, TMH. 2022
2. Nelson, *Organisational Behaviour*, Thomson. 2012

3. Robbins, P. Stephen, Timothy A. Judge, *Organisational Behaviour*, Pearson. 2013
4. Aswathappa, *Organisational Behaviour*, Himalaya. 2010

Online Learning Resources:
https://www.slideshare.net/Knight1040/organizational-culture
9608857s://www.slideshare.net/Abhay
Rajpoot3/motivation-165556714
https://www.slideshare.net/harshrastogi1/group-dynamics-159412405
https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951

Subject Code	Title of the Subject	L	T	P	C
23A45401c	**Business Environment** **(Common to CE, Chem)**	2	0	0	2

Course Objectives:
- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monitory policy
- To facilitate them in understanding the export policy of the country
- To Impart knowledge about the functioning and role of WTO
- To Encourage the student in knowing the structure of stock markets

Course Outcomes:
- Define Business Environment and its Importance. (L1)
- Understand various types of business environment. (L2)
- Apply the knowledge of Money markets in future investment (L3)
- Analyze India's Trade Policy (L4)
- Evaluate fiscal and monitory policy (L5)
- Develop a personal synthesis and approach for identifying business opportunities (L6)

UNIT - I   Overview of Business Environment
Introduction – meaning nature, scope, significance, functions and advantages - Internal & External environment - Competitive structure of industries -Environmental analysis

UNIT - II   Fiscal & Monetary Policy
 Meaning – advantages of Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI - Monetary Policy – RBI -Objectives of monetary and credit policy - Role of Finance Commission.

UNIT - III   India's Trade Policy
 Meaning- Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments – Causes for Disequilibrium in Balance of Payments.

UNIT - IV   World Trade Organization
Nature, significance, functions and advantages - Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

UNIT - V   Money Markets and Capital Markets
Nature, meaning - Features and components of Indian financial systems - Objectives and structure of money markets and capital markets – SEBI – Stock Exchanges

- Investor protection and role of SEBI

Textbooks:
  1. Cherunilam Francis, *International Business*: Text and Cases, Prentice Hall of India. 2010
  2.   K. Aswathappa, *Essentials of Business Environment*: Texts and Cases & Exercises 13th Revised Edition.HPH 2015

Reference Books:
  1.   K. V. Sivayya, V. B. M Das, *Indian Industrial Economy*, Sultan Chand Publishers, New Delhi, India. 1975
  2.   Sundaram, Black, *International Business Environment* Text and Cases, Prentice Hall of India, New Delhi, India. 2015
3. Chari. S. N, *International Business*, Wiley India. 2005
4.E. Bhattacharya, *International Business*, Excel Publications, New Delhi. 2022

Online Learning Resources:
https://www.slideshare.net/ShompaDhali/business-environment-53111245
https://www.slideshare.net/rbalsells/fiscal-policy-ppt
https://www.slideshare.net/aguness/monetary-policy-presentationppt
https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982
https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt
https://www.slideshare.net/viking2690/wto-ppt-60260883
https://www.slideshare.net/prateeknepal3/ppt-mo
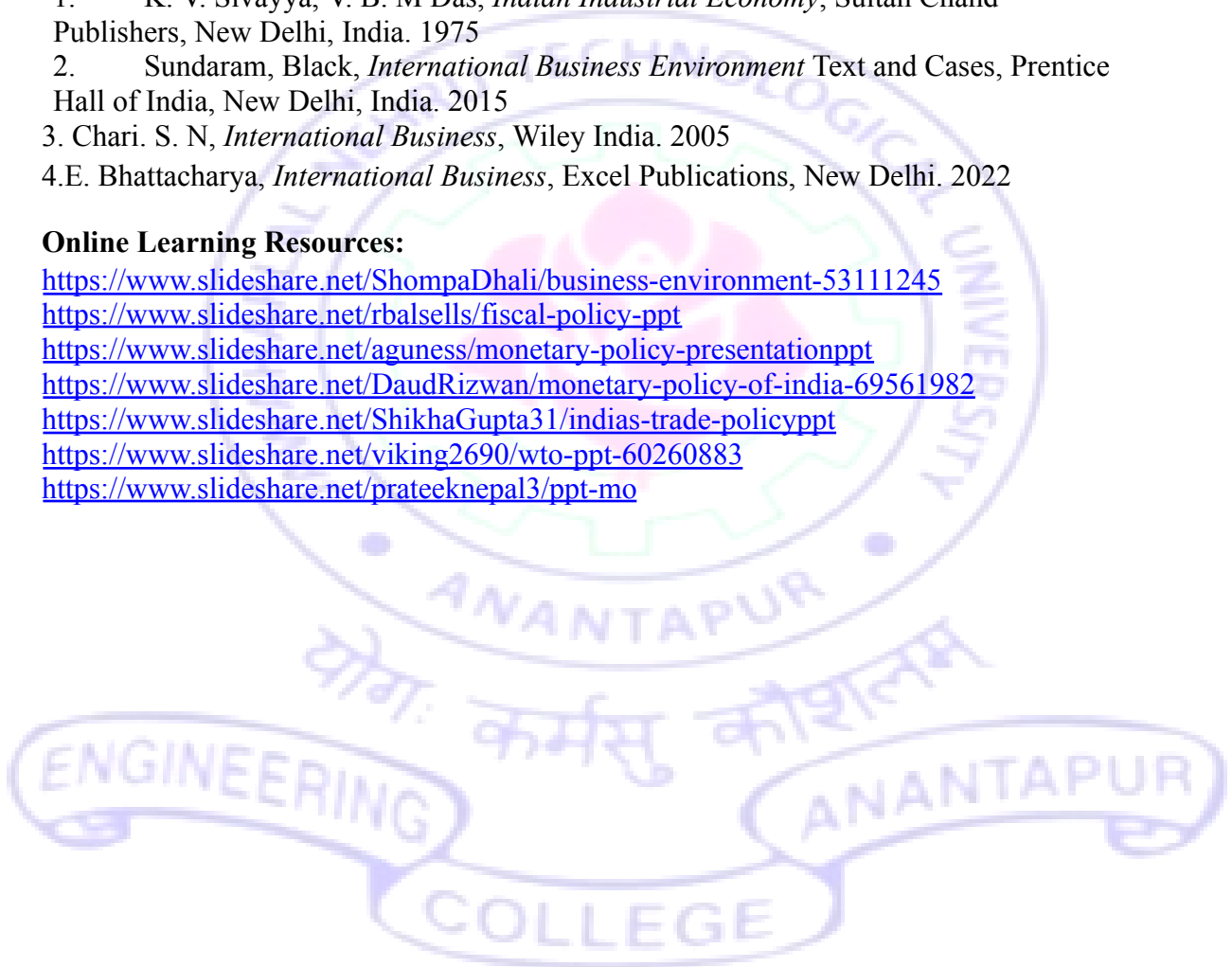
Subject Code	Title of the Subject	L	T	P	C
23A40801	Chemical Engineering Thermodynamics-I	3	0	0	3

Course Objectives:

- To introduce the laws of thermodynamics and their scope along with properties of different types.
- To explain how to calculate the heat and work requirements for industrial processes
- To teach the importance of PVT behaviour and its prediction using different equations of state and generalized correlations.
- To expose second law of thermodynamics and its application to find entropy changes.
- To understand power cycles and explain the concept of refrigeration
- To explain about thermodynamic properties of fluids

UNIT -I

Introduction: The scope of thermodynamics, Joule's Experiment, zeroth law of thermodynamics.

The first law and other basic concepts: The first law of thermodynamics, thermodynamic state and state functions, enthalpy, the steady-state steady-flow process, equilibrium, the phase rule, the reversible process, constant-V and constant- P processes, heat capacity, isobaric, isochoric, isothermal, adiabatic and polytrophic processes.

UNIT -II

Volumetric properties of pure fluids: The PVT behavior of pure substances, virial equations, the ideal gas, the applications of the virial equations, second virial coefficients from potential functions. Cubic equations of state, generalized correlations for gases, generalized correlations for liquids, molecular theory of fluids.

UNIT- III

The second law of thermodynamics: Statements of the second law, heat engines, thermodynamic temperatures scales, thermodynamic temperature and the ideal gas scale Entropy, Entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point, calculation of ideal work and lost work.

UNIT -IV

Power cycles: Carnot cycle, Rankine cycle

Refrigeration and liquefaction: The Carnot refrigerator, the vapor compression cycle, the comparison of refrigeration cycles, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction processes.

UNIT –V

Thermodynamic properties of fluids: Property relations for homogeneous phases, residual properties, two phase systems, thermodynamic diagrams, tables of thermodynamic properties, generalized property correlation for gases.

TEXT BOOKS

1. J. M. Smith and HC Van Ness, Introduction to Chemical Engineering Thermodynamics, 6[th]ed,

   McGraw Hill, 2003.

REFERENCES

1. Chemical Engineering Thermodynamics, Y.V. C. Rao, University publications, 2003

2. Chemical Engineering Thermodynamics, K. V. Narayanan, 2nd Edition, PHI, 2013

Course outcomes:
At the end of the course, student will be able to:
CO1: Apply the first and second laws of thermodynamics to chemical processes.
CO2: Compute the properties of ideal and real mixtures using equations of state and generalized correlations.
CO3: Understand thermodynamic properties of fluids
CO4: Estimate heat and work requirements for industrial processes.
CO5: Determine the efficiency of processes involving heat into work, refrigeration and liquefaction.

Articulation matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	3	2	1	1	1	-	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	-
CO5	3	2	2	2	1	1	1	-	-	-	-	1

Subject Code	Title of the Subject	L	T	P	C
23A40802	Process Heat Transfer	3	0	0	3

COURSE OBJECTIVES:
- To demonstrate different modes of heat transfer
- To describe formulae for steady/ unsteady rate of heat transfer by conduction for rectangular, cylindrical and spherical geometries
- To teach how to estimate the heat transfer coefficients for different flow geometries
- To explain the working and design of double pipe, shell and tube heat exchangers and evaporators
- To impart knowledge on the phenomenon of radiation, radiation shields and estimation of emissivity.

UNIT -I
Introduction: Nature of heat flow, conduction, convection, natural and forced convection, radiation.
Heat transfer by conduction in Solids: Fourier's law, thermal conductivity, steady state conduction in plane wall & composite walls, compound resistances in series, heat flow through a cylinder, conduction in spheres.
Unsteady state heat conduction: Equation for one-dimensional conduction, Semi-infinite solid.
UNIT- II
Principles of heat flow in fluids: Typical heat exchange equipment, counter current and parallel current flows, energy balances, rate of heat transfer, overall heat transfer coefficient, electrical analogy, critical radius of insulation, logarithmic mean temperature difference, variable overall coefficient, multi-pass exchangers, individual heat transfer coefficients, resistance form of overall coefficient, fouling factors, classification of individual heat transfer coefficients, magnitudes of heat transfer coefficients, effective coefficients for unsteady-state heat transfer.

UNIT- III

Heat Transfer to Fluids without Phase change: Regimes of heat transfer in fluids, thermal boundary layer, heat transfer by forced convection in flow, heat transfer by forced convection in turbulent flow, the transfer of heat by turbulent eddies and analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids in forced convection outside tubes.
Natural convection: Natural convection to air from vertical shapes and horizontal planes, effect of natural convection in laminar-flow heat transfer.
UNIT -IV
Heat transfer to fluids with phase change: Heat transfer from condensing vapors, heat transfer to boiling liquids.

Radiation: Introduction, properties and definitions, black body radiation, real surfaces and the
Gray body, absorption of radiation by opaque solids, radiation between surfaces, radiation
Shielding, radiation to semi-transparent materials, combined heat transfer by conduction, convection and radiation.

UNIT- V
Heat exchange equipment: General design of heat exchange equipment, heat exchangers, condensers, boilers and calendrias, extended surface equipment, heat transfer in agitated vessels, scraped surface heat exchangers, heat transfer in packed beds, heat exchanger effectiveness (NTU method)
Evaporators: Evaporators, performance of tubular evaporators, capacity and economy, multipleeffect evaporators, methods of feeding, vapor recompression

TEXT BOOK:
Unit Operations of Chemical Engineering, 6th ed., W.L. McCabe, J.C. Smith and P. Harriot, McGraw-Hill, New York, 2001.

REFERENCES:
1. Process Heat Transfer, D.Q. Kern, Tata McGraw-Hill, New Delhi, 1997.
2. Heat Transfer, J.P. Holman, 4th ed., McGraw-Hill, New York, 1976.
3. Coulson and Richardson's Chemical Engineering, J.M.Coulson, J.F.Richardson, Vol-I, Pergamon Press, 1990

COURSE OUCOMES:
At the end of the course the student will be able to

CO1: Analyse problems involving steady state and transient heat conduction in simple geometries.

CO2: Determine individual and overall heat transfer coefficients in laminar and turbulent flow conditions.

CO3: Calculate heat transfer coefficient in forced convection and natural convection.

CO4: Analyse heat transfer processes involving boiling, condensation and radiation.

CO5: Understand the basic design of common heat exchange equipment and estimate performance of single/multiple effect evaporator.

Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	2	2	-	2	2	1	1
CO2	3	3	3	1	1	2	2	-	2	2	1	1
CO3	3	3	3	1	1	2	3	-	2	2	1	1
CO4	3	3	2	1	1	2	2	-	2	2	1	1
CO5	3	3	3	1	1	2	3	-	2	2	1	1

Subject Code	Title of the Subject	L	T	P	C
23A40803	**Instrumentation & Process Control**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- Describe the various elements of instruments, measurement of temperature, pressure and level in process industries.
- Explain the basics of process control and develop transfer function models for dynamic processes.
- Draw the block diagrams and analyse process stability
- Describe the stability methods like root locus and frequency response
- Explain the controller tuning & advanced control strategies

UNIT- I

Elements of instruments, static and dynamic characteristics, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer. Industrial thermocouples, thermocouple wires, thermocouple wells. Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels. **Pressure vacuum and head**: liquid column manometers, measuring elements for gauge pressure and vacuum

UNIT- II

Response of First order Systems: Transfer function of 1st order system, Response of 1st order system for step, impulse and sinusoidal inputs

Physical examples of first order systems: Liquid level, mixing process, R- C circuit. Linearization.

Response of first order systems in series: interacting and non- interacting systems, second order systems, transportation lag.

UNIT- III

Control system: Components of a control system, Servo Vs regulator problem, development of block diagram. **Controllers and final control elements**: Control valve and its construction, PD, PI, PID controllers.

Stability: Concept of Stability, Stability criterion, Routh test for stability.

UNIT- IV
Root locus: concept of root locus, rules for plotting the root locus diagram.

Introduction to frequency response: Substitution rule, Bode diagram of 1st order system

Control systems design by frequency response: Bode stability criterion, Gain and Phase margins.

UNIT- V

Controller tuning: Tuning of P, PD, PI, PID controllers, Ziegler- Nichols technique, Cohen and Coon rules.

Advanced control strategies: Cascade control, feed forward control, ratio control.

TEXT BOOKS:

1. Industrial instrumentation by Donald P.Eckman, Wiley eastern, 1950.

2. Process Systems Analysis and Control, 3rd ed., D.R. Coughanowr and Steven E. LeBlanc

   McGraw-Hill, 2009

REFERENCES:

1. Chemical Process Control, G. Stephanopoulos, PHI Learning Pvt. Ltd., New Delhi, 2010 2. Process Control, B.W. Bequette, PHI Learning Pvt. Ltd., New Delhi, 2010

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

CO1: Understand the dynamic behaviour of processes

CO2: Develop the transfer functions for first and second order processes

CO3: Classify the types of control systems

CO4: Understand different types of controllers and their applications

CO5: Determine the stability using root locus & frequency response methods

Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	2	3	-	-	-	-	-	-	1
CO3	3	2	3	3	3	-	-	-	-	-	1	1
CO4	3	3	2	3	3	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	1	1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS) ANANTHAPURAMU– 515002
(A.P) INDIA
Department of Chemical Engineering
II B.Tech II Semester (R23)

Subject Code	Title of the Subject	L	T	P	C
23A40804	Momentum Transfer Lab	0	0	2	1

COURSE OBJECTIVES: The lab provides knowledge on various flow patterns, flow measuring devices and pumps.

LIST OF EXPERIMENTS:

1. Identification of laminar and turbulent flows using Reynolds apparatus

2. Measurement of point velocities using Pitot tube setup

3. Verification of Bernoulli's equation using Bernoulli's Apparatus

4. Calibration of Rotameter using Rotameter Assembly

5. Variation of Orifice coefficient with Reynolds Number using Orifice meter Assembly

6. Determination of Venturi coefficient using Venturi meter Assembly

7. Determination of friction losses in Fluid flow in pipes using Pipe Assembly with provision for Pressure measurement

8. Determination of Pressure drop in a packed bed for different fluid velocities

9. Determination of Pressure drop and void fraction in a fluidized bed

10. Study the coefficient of contraction for a given open orifice meter

11. Study the coefficient of discharge in a V-notch

12. Study the Characteristics of a centrifugal pump

13. Drag studies using two different fluids

Subject Code	Title of the Subject	L	T	P	C
23A40805	**Process Heat Transfer Lab**	**0**	**0**	**2**	**1**

Course Objectives

To make the students learn heat transfer principles by experiencing the different modes of heat transfer in a laboratory setup. Impart practical knowledge regarding operation and control of equipment like heat exchangers and evaporators common in chemical processes. Design experiments so as to generate necessary data for making calculations of critical heat transfer parameters. Conduct performance studies of heat transfer equipment.

List of Experiments

1. Determination of thermal conductivity of metal rod.
2. Determination of heat transfer rate in Natural Convection.
3. Find heat transfer coefficient in Forced Convection heat transfer.
4. Determine Stefan Boltzmann Constant using Stefan Boltzmann Apparatus.
5. Study pool boiling phenomenon using Critical heat flux apparatus.
6. Determination of emissivity of a surface at different temperatures
7. Conduct experiment to find the overall heat transfer coefficient in a shell & tube heat exchanger
8. Comparison studies of performance of parallel and counter flow double pipe heat exchanger.
9. Study of heat transfer in helical coil heat exchanger.
10. Determination of heat transfer rate and interface temperatures in a heated composite wall.
11. Performance study of a single effect evaporator.
12. Study heat transfer in a pin finned surface.

Course Outcomes:

At the end of the course the student will be able to

1. Analyse the need, design and perform a set of experiments to understand the different modes of heat transfer following safe laboratory practices and procedures.
2. Learn and apply basic techniques to operate and control heat transfer equipment commonly used in chemical process industries.
3. Generate necessary data by conducting experiments for calculating various heat transfer parameters.
4. Function as a member of a team, communicate effectively and engage in further learning.
5. Articulate by writing a laboratory report following standard writing procedures.

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II B.Tech II Semester (R23)

Subject Code	Title of the Subject	L	T	P	C
23A40806	**Instrumentation & Process Control Lab**	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES:

1. Study about process dynamics and various forms of mathematical models to express them
2. Determine the time lag for first and second order systems.
3. Emphasize theoretical concepts of open and close loop runs on liquid level and liquid temperature.

List of Experiments:

1. Study the dynamics of first order system like Mercury-in-Glass thermometer for step change
2. Study the dynamics of second order like thermometer in a thermal well for step change
3. Study the dynamics of a single tank system for Step input in the flow rate
4. Study the dynamics of a single tank system for Impulse input in the flow rate
5. Study the dynamics of a two tank interacting system for Step input in the flow rate.
6. Study the dynamics of a two tank Non-interacting system for Step input in the flow rate.
7. Experiments on proportional, reset, rate mode of control using a PID controller setup
8. Study the dynamics of U-tube manometer to find damping coefficient & overshoot
9. Calibration of a Bimetallic thermometer
10. Study the level using level transmitter

Course Outcomes: At the end of the Course, the Student will be able to

CO1: Evaluate the dynamics of the first & second order systems.

CO2: Estimate the dynamics of a U tube manometer.

CO3: Analyse the behaviour of two tank non-interacting and interacting systems for step and impulse inputs.

CO4: Draw the response of a second order system

CO5: Examine the response of the PID controller.

Subject Code	Title of the Subject	L	T	P	C
23A45501	**Soft Skills (Skill Oriented Course)** **(Common to CE,ME, ECE,CHEM)**	**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 (CO):

COs	Statements	Blooms level
CO1	List out various elements of soft skills	L1, L2,
CO2	Describe methods for building professional image	L1, L2
CO3	Apply critical thinking skills in problem solving	L3
CO4	Analyse the needs of an individual and team for well-being	L4
CO5	Assess the situation and take necessary decisions	L5
CO6	Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being	L6

SYLLABUS

UNIT – I	**Soft Skills & Communication**	Lecture Hrs

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	Lecture Hrs

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	Lecture Hrs

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**	Lecture Hrs

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**	Lecture Hrs

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. 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

Subject Code	Title of the Subject	L	T	P	C
23A49901	**Design Thinking for Innovation** **(Common to All Branches)**	1	0	2	2

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.

Course Outcomes (CO):	**Blooms Level**
● Define the concepts related to design thinking.	L1, l2
● Explain the fundamentals of Design Thinking and innovation	L1, L2
● Apply the design thinking techniques for solving problems in various sectors.	L3
● Analyse to work in a multidisciplinary environment	L4
● Evaluate the value of creativity	L5
● Formulate specific problem statements of real time issues	L3, L6

UNIT - I	**Introduction to Design Thinking**	**10 Hrs**

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**	**10 Hrs**

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, brain storming, 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**	**8 Hrs**

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	8 Hrs

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

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

UNIT - V	Design Thinking in Business Processes	10 Hrs

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

Reference Books:
1. David Lee, *Design Thinking in the Classroom,* Ulysses press
2. Shrutin N Shetty, *Design the Future*, Norton Press
3. William Lidwell,*Universal Principles of Design-* Kritinaholden, Jill Butter.
4. Chesbrough.H, T*he Era of Open Innovation* – 2013

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

Department of Chemical Engineering

II B.Tech II Semester (R23)

Title of the Subject-23A49903
COMMUNITY SERVICE PROJECT
……Experiential learning through community engagement

Introduction

Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.

Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.

Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

To sensitize the students to the living conditions of the people who are around them,

To help students to realize the stark realities of society.

To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability

To make students aware of their inner strength and help them to find new /out of box solutions to social problems.

To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.

To help students to initiate developmental activities in the community in coordination with public and government authorities.

To develop a holistic life perspective among the students by making them study

culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

Every student should put in 6 weeks for the Community Service Project during the summer vacation.

Each class/section should be assigned with a mentor.

Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc

A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.

The logbook has to be countersigned by the concerned mentor/faculty in charge.

An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.

The final evaluation to be reflected in the grade memo of the student.

The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.

Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.

Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.

The Community Service Project is a twofold one –

- o First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed.   This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
- o Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - ▪ Agriculture

- Health
- Marketing and Cooperation
- Animal Husbandry
- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

Positive impact on students' academic learning

Improves students' ability to apply what they have learned in "the real world"

Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
Improved ability to understand complexity and ambiguity

Personal Outcomes

Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

Reduced stereotypes and greater inter-cultural understanding

Improved social responsibility and citizenship skills

Greater involvement in community service after graduation

Career Development

Connections with professionals and community members for learning and career opportunities

Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

Stronger relationships with faculty

Greater satisfaction with college

Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

Satisfaction with the quality of student learning

New avenues for research and publication via new relationships between faculty and community

Providing networking opportunities with engaged faculty in other disciplines or institutions

A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

Improved institutional commitment.

Improved student retention

Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

Satisfaction with student participation

Valuable human resources needed to achieve community goals.

New energy, enthusiasm and perspectives applied to community work.

Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project.

The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant

themes. Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social

Entrepreneurship General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of

important days Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality

Development Common
Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –

i. Agriculture
ii. Health
iii. Marketing and Cooperation
iv. Animal Husbandry
v. Horticulture
vi. Fisheries
vii. Sericulture
viii. Revenue and Survey
ix. Natural Disaster Management
x. Irrigation
xi. Law & Order
xii. Excise and Prohibition
xiii. Mines and Geology
xiv. Energy

Role of Students:

Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.

For conducting special camps like Health related, they will be coordinating with the Governmental agencies.

As and when required the College faculty themselves act as Resource Persons.

Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.

And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.

An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project

Activity Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**

   ● Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmesto be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**

   Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**

   ● During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

   1. Awareness Program on Good Touch and Bad Touch(Sexual abuse)

   2. Awareness Program on Socially relevant themes. Programs for Women Empowerment

Government Guidelines and Policy Guidelines

   1. Women's Rights
   2. Domestic Violence
   3. Prevention and Control of Cancer
   4. Promotion of Social

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    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
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