JNTUH COLLEGE OF ENGINEERING HYDERABAD

(AUTONOMOUS)

B.TECH. FOUR YEAR DEGREE COURSE (CHEMICAL ENGINEEERING)

COURSE STRUCTURE

I Year **I Semester**

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Matrix Algebra and Calculus	3	1	0	4
2	BSC	Engineering Physics	3	1	0	4
3	ESC	Programming for Problem Solving	3	0	0	3
4	ESC	Engineering Graphics	1	0	3	2.5
5	BSC -LC	Engineering Physics Lab	0	0	3	1.5
6	ESC -LC	Programming for Problem Solving Lab	0	0	3	1.5
		Total Credits				**16.5**

I Year **II Semester**

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Applied and Multi Variable Calculus	3	1	0	4
2	BSC	Engineering Chemistry	3	1	0	4
3	ESC	Classical Mechanics	3	1	0	4
4	HSMC	English	2	0	0	2
5	BSC	Engineering Chemistry Lab	0	0	2	1
6	ESC	Engineering Workshop Practice	0	0	3	1.5
7	HSMC	English Language & Communication Skills Lab	0	0	2	1
8	ESC	Applied Python Programming Lab	0	1	2	2
		Total Credits				**19.5**

JNTUH COLLEGE OF ENGINEERING HYDERABAD

(AUTONOMOUS)

B.TECH. FOUR YEAR DEGREE COURSE (CHEMICAL ENGINEEERING)

COURSE STRUCTURE

II YEAR **I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Probability Distributions and Complex Variables	3	1	0	4
2	PCC	Material and Energy Balance Computations	2	1	0	3
3	PCC	Chemical Engineering Fluid Mechanics	3	1	0	4
4	BSC	Physical and Analytical Chemistry	3	0	0	3
5	ESC	Basic Electrical Engineering	3	0	0	3
6	PCC	Fluid Mechanics Lab	0	0	3	1.5
7	BSC	Physical and Analytical Chemistry Lab	0	0	3	1.5
8	ESC	Basic Electrical Engineering Lab	0	0	2	1
9	*MC	Environmental Science	2	0	0	0
		Total Credits				**21**

II YEAR **II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	PCC	Chemical Engineering Thermodynamics-I	3	0	0	3
2	PCC	Mechanical Operations	3	1	0	4
3	PCC	Process Heat Transfer	3	1	0	4
4	HSMC	Management Fundamentals for Engineers	3	0	0	3
5	BSC	Organic Chemistry	3	0	0	3
6	PCC	Mechanical Operations Lab	0	0	3	1.5
7	PCC	Process Heat Transfer Lab	0	0	3	1.5
8	BSC	Organic Chemistry Lab	0	0	2	1
9	*MC	Constitution of India	2	0	0	0
Total Credits						**21**

JNTUH COLLEGE OF ENGINEERING HYDERABAD

(AUTONOMOUS)

B.TECH. FOUR YEAR DEGREE COURSE (CHEMICAL ENGINEEERING)

COURSE STRUCTURE

III YEAR **I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	PE-1	Professional Elective – I	3	0	0	3
2	PCC	Mass Transfer Operations-I	3	0	0	3
3	PCC	Chemical Reaction Engineering-I	3	0	0	3
4	PCC	Instrumentation and Process Control	3	0	0	3
5	PCC	Chemical Engineering Thermodynamics-II	3	0	0	3
6	PCC	Chemical Technology	3	0	0	3
7	PCC	Instrumentation and Process Control Lab	0	0	3	1.5
8	PCC	Chemical Technology Lab	0	0	3	1.5
9	HSMC	Advanced English Communications Skills Lab	0	0	2	1
10	*MC	Introduction to Artificial Intelligence	2	0	0	0
Total Credits						**22**

Professional Elective – I

i) Petroleum Refining and Petrochemicals
ii) Energy Engineering
iii) Basics of Nanotechnology

III YEAR **II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	OE-I	Open Elective – I	3	0	0	3
2	PE-II	Professional Elective – II	3	0	0	3
3	PCC	Computational Methods in Chemical Engineering	3	1	0	4
4	PCC	Mass Transfer Operations-II	3	1	0	4
5	PCC	Chemical Reaction Engineering-II	3	1	0	4
6	PCC	Computational Methods Lab	0	0	2	1
7	PCC	Mass Transfer Operations Lab	0	0	3	1.5
8	PCC	Chemical Reaction Engineering Lab	0	0	3	1.5
9	*MC	Introduction to Cyber security	2	0	0	0
Total Credits						**22**

Note: * MC- Mandatory Course (Non-credit course)

Open Elective-I:

1. Solid Waste Management

Professional Elective – II

i) Interfacial and Colloidal Science
ii) Process Modeling & Simulation
iii) Polymer Science and Engineering

JNTUH COLLEGE OF ENGINEERING HYDERABAD

(AUTONOMOUS)

B.TECH. FOUR YEAR DEGREE COURSE (CHEMICAL ENGINEEERING)

COURSE STRUCTURE

IV YEAR **I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	OE - II	Open Elective – II	3	0	0	3
2	PE-III	Professional Elective – III	3	0	0	3
3	PE-IV	Professional Elective - IV	3	0	0	3
4	PCC	Chemical Engineering Plant Design and Economics	2	0	0	2
5	PCC	Transport Phenomena	3	0	0	3
6	PCC	Process Equipment Design Lab	0	0	2	1
7	MINI PROJ	Industry Oriented Mini Project / Industrial Training	0	0	4	2
8	Seminar	Seminar	0	0	2	1
9	Proj-I	Major Project (Phase-I)	0	0	0	3
Total Credits						**21**

Open Elective-II:

1. Industrial Pollution Prevention & Control

Professional Elective – III

i) Biochemical Engineering

i) Industrial Pollution Control Engineering

ii) Fluidization Engineering

Professional Elective - IV

i) Computational Fluid Dynamics

ii) Nuclear Engineering

iii) Process Intensification

IV YEAR **II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	OE - III	Open Elective – III	3	0	0	3
2	PE-V	Professional Elective – V	3	0	0	3
3	PE-VI	Professional Elective – VI	3	0	0	3
4	Proj-II	Major Project (Phase-II)	0	0	16	8
Total Credits						**17**

Open Elective-III:

1. Industrial Process Safety

Professional Elective – V

i) Optimization of Chemical Processes

ii) Technology of Pharmaceuticals and fine chemicals

iii) Food Processing Technology

Professional Elective – VI

i) Membrane Technology

ii) Industrial Safety Hazard Management

iii) Design & Analysis of Experiments

B.Tech. Minor Program – Chemical Engineering

S. No.	Year/ Semester	Course Code	Course Title	L	T	P	Credits
1	III/I	CHM01	Introduction to Unit Operations and Process Calculations	3	0	0	3
2	III/I	CHM02	Fluid Mechanics and Heat Transfer	3	0	0	3
3	III/II	CHM03	Chemical Engineering Thermodynamics	3	0	0	3
4	IV/I	CHM04	Chemical Reaction Engineering	3	0	0	3
5	IV/I	CHM05	Chemical Reaction Engineering Lab	0	0	3	1.5
6	IV/II	CHM06	Process Dynamics and Control	3	0	0	3
7	IV/II	CHM06	Process Dynamics and Control Lab	0	0	3	1.5
Total Credits							**18**

B. Tech. Honor's Program - Chemical Engineering

S. No.	Year/ Semester	Course Code	Course Title	L	T	P	Credits
1	III/I	CHH101	Advanced Thermodynamics	3	0	0	3
2	III/I	CHH102	Advanced Process Heat Transfer	3	0	0	3
3	III/II	CHH103	Advanced Reaction Engineering	3	0	0	3
4	III/II	CHH104	Advanced Reaction Engineering Lab	0	0	2	1
5	IV/I	CHH105	Process Modeling & Simulation	3	0	0	3
6	IV/I	CHH106	Advanced Separation Processes	3	0	0	3
7	IV/I	CHH107	Advanced Separation Processes Lab	0	0	2	1
8	IV/II	CHH108	Advanced Transport Phenomena	3	0	0	3
Total Credits							**20**

MATRIX ALGEBRA AND CALCULUS

I Year B. Tech. I- Sem

L	T	P	C
3	1	0	4

Pre-requisites: Mathematical Knowledge of 12th / intermediate level

Course Objectives: To learn

- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of Eigenvalues and Eigenvectors and to reduce the quadratic form to canonical form
- Methods of solving the differential equations of first and higher order.
- Geometrical approach to the mean value theorems and their application to the mathematical problems
- Evaluation of surface areas and volumes of revolutions of curves.
- Evaluation of improper integrals using Beta and Gamma functions.

UNIT-I: Matrices

Matrices: Rank of a matrix: Echelon form, Normal form, System of linear equations: solving system of Homogeneous and Non-Homogeneous equations, Gauss-elimination method, LU Decomposition method.

Linear Transformation and Orthogonal Transformation: Eigenvalues and Eigenvectors and their properties, Eigenvalues and Eigenvectors of Symmetric, Hermitian, Skew-Symmetric, Skew-Hermitian, Orthogonal and Unitary matrices.

UNIT-II: Diagonalization of a Matrix

Diagonalization of a matrix. Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms: Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Mean value theorems and Beta, Gamma functions

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series. (All theorems without proof).

Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-IV: First Order ODE

Exact differential equations, converting non-exact equations to exact equations, Linear and Bernoulli's differential equations. Applications: Newton's law of cooling, Law of natural growth and decay, orthogonal trajectories and electrical circuits. First order equations with higher degree: solvable for the differential coefficient, dependent variable and Independent variable.

UNIT-V: Ordinary Linear Differential Equations of Higher Order

Second order linear differential equations with constant coefficients - Non-Homogeneous terms of the type $e^{ax}, \sin ax, \cos ax,$ polynomials in$x$, $e^{ax}V(x)$ and $x\,V(x)$ - method of variation of parameters, Equations reducible to linear ODE with constant coefficients, Legendre's equation, Cauchy-Euler equation. Applications: Electrical circuits.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons,2006.

References

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.
3. RamanaB.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11thReprint, 2010.

Course outcomes:

After learning the contents of this paper the student must be able to

- Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
- Find the Eigenvalues and Eigenvectors
- Reduce the quadratic form to canonical form using orthogonal transformations.
- Identify whether the given differential equation of first order is exact or not
- Solve higher differential equation and apply the concept of differential equation to real world problems
- Solve the applications on the mean value theorems.
- Evaluate the improper integrals using Beta and Gamma functions

ENGINEERING PHYSICS

I Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Course Objectives:

The course enables the students to understand:

1. Fundamental properties of free, damped and forced harmonic oscillators.
2. The concepts of wave optics for the exploration of inference, diffraction and polarization.
3. Lasing action and study various types of lasers and to learn fundamental principles of Optical fibres.
4. The concepts of various theories of solids and the classification of materials into three groups.
5. Principles, fabrication and characterization of nanomaterials.

Course Outcomes:

The student should be able to gain knowledge on:

1. Formulation of differential equations that describe the behaviour of oscillators under various conditions.
2. The Principle of optical phenomenon like interference, diffraction and polarization of light.
3. Various types of lasers and transmission characteristics of fibre optics.
4. Classical, Quantum and band theories on electrical behavior of solids and their classifications.
5. Origin, fabrication and characterization of nanomaterials.

UNIT-I: OSCILLATIONS & WAVES

Oscillations: Introduction, Oscillations-Simple harmonic oscillations, Simple harmonic motion– Energy function, Simple harmonic motion-Equation, Oscillations of a spring, Torsional pendulum, Projection of a uniform circular motion, Combination of simple harmonic motions, Damped harmonic motion, Forced oscillations, Resonance.

Waves: Mechanical waves and types of waves, Travelling wave equation, Wave speed – Dimensional method, Wave speed-Mechanical method, Power and intensity of a wave, Standing waves, Waves in string-Laws of transverse vibration, Verification of laws of transverse vibration- Sonometer, Melde's apparatus.

UNIT-II: OPTICS

Interference and Diffraction: Introduction, Huygen's principle, Superposition of waves, Interference of light by wave front splitting- Young's double slit experiment, Amplitude splitting- Newton's rings, Fresnel and Fraunhofer diffractions, Fraunhofer diffraction at a single slit and double slit, Diffraction grating.

Polarization: Introduction to polarization, Polarized and unpolarised light, Types of polarization: Plane polarized, Circularly polarized and Elliptically polarized light, Polarizer and Analyser: Production and Detection of linearly polarized light, Malus law.

UNIT-III: LASERS AND FIBRE OPTICS

Lasers: Introduction, Laser Beam Characteristics, Interaction of light with matter and the three Quantum Processes, Einstein Coefficients and their relations, Light Amplification, Components of Laser, Three requirements for Lasing Action, Pumping Methods, Types of Lasers: Ruby Laser, He- Ne Laser, Semiconductor Laser, Applications of laser.

Fibre Optics: Introduction to Optical Fibre, Total Internal Reflection, Construction of optical fibre, Acceptance angle - Numerical Aperture, Classification based on materials, Refractive index profile and mode propagation, Losses in Optical Fibre, Fibre Optic Communication System, Merits of Optical Fibres, Applications.

UNIT-IV: ELECTRON THEORY OF SOLIDS

Classical and Quantum theories: Introduction, Free electron theory of metals, Classical and quantum free electron theory, Estimation of Fermi energy, Dependence of Fermi level on temperature, Density of states

Band theory of solids: Bloch's theorem, Kronig – Penny model, E-K diagram, Effective mass of electron, Origin of energy bands, Classification of materials on the basis of energy bands.

UNIT-V: NANOMATERIALS

Introduction, nanoscale, Quantum confinement, Surface to volume ratio , Bottom-up Fabrication: Sol-Gel, Precipitation, Combustion Methods, Top-Down Fabrication: Chemical Vapor Deposition, Physical Vapor Deposition, Characterization Techniques: XRD, SEM &TEM, Applications of nanomaterials.

Text Books:

1. Principles of Physics, Jearl Walker, David Halliday and Robert Resnick- Wiley publications.
2. A textbook of Engineering Physics, Dr. M.N. Avadhanulu, Dr. P.G Kshirsagar – S.Chand.
3. Engineering Physics, R.K. Gaur - S.L.Gupta, Dhanpat Rai & Sons

References:

1. Introduction to Solid State Physics by Charles Kittel, Wiley student edition.
2. Ajoy Ghatak, "Optics", Mc Graw-Hill Education, 2012.
3. Applied Physics by P.K.Mittal, I.K.International.
4. Introduction to Nanotechnology, Charles P.Pode, Jr.Frank J.Owens, Wiley-India Edition..

PROGRAMMING FOR PROBLEM SOLVING

I Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in Program development.
3. To learn the syntax and semantics of C Programming Language.
4. To learn the usage of structured programming approach in solving problems.

UNIT-I:

INTRODUCTION TO COMPUTERS – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development Method, Algorithms, Pseudo code, flow charts, applying the software development method.

INTRODUCTION TO C LANGUAGE – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output, Operators. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Bit wise operators, Statements, Simple C Programming examples.

UNIT-II:

STATEMENTS – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Simple C Programming examples.

DESIGNING STRUCTURED PROGRAMS- Functions, basics, user defined functions, inter function communication, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion-recursive functions, Preprocessor commands, example C programs

UNIT-III:

ARRAYS AND STRINGS – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C program examples. Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

UNIT-IV:

POINTERS – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions, command –line arguments.

INPUT AND OUTPUT – Concept of a file, streams, standard input / output functions, formatted input / output

functions, text files and binary files, file input / output operations, file status functions (error handling), C program examples.

UNIT-V:

DERIVED TYPES – Structures – Declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, bit fields, enumerated types, C programming examples.

SORTING AND SEARCHING – Selection sort, Bubble sort, Insertion sort, Linear search and Binary search methods.

Textbooks:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

References:

1. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
2. Data Structures using C – A. M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI
3. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes

1. Write algorithms and to draw flowcharts for solving problems.
2. Translate the algorithms/flowcharts to programs (in C language).
3. Code and test a given logic in C programming language.
4. Formulate simple algorithms for arithmetic and logical problems.
5. Decompose a problem into functions and to develop modular reusable code.
6. Use arrays, pointers, strings and structures to formulate algorithms and programs.
7. Searching and sorting problems.

ENGINEERING GRAPHICS

I Year B.Tech. I-Sem

L	T	P	C
1	0	3	2.5

Pre-requisites: Nil

Course objectives:

- To provide basic concepts in engineering drawing
- To impart knowledge about standard principles of orthographic projection of objects
- To draw sectional views and pictorial views of solids

UNIT–I:

INTRODUCTION TO ENGINEERING DRAWING:

Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Involute. Scales – Plain, Diagonal and Vernier Scales.

UNIT-II:

ORTHOGRAPHIC PROJECTIONS:

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. —Auxiliary Planes.

UNIT–III:

Projections of Regular Solids – Auxiliary Views.

UNIT–IV:

Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere. Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT–V:

ISOMETRIC PROJECTIONS:

Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions Auto CAD: Basic principles only

Text Books:

1. Engineering Drawing by N.D. Bhatt, Charotar
2. Engineering Drawing and Graphics by Rane and Shah, Pearson Edu.

Reference Books:

1. A Text Book of Engineering Drawing by Dhawan R K, S. Chand
2. Engineering Graphics with Auto CAD by James D Bethune, Pearson Edu.
3. Engineering Graphics by K R Mohan, Dhanpat Rai.
4. Text book on Engineering Drawingby KL Narayana, P Kannaih, Scitech

Course Outcomes:

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

- Prepare working drawings to communicate the ideas and information.
- Read, understand and interpret engineering drawings.

ENGINEERING PHYSICS LAB

I Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Course Objectives:

The course enables the students to understand:

1. The concepts of mechanical waves and their resultant phenomena.
2. The phenomena of interference using Newton's rings and diffraction phenomena using diffraction grating.
3. The electrical resonance using LCR circuit.
4. The band concept of semiconductor diode and light phenomenon of Lasers and Optical fibres.

Course Outcomes:

By the end of the course students will be able to:

1. Understand the mechanical waves concepts and elastic properties.
2. Understand the light phenomena such as interference and diffraction.
3. Confirm the resonance produced by electrical waves.
4. Understand the band gap of semiconductor and certain characteristics of lasers and optical fibres.

List of Experiments:

1. Melde's experiment: Determination of the frequency of a vibrating bar or turning fork using Melde's arrangement.
2. Torsional pendulum: Determination of the rigidity modulus of the material of the given wire using torsional pendulum.
3. Newton's rings: Determination of the radius of curvature of the lens by forming Newton's rings.
4. Diffraction grating: Determination of the number of lines per inch of the grating.
5. Dispersive power: Determination of the dispersive power of prism by using spectrometer.
6. Coupled Oscillator: Determination of the spring constant by single coupled oscillator.
7. LCR Circuit: Determination of quality factor and resonant frequency of LCR circuit.
8. LASER: The characteristics of LASER sources.
9. Optical fibre: Determination of the bending losses of Optical fibres.
10. Optical fibre: Determination of the Numerical aperture of a given fibre.
11. Sonometer: Determination of the AC frequency.
12. Energy gap of PN Junction diode: determination energy gap of a semiconductor diode

Note: Any 8 experiments are to be performed by each student.

PROGRAMMING FOR PROBLEM SOLVING LAB

I Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Course Objectives

1. To learn the fundamentals of computers.
2. To understand the various steps in Program development.
3. To learn the syntax and semantics of C Programming Language.
4. To learn the usage of structured programming approach in solving problems.

Week 1:

1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
3. Write a C program to generate the first n terms of the sequence.
4. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
5. Write a C program to find the roots of a quadratic equation.

Week 2:

6. Write a C program to find the factorial of a given integer.
7. Write a C program to find the GCD (greatest common divisor) of two given integers.
8. Write a C program to solve Towers of Hanoi problem.
9. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 3:

10. Write a C program to find both the largest and smallest number in a list of integers.
11. Write a C program that uses functions to perform the following:
    i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 4:

12. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string in to a given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
13. Write a C program to determine if the given string is a palindrome or not
14. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
15. Write a C program to count the lines, words and characters in a given text.

Week 5:

16. Write a C program to generate Pascal's triangle.
17. Write a C program to construct a pyramid of numbers
18. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:
    $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$
    For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
    Print x, n, the sum
    Perform error checking.
    For example, the formula does not make sense for negative exponents – if n is less than 0.
    Have your program print an error message if n<0, then go back and read in the next pair of numbers of without without computing the sum. Are any values of x also illegal? If so, test for them too.

Week 6:

19. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
20. Write a C program to convert a Roman numeral to its decimal equivalent.

Week 7:

21. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers

    (Note: represent complex number using a structure.)

Week 8:

22. . i) Write a C program which copies one file to another.
    ii) Write a C program to reverse the first n characters in a file.

    (Note: The file name and n are specified on the command line.)
23. . i) Write a C program to display the contents of a file.
    ii) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Week 9:

24. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii) Insertion sort

Week 10:

25. Write C programs that use both recursive and non-recursive functions to perform the following searching Operations for a Key value in a given list of integers:
    i) Linear search ii) Binary search

Textbooks:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

References:

1. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
2. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI
3. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes

1. Write algorithms and to draw flowcharts for solving problems.
2. Translate the algorithms/flowcharts to programs (in C language).
3. Code and test a given logic in C programming language.
4. Formulate simple algorithms for arithmetic and logical problems.
5. Decompose a problem into functions and to develop modular reusable code.
6. Use arrays, pointers, strings and structures to formulate algorithms and programs.
7. Searching and sorting problems.

APPLIED AND MULTIVARIABLE CALCULUS

I Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

Pre-requisites: Mathematical Knowledge of 12th / Intermediate level

Objectives: To learn

- Concept, properties of Laplace transforms
- Solving ordinary differential equations using Laplace transforms techniques.
- Partial differentiation, concept of total derivative
- Finding maxima and minima of function of two and three variables.
- Evaluation of multiple integrals and their applications
- The physical quantities involved in engineering field related to vector valued functions
- The basic properties of vector valued functions and their applications to line, surface and volume integrals.

UNIT-I: Laplace transforms:

Laplace Transforms; Laplace Transform of standard functions, first shifting theorem, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof), solving Initial value problems by Laplace Transform method.

UNIT-II: Partial Derivatives and applications

Definitions of Limit and continuity.

Partial Differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence, Maxima and minima of functions of two variables and three variables, method of Lagrange multipliers.

UNIT-III: Multiple Integration

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form). Evaluation of Triple Integrals, Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals), Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallel piped).

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions. Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons,2006
3. M Apostol, Calculus vol-2, John Wiley & Sons

References

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002
2. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

Course Outcomes:

After learning the contents of this paper the student must be able to

- Use the Laplace transforms techniques for solving ODE's.
- Find the extreme values of functions of two variables with/ without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and gravity for cubes, sphere and rectangular parallel piped
- Evaluate the line, surface and volume integrals and converting them from one to another

ENGINEERING CHEMISTRY

I Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

Course Objectives:

1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To acquire the knowledge of water treatment, electrochemistry and corrosion which are essential for the Engineers and in industry.
3. To acquire the skills pertaining to Polymers and Energy sources to apply them for various engineering fields etc.
4. To impart then knowledge of Engineering materials and their aspects useful for understanding material chemistry.

UNIT-I: Water and its treatment:

Introduction – hardness of water – Causes of hardness. Types of hardness: temporary and permanent. Expression and units of hardness. Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination, breakpoint chlorination, Ozonisation. Boiler troubles - Scale, Sludge, Priming, Foaming and Caustic embrittlement. Treatment of boiler feed water by Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water- Ion exchange process. Desalination of water – Reverse osmosis. Numerical problems based on Determination of hardness of water.

UNIT-II: Electrochemistry and corrosion:

Electrochemistry: Electrochemical cells – Cell, Electrode, electrode potential, standard electrode potential, Nernst equation-derivation and significance- Electrochemical series and its applications. Construction and functioning of Calomel, Quinhydrone and glass electrode. Determination of pH of a solution by using quinhydrone and glass electrode. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

Corrosion: Causes and effects of corrosion – Theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion. Galvanic corrosion, Concentration cell corrosion- water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anodic protection and impressed current cathodic methods. Surface coatings – metallic coatings – Methods of coatings - Hot dipping - galvanization, tinning. cementation, electroplating and electroless plating of copper.

UNIT –III: Polymeric materials:

Polymers: Definition, Monomer, functionality and degree of polymerisation. Classification – Types of Polymerisation - Addition & Condensation – Mechanisms of Polymerisation. Plastics: Definition, characteristics - Compounding and fabrication- Methods of Moulding - Thermoplastics and Thermosets – Preparation, properties and applications– PVC, Teflon and Bakelite. Fibres: Definition, Characteristics. Preparation, Properties and applications of Terylene, Nylon 6:6. Elastomers: Definition and characteristics. Natural rubber- structure, processing of latex, Vulcanisation. Preparation, properties and applications of BuNa-S and Butyl rubber. Conducting Polymers- Definition, Classification. Mechanism of conduction in Polyacetylene, Polyaniline & Applications. Biodegradable polymers - Concept, Synthetic and Natural polymers, Polylactic acid, Poly Vinyl alcohol, Nylon-2 and Nylon – 6. Applications and advantages of biodegradable polymers.

UNIT –IV: Energy sources:

Fuels: Definition, classification with examples. Calorific value. Determination of calorific value by Junker's gas Calorimeter. Characteristics of good fuel. Coal: Types- Analysis of coal- proximate analysis. Petroleum- Refining- Fractional distillation- composition, properties and uses of petrol, diesel and kerosene. Cracking-types, Moving bed catalytic cracking. Knocking - Octane and Cetane rating, Composition, characteristics and uses of LPG, CNG. Biodiesel-Transesterification. Advantages. Hydrogen fuel- Production, storage, advantages and limitations. Combustion - Definition, Calculation of air required for the combustion of fuel, numerical problems related to calorific value and combustion.

UNIT-V: Engineering Materials:

Portland cement: Composition and constituents. Setting and hardening of cement, special cements- properties and uses of High alumina cement, White cement and water proof cement. RCC, Decay of Concrete. Refractories: Classification, Properties - Refractoriness, RUL, Chemical inertness and porosity. Characteristics of a good refractory. Engineering Applications. Failure of a refractory. Lubricants: functions of lubricants, Classification, Mechanism of Lubrication, Properties - Viscosity, Acid value, Flash & Fire point, Cloud & Pour point, Aniline point.

Text Book:

1. Engineering Chemistry – PC Jain and M Jain – Dhanpath Rai and Sons, New Delhi.

Reference Books:

1. Text book of Engineering Chemistry by Ramadevi, Venkata Ramana Reddy & Prashanth Rath, Cengage learning publications.
2. A text book of Engineering Chemistry by Thirumala Chary, Laxminarayana, Shashikala. Pearson Publications.

Course Outcomes:

The basic concepts included in this course will help the student to gain:

1. Differentiate hard and soft water; solve the related problems on water purification and its significance in industry and daily life.
2. Understand the principles, concepts of electrochemistry and causes of corrosion, its consequences and methods to minimize corrosion to improve industrial designs.
3. The required skills to get clear concepts on polymers and energy sources and their applications to various engineering fields etc.
4. The knowledge of engineering materials such as Portland cement, white cement, concrete and lubricants etc.

CLASSICAL MECHANICS

I Year B.Tech. II-Sem

L	T	P	C
3	1	0	4

Course Objectives:

- To understand the resolving forces and moments for a given force system.
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area

UNIT-I:

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces -Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II:

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions -Motion of Bodies-Wedge Screw, Screw-jack and differential screw –jack

UNIT-III:

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

UNIT-IV:

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT-V:

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

Text Books:

1. Singer's Engineering Mechanics Statics and Dynamics by K. Vijaya Kumar Reddy and J. Suresh Kumar, BS Publications, 3rd Edition (SI Units) Fifth impression 2013.
2. Engg. Mechanics by Irving Shames, G. Krishna Mohan Rao, Prentice Hall

Reference Books:

1. Engineering Mechanics by Timoshenko & Young
2. Engineering Mechanics by Umesh Regl, Tayal.
3. A text of Engineering Mechanics by YVD Rao, K. Govinda Rajulu, M. Manzoor Hussain, Academic Publishing Company
4. Text Book in Applied Mechanics by Malhotra, Subramanian, Gahlot and Rathore, New Age.
5. Engineering Mechanics by KL Kumar, Tata McGraw Hill.
6. Engineering. Mechanics by M.V. Seshagiri Rao & D Rama Durgaiah.
7. Engineering Mechanics by S.S. Bhavikati & K.G. Rajasekharappa

Course Outcomes:

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

- Resolve forces and moments for a given system.
- Analyze the friction for moving bodies.
- Determine centroid and second moment for a given area of a body.

ENGLISH

I Year B.Tech. II-Sem

L	T	P	C
2	0	0	2

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, and communicative competencies of Engineering students. In English classes, the focus would be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers use the prescribed text for detailed study. The students are encouraged to read the texts leading to reading comprehension and different known/unknown passages may be given for practice in the class. The time is utilized for working out the exercises given after each excerpt. Authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material are used to supplement exercises. *The focus in this syllabus is on skill development in the areas of Vocabulary, Grammar, Reading and Writing Skills and practice of language skills in various contexts.*

LEARNING OBJECTIVES

The course will help students to:

a. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
b. Develop study skills and communication skills in formal and informal situations.
c. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Reading Skills

Objectives

1. To develop an awareness in students about the significance of silent reading and comprehension.
2. To develop students' ability to guess meanings of words from the context and grasp the overall message of the text, draw inferences, etc.,
3. To facilitate the students practice the sub-skills of reading viz., Skimming and Scanning the text, Intensive and Extensive Reading, Reading for Pleasure, Identifying the topic sentence, Inferring lexical and contextual meaning, Recognizing Coherence/Sequencing of Sentences.

☛ **NOTE:** *The students will be trained in reading skills using the prescribed texts for detailed study. They will be tested in reading comprehension of different 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.*

Writing Skills

Objectives

1. To bring an awareness in the students about the difference between formal and informal writing
2. To make students understand sentence structures and variations in process writing
3. To develop students' creativity in different disciplines of academic writing

SYLLABUS

The course content / study material is divided into **Five Units.**

Unit –I

Chapter entitled '***Presidential Address' by Dr. A.P.J. Kalam*** from ***"Fluency in English– A Coursebook for Engineering Students"*** published by Orient BlackSwan, Hyderabad

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes- Collocations

Grammar: Punctuation - Identifying Common Errors in Writing with reference to Articles.

Reading: Reading and its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Paragraph Writing - Creating Coherence and Cohesiveness.

Unit –II

Chapter entitled ***Satya Nadella: Email to Employees on his First Day as CEO*** from ***"Fluency in English– A Coursebook for Engineering Students"*** Published by Orient BlackSwan, Hyderabad.

Vocabulary: Synonyms and Antonyms – Homonyms, Homophones and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-Pronoun Agreement – Words with appropriate Prepositions - Phrasal Verbs

Reading: Improving Comprehension Skills – Techniques for Good Comprehension

Writing: Writing Formal Letters **–** Format - Letter of Complaint and Reply - Letter of Requisition and Reply.

Unit –III

Vocabulary: Acquaintance with Phrases from Foreign Languages (Latin/French) with a focus on usage in English **Grammar:** Tenses - Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses **Reading:** Sub-skills of Reading- Skimming and Scanning.

Writing: Job Application with Resume- Writing Introduction and Conclusion - Essay Writing.

Unit –IV

Chapter entitled **'*Good Manners' by J.C. Hill*** from ***Fluency in English – A Coursebook for Engineering Students"***

published by Orient BlackSwan, Hyderabad

Vocabulary: Standard Abbreviations in English – Idioms – One Word Substitutes

Grammar: Subject-Verb Agreement - Redundancies and Clichés in Oral and Written Communication – Sequence of Tenses.

Reading: Comprehension- Intensive Reading and Extensive Reading- Reading Practice – *'If'* by Rudyard Kipling.

Writing: Writing Practices - Information Transfer -Précis Writing.

Unit –V

Chapter entitled ***'Father Dear Father'*** **by Raj Kinger** from ***Fluency in English – A Coursebook for Engineering Students"*** Published by Orient BlackSwan, Hyderabad

Vocabulary: Technical Vocabulary and their Usage – Indian Colloquial Terms

Grammar: Common Errors in English

Reading: Reading Comprehension-Exercises for Practice.

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Note: *Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.*

☞ (**Note**: As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year is* ***Open-ended,***

besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

Course Outcomes:

Students will be able to:

1. Choose appropriate vocabulary and sentence structures for their oral and written communication.
2. Demonstrate their understanding of the rules of functional grammar.
3. Develop comprehension skills from the known and unknown passages and respond appropriately.
4. Take an active part in drafting paragraphs, letters, essays, abstracts and reports in various contexts
5. Adapt basic proficiency in English

Prescribed Textbook:

1. ***"Fluency in English – A Coursebook for Engineering Students"*** by Board of Editors**:** Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.

Suggested Reading:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.

(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007

(iii) *Contemporary English Grammar Structures and Composition*. David Green. Macmillan. 2010.

(iv) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

ENGINEERING CHEMISTRY LAB

I Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

I. Volumetric Analysis:

1. Estimation of Ferrous iron by Dichrometry method.
2. Estimation of Ferrous iron by Permanganometry method.
3. Estimation of Hardness of water by EDTA Complexometry method.

II. Conductometry:

1. Estimation of the concentration of an acid by Conductometry.

III. Potentiometry:

1. Estimation of the amount of Fe^{+2} by Potentiomentry.

IV. *p*H Metry:

1. Determination of an acid concentration using *p*H meter.

V. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon-6.

VI. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation Saponification value of a lubricant oil.
3. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VII. Corrosion:

1. Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

Recommended Books:

1. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
2. Laboratory Manual of Engineering Chemistry by Y. Bharathi Kumari & Jyotsna C, VGS Booklinks, Vijayawada, 2009.
3. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).
4. Engineering Chemistry Lab Manual by Cengage Publications.

ENGINEERING WORKSHOP PRACTICE

I Year B.Tech. II-Sem

L	T	P	C
0	0	3	1.5

Pre-requisites: Practical skill

Course Objectives: The objectives of this course is to acquire knowledge on the

i. To impart hands-on practice on Carpentry trade and skills.
ii. To impart hands-on practice on Fitting trade and skills
iii. To impart hands-on practice on Black Smithy trade and skills
iv. To impart hands-on practice on House Wiring trade and skills
v. To impart hands-on practice on Tin Smithy trade and skills
vi. To impart hands-on practice on Plumbing trade and skills

Note: At least two exercises to be done from each trade.

A. Carpentry
1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint

B. Fitting
1. Vee Fit
2. Square Fit
3. Half Round Fit

C. Black Smithy
1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring

D. House Wiring
1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting

E. Tin Smithy
1. Taper Tray
2. Open Scoop
3. Funnel

F. Plumbing
1. Coupling Joint
2. Elbow Joint
3. T Joint

Text Books:

1. Workshop Practice by B.L.Juneja Cengage Learning
2. Elements of Workshop Technology–S. K.Hajra Choudhury and A. K. Hajra Choudhury.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS(ELCS) LAB

I Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Objectives

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking, group discussions and interviews

Learning Outcomes

Students will be able to:

- Understand the nuances of English language through audio- visual experience and group activities
- Neutralise their accent for intelligibility
- Speak with clarity and confidence which in turn enhances their employability skills

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

Listening Skills:

Objectives

1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
   - Oral practice
   - Describing objects/situations/people
   - Role play – Individual/Group activities
   - Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II

CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Sentence Stress – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Sentence Stress – Intonation - *Testing Exercises*

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III

CALL Lab:

Understand: Errors in Pronunciation-the Interference of Mother Tongue (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation - *Testing Exercises*

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines.

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - *Testing Exercises*

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests -*Testing Exercises*

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 8th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

References:

1. Suzanna, R. *A Practical Course in English Pronunciation (with CD).* McGraw Hill Education. 2017. Print.
2. *Exercises in Spoken English*. Part 1, 2 and 3. CIEFL. Oxford University Press, 1997. Print.
3. Hancock, M. *English Pronunciation in Use. Intermediate Cambridge*: Cambridge University Press. 2009. Print.

APPLIED PYTHON PROGRAMMING LAB

I Year B.Tech. II-Sem

L	T	P	C
0	1	2	2

Cycle - 1

1. **Downloading and Installing Python and Modules**
   a) **Python 3 on Linux**
   Follow the instructions given in the URL https://docs.python-guide.org/starting/install3/linux/
   b) **Python 3 on Windows**
   Follow the instructions given in the URL https://docs.python.org/3/using/windows.html
   (Please remember that Windows installation of Python is harder!)
   c) **pip3 on Windows and Linux**
   Install the Python package installer by following the instructions given in the URL
   https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/
   d) **Installing numpy and scipy**
   You can install any python3 package using the command pip3 install <packagename>
   e) **Installing jupyterlab**
   Install from pip using the command pip install jupyterlab
2. **Introduction to Python3**
   a) Printing your biodata on the screen
   b) Printing all the primes less than a given number
   c) Finding all the factors of a number and show whether it is a *perfect* number, i.e., the sum of all its factors (excluding the number itself) is equal to the number itself
3. **Defining and Using Functions**
   a) Write a function to read data from a file and display it on the screen
   b) Define a boolean function *is palindrome*(<input>)
   c) Write a function *collatz(x)* which does the following: if x is odd, $x = 3x + 1$; if x is even, then $x = x/2$. Return the number of steps it takes for $x = 1$
   d) Write a function $N(m, s) = exp(-(x-m)^2/(2s^2))/sqrt(2\pi)s$ that computes the Normal distribution
4. **The package** numpy
   a) Creating a matrix of given order $m \times n$ containing *random numbers* in the range 1 to 99999
   b) Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed
   c) Write a program to solve a system of n linear equations in n variables using matrix inverse
5. **The package** scipy **and** pyplot
   a) Finding if two sets of data have the same *mean* value
   b) Plotting data read from a file
   c) Fitting a function through a set a data points using *polyfit* function
   d) Plotting a histogram of a given data set
6. **The** strings **package**
   a) Read text from a file and print the number of lines, words and characters
   b) Read text from a file and return a list of all n letter words beginning with a vowel
   c) Finding a secret message hidden in a paragraph of text
   d) Plot a histogram of words according to their length from text read from a file

Cycle -2

7. Installing OS on Raspberry Pi
   a) Installation using PiImager
   b) Installation using image file
      - Downloading an Image
      - Writing the image to an SD card
      - using Linux
      - using Windows
      - Booting up

   Follow the instructions given in the URL
   https://www.raspberrypi.com/documentation/computers/getting-started.html
8. Accessing GPIO pins using Python
   a) Installing GPIO Zero library.
      First, update your repositories list:
      sudo apt update
      Then install the package for Python 3:
      sudo apt install python3-gpiozero
   b) Blinking an LED connected to one of the GPIO pin
   c) Adjusting the brightness of an LED

   Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.
9. Collecting Sensor Data
   a) DHT Sensor interface
   - Connect the terminals of DHT GPIO pins of Raspberry Pi.
   - Import the DHT library using ***import Adafruit_DHT***
   - Read sensor data and display it on screen.

PROBABILITY DISTRIBUTIONS AND COMPLEX VARIABLES

II Year B.Tech. I-Sem

L	T	P	C
3	1	0	4

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The basic ideas of statistics including measures of central tendency, correlation and regression.
- The statistical methods of studying data samples.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

UNIT-I: Basic Probability

Probability spaces, conditional probability, independent events, and Bayes' theorem.

Random variables: Discrete and continuous random variables, Expectation of Random Variables, Variance of random variables.

UNIT-II: Probability distributions

Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson approximation to the binomial distribution, Continuous random variables and their properties, distribution functions and density functions, Normal and exponential, evaluation of statistical parameters for these distributions.

UNIT-III: Estimation & Tests of Hypotheses

Introduction, Statistical Inference, Classical Methods of Estimation.: Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Estimating a Proportion for single sample, Difference between Two Means, difference between two proportions for two Samples.

Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, Tests Concerning a Single Mean, Tests on Two Means, Test on a Single Proportion, Two Samples: Tests on Two Proportions.

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series; Residues, Cauchy Residue theorem, Conformal mappings, Mobius transformations and their properties. (All theorems without Proof)

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.
3. A first course in complex analysis, D Zill,

References

1. Fundamentals of Mathematical Statistics, Khanna Publications, S C Guptha and V.K. Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

Course Outcomes:

After learning the contents of this paper the student must be able to

- Formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.
- Apply concept of estimation and testing of hypothesis to some case studies.
- Analyse the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems
- Taylor's and Laurent's series expansions of complex function

MATERIAL AND ENERGY BALANCE COMPUTATIONS

II Year B. Tech. I- Sem

L	T	P	C
2	1	0	3

Pre Requisites: NIL

Course Objectives:

1. To describe the fundamentals of stoichiometric relations to calculate composition of different mixtures and solutions.
2. To solve problems on mass balance, using, different gas laws, vapor pressure laws and humidity concept and psychometric charts
3. To demonstrate enthalpy balance concept needed for solution of energy balance of different chemical engineering processes in industries.

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.

Behavior of Ideal gases: Kinetic theory of gases, application of ideal gas law, gaseous mixtures, gases in chemical reactions.

UNIT- II

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

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, Kirchhoff's equation, enthalpy concentration change, calculation of theoretical and actual flame temperatures.

UNIT- V

Combustion Calculations: Introduction, fuels, calorific value of fuels, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations, incomplete combustion, material and energy balances, thermal efficiency calculations

Text Books:

1. Basic principles and calculations in chemical engineering by D. H. Himmelblau, 7th Ed. PHI, 2013
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.

Reference Books:

1. Stoichiometry by B.I. Bhatt and S. M. Vora (3rd Ed.) Tata McGraw Hill publishing company, Ltd. New Delhi (1996)

Course Outcomes:

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

1. Apply basic principles of stoichiometry and material balance on unit operations and processes
2. Identify equations of state and properties of gases and liquids, including phase transition
3. Evaluate humidity with / without the use of psychometric chart.
4. Demonstrate elementary flow-sheeting, material and energy balance calculations with out and with chemical reactions, and involving concepts like recycle, by pass and purge.
5. Developmasteryoverprocesscalculationsrelevanttochemicalengineeringprocesses

CHEMICAL ENGINEERING FLUID MECHANICS

II Year B. Tech. I- Sem

L	T	P	C
3	1	0	4

Pre Requisites: Basic of Hydrostatics and Hydrodynamics-Mechanics of Fluid flow

Course Objectives:

1. To describe the fundamentals of stoichiometric relations to calculate composition of different mixtures and solutions.
2. To solve problems on mass balance, using, different gas laws, vapor pressure laws and humidity concept and psychometric charts
3. To demonstrate enthalpy balance concept needed for solution of energy balance of different chemical engineering processes in industries.

UNIT- I

Unit operations and unit processes, unit systems, basic concepts, 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, pump work in 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, Dimensional analysis including Buckingham π Theorem and Rayleigh's method.

UNIT- III

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 meters- Rotameter.

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

Text Books:

1. Unit Operations of Chemical Engineering by W. L. Mc- Cabe, J. C. Smith & Peter Harriot, McGraw-Hill, 7thed, 2007
2. Chemical Engineering Fluid Mechanics by Ron Darby, CRC Press, 2nd Edn,2001

Reference Books:

1. Transport processes and unit operations by Christie J. Geankoplis, PHI (2009).
2. Chemical Engineering, Vol-I, Coulson and Richardson, Pergamon Press (1991).

Course Outcomes:

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

1. Illustrate by simplification of equations of motion in simple1-D flows
2. Calculate Boundary layer thicknesses, friction factor, pressure drop
3. Explain about the compressible fluid flow
4. Design fluidized and packed beds.
5. Select pump based on their performance and flow measurement by various meters.

PHYSICAL AND ANALYTICAL CHEMISTRY

II Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Objectives:

To impart knowledge and importance of chemical kinetics, catalysis and surface Chemistry and certain concepts of analytical Chemistry.

UNIT-I: Chemical Kinetics:

Introduction, Definition: Order, molecularity, Rate, Kinetics of first and second order reaction. Theories of reaction rates – Collision theory and transition state theory. Theory of unimoleculr reactions – Lindemann's theory. Kinetics of Photochemical rections. Chain reation and their characteristics, steady state treatment – dissociation of HI, reaction between H_2 & O_2.

UNIT-II: Catalysis & Surface chemistry

Characteristics of catalysts, Homogeneous and Heterogeneous catalysis. Characteristics of enzyme catalysis – factor affecting rate of enzyme reaction – Michaelis Menten mechanism.

Concept of adsorption, factors influencing adsorption. Adsorption isotherms – Freundlich, Langmuir, B.E.T theory of adsorption equation. Determination of surface area using B.E.T. method. Adsorption of gases on solids – Physisorption and chemisorption, Applications of adsorption.

UNIT-III: Concepts of Analytical Chemistry

Role of analysis – Classification of analytical methods – Classical and Instrumental. Selecting an analytical method – analytical method validation, sensitivity, limit of detection – precision, accuracy. Quantitative analysis – Gravimetry: Precipitation- types of precipitates, impurities, co-precipitation – post precipitation – conditions for precipitation – precipitation from homogeneous solution – Gravimetric determination of Ni.

UNIT-IV: Chromatography: Principle-Types of adsorption – column chromatography – retention time, retention volume, RF value. Thinlayer chromatography-identification of spots by spraying and other methods: Gas Chromatography: Principle-block diagram of gas chromatograph, functions of each component, detectors-(FID, ECD)-Applications – Qualitative analysis, quantitative analysis, retention time, retention volume, capacity factor, area normalization method: HPLC: Principle, block diagram – functions of each component, stationary phases, eluting solvents, pumps, detectors – quantitative applications of HPLC.

UNIT-V: Spectroscopy: Electromagnetic spectrum – Molecular Spectroscopy – UV visible spectroscopy - Introduction – Definitions – absorbance, transmittance, optical density, molar extinction coefficient. Beer – Lambertt's Law – derivation and applications – Concept of Chromophores and auxochromes, bathochromic and hypschromic shifts – selection rules – Instrumentation – Double beam UV – Spectrophotometer – Applications – Quantitative analysis IR - Introduction – Hook's law – Selection rules – Modes of vibrations – Calculation of number of fundamental principle, vibrations – Applications of IR spectra in the identification of > C = 0, -NH_2, -COOH, -COOR, -$CONH_2$, -OH.

Text Books:

1. Quantitative analysis, R.A. Day & A.L. Underwood Prentice-Hall of India, Pvt. Ltd.
2. Vogel's Text book of Quantitative chemical analysis, J. Mendham, R.C Denny, J.D. Barnes, M J. K. Thomas, pearson education

Reference Books:

1. Elements of Physical Chemistry – Peter Atkins, Oxford Uni Press
2. Advanced Physical Chemistry – Gurudeep Raj, Goel Publishing house
3. Instrumental Methods of Chemical Analysis, BSP Galen W. Ewing.
4. Essentials of Physical Chemistry – Bahl, Tuli and ArunBahl, S. Chand and Company Ltd.,

Course Outcomes:

The students will acquire knowledge of

1. Concepts of Chemical kinetics, catalysis and surface Chemistry
2. Basic concepts of Analytical Chemistry
3. The student can acquire the knowledge of Chromatography and Spectroscopy

BASIC ELECTRICAL ENGINEERING

II Year B. Tech. I- Sem

L	T	P	C
3	0	0	3

Pre- Requisites:

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits.
3. To study and understand the different types of DC/AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.

UNIT-I

D.C. CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

Time-domain analysis of first-order RL and RC circuits.

UNIT-II

A.C. CIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit.

Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

TRANSFORMERS

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV

ELECTRICAL MACHINES

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT-V

ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits.
3. To study the working principles of Electrical Machines.
4. To introduce components of Low Voltage Electrical Installations.

FLUID MECHANICS LAB

II Year B. Tech. I- Sem

L	T	P	C
0	0	3	1.5

Pre Requisites: Chemical Engineering Fluid Mechanics

Course Objectives:

1. Verify Bernoulli's equation using Bernoulli's apparatus.
2. Analyze and compare orifice and venturi coefficients.
3. Test the characteristics of centrifugal pump.

List of Experiments

1. Identification of laminar and turbulent flows
2. Measurement of point velocities
3. Verification of Bernoulli's equation
4. Calibration of Rotameter
5. Variation of Orifice coefficient with Reynolds Number
6. Determination of Venturi coefficient
7. Friction losses in Fluid flow in pipes
8. Pressure drop in a packed bed for different fluid velocities
9. Pressure drop and void fraction in a fluidized bed
10. Studying the coefficient of contraction for a given open orifice
11. Studying the coefficient of discharge in a V-notch
12. Studying the Characteristics of a centrifugal pump

Course Outcomes:

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

1. Understand the concept of fluid flow phenomena and the types of flow by calculating Reynolds Number.
2. Calibrate the flow meters with actual discharge, characterize the centrifugal pump and its efficiency
3. Calculate the coefficient of contraction in an orifice and venture meters.
4. Calculate the pressure drop in packed bed for different velocities.
5. Calculate the discharge coefficient in notches.
6. Interpret the data and prepare formal lab reports describing the obtained experimental results.

PHYSICAL AND ANALYTICAL CHEMISTRY LAB

II Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Pre Requisites: Physical and Analytical Chemistry

Course Objectives:
1. To determine the partition coefficient using adsorption technique.
2. To describe the chemical kinetics for a given reaction.
3. To analyze given sample using various chromatographic and spectroscopic techniques.

List of Experiments:
1. Verification of Freundlich adsorption-adsorption of acetic acid on animal charcoal.
2. Determination of rate constant of reaction between $K_2S_2O_8$ and KI.
3. Determination of Rate constant of hydrolysis of Methylacetate.
4. Complex preparations: a) $[Ni(DMG)_2]$ b) $[Co(NH_3)_4Cl]\ Cl_2$ c) $[Cu(NH_3)_4]\ SO_4$
5. Estimation of iron in cement using Spectrophotometer.
6. Thin layer chromatography:
   a) Determination of the purity (No. Of compounds present) of a given sample by thin layer chromatography (TLC).
   b) Monitoring the progress of chemical reactions of thin layer chromatography (TLC).
7. Determination of R_f values of *p*-nitoraniline and *o*-nitroaniline using TLC technique.
8. Determination of stability constant by Job's method – Cu EDTA Complex.
9. Redox titrations by Potentiometry. Estimation of Ferrous iron.

Suggested Books:
1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition- J.Mendham et al, Pearson Education.
2. Practical Manual of Analytical Chemistry- Neelam, Singh, Navneet Kaur and Kanchan kohli.

Course Outcomes: At the end of the course, student will be able to
1. Apply adsorption technique to estimate the partition coefficient value.
2. Study the chemical kinetics and interpret the order from the given chemical reaction.
3. Apply spectroscopic and thin layer chromatographic techniques by determining the purity and observing the progress of given sample.
4. Estimate the amount of dissolved oxygen and sulphates in water.
5. Perform redox titrations by using potentiometric technique.
6. Interpret the data and prepare formal lab reports describing the obtained experimental results.

BASIC ELECTRICAL ENGINEERING LAB

II Year B.Tech. I-Sem

L	T	P	C
0	0	2	1

Pre-Requisites: Basic Electrical Engineering

Course Objectives:

- To analyze a given network by applying various electrical laws and network theorems
- To know the response of electrical circuits for different excitations
- To calculate, measure and know the relation between basic electrical parameters.
- To analyze the performance characteristics of DC and AC electrical machines

List of Experiments/Demonstrations:

1. Verification of Ohms Law.
2. Verification of KVL and KCL.
3. Transient Response of Series RL and RC circuits for DC excitation.
4. Transient Response of RLC Series circuit for DC excitation.
5. Resonance in series RLC circuit.
6. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
7. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer.
8. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
9. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
10. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
11. Performance Characteristics of a Separately/Self Excited DC Shunt/Compound Motor.
12. Torque-Speed Characteristics of a Separately/Self Excited DC Shunt/Compound Motor.
13. Performance Characteristics of a Three-phase Induction Motor.
14. Torque-Speed Characteristics of a Three-phase Induction Motor.
15. No-Load Characteristics of a Three-phase Alternator.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

References:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Outcomes:

- Get an exposure to basic electrical laws.
- Understand the response of different types of electrical circuits to different excitations.
- Understand the measurement, calculation and relation between the basic electrical parameters
- Understand the basic characteristics of transformers and electrical machines.

ENVIRONMENTAL SCIENCE

II Year B.Tech. I-Sem

L	T	P	C
2	0	0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity. Structural features, Biotic structure, Abiotic structure, Ecological succession, Types of Ecosystems, Field visits.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies. **Food recourses**: Desertification, Equitable use of resource for sustainable use style.

UNIT-III

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. Landslides, floods, cyclones. **Noise Pollution:** Sources and Health hazards, standards, **Thermal pollution:** Introduction, causes and consequences. **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

Text Books:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

2 Environmental Studies by R. Rajagopalan, Oxford University Press.

Reference Books:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

CHEMICAL ENGINEERING THERMODYNAMICS–I

II Year B. Tech. II-Semester

L	T	P	C
3	0	0	3

Pre Requisites: NIL

Course Objectives:

1. To provide the knowledge on basics of thermodynamics like system, properties, processes, reversibility, equilibrium, phases, components; the relationship between heat and work.
2. To learn in details the laws of thermodynamics and their applications; thermodynamic relations
3. To learn the basics of sensible& latent heat effects of industrial processes

UNIT- I

Introduction: The scope of thermodynamics, temperature, defined quantities; volume, pressure, work, energy, heat, Joules Experiment.

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

Heat effects: Sensible heat effects, Latent heats of pure substances, heat effects of industrial reactions, heat effects of mixing processes. Standard heat of reaction, Standard heat of formation, Standard heat of combustion, temperature dependence of heat of reaction

Power cycles: Carnot cycle, Rankine cycle.

UNIT- V

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.

Thermodynamic properties of fluids: Property relations for homogeneous phases, Maxwell relations, residual properties, thermodynamic diagrams, generalized property correlation for gases. Turbines, Throttling process, compression process.

Text Books:

1. J. M. Smith and HC Van Ness, Introduction to Chemical Engineering Thermodynamics, 7th ed, McGraw Hill,2005.

Reference Books:

1. Y. V. C. Rao, Chemical Engineering Thermodynamics, Universities Press (1997).
2. K. V. Narayanan, Chemical Engineering Thermodynamics, PHI, 2013.

Course Outcomes:

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

1. Apply fundamental concepts of thermodynamics to engineering applications
2. Estimate thermodynamic properties of substances in gas and liquid states
3. Apply mass, energy and entropy balances to flow processes.
4. Describe about various power cycles.
5. Understand the thermodynamic properties of fluids.

MECHANICAL OPERATIONS

II Year B. Tech. II -Sem

L	T	P	C
3	1	0	4

Pre Requisites: NIL

Course Objectives:

1. To describe the numerous industrial operations dealing with the particulate solids, their handling in various unit operations, and those in which particle- fluid interactions are important.
2. To explain fluid-particle mechanics, such as the notion of drag, and builds on those fundamentals to develop design concepts for various industrial processes like packed bed operation, fluidized operations, sedimentation, filtration, separation of solids and fluids, etc. Industrial applications are discussed.
3. To explain the methods of separations based on motion of a particle through fluids.
4. To describe the working of size reduction equipment's

UNIT- I

Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate mass, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids. Transportation of solid particulate mass, belt, screw, apron conveyers, bucket elevators, pneumatic conveying.

UNIT- II

Size reduction: Principles of comminution, 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 equipments, Effectiveness of the screen, differential & cumulative analysis.

UNIT- III

Separations based on motion of particles through fluids, gravity settling processes and centrifugal settling processes, float and sink method, differential settling, design of thickeners, coagulation, cyclone separator, electro-static precipitators.

UNIT- IV

Filtration, cake filters, centrifugal filters, principles of cake filtration. Clarifying filters, liquid clarification, gas cleaning, and principles of clarification.

UNIT- V

Introduction to membrane separations, cross flow filtration, permeate flux for ultra-filtration, concentration polarization, particle rejection of solutes, micro filtration, electrostatic separation, magnetic separator, flotation and flotation agents.

Text Book:

1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc. Graw Hill 7thedn. 2001.

Reference Books:

1. Chemical engineers hand book, J.H. Perry, 7th ed. Mc- Graw Hill
2. Introduction to Chemical Engineering by J.T. Banchero & W.L Badger, TMH, 1997.

Course Outcomes:

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

1. State the significance and usage of different particulate characterization parameters and equipment to estimate them
2. Describe size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment.
3. Calculate the drag force and terminal settling velocity for single particles.
4. Calculate pressure drop in fixed and fluidized beds
5. Analyze filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage.

PROCESS HEAT TRANSFER

II Year B. Tech. II- Sem

L	T	P	C
3	1	0	4

Pre Requisites: Chemical Engineering Fluid Mechanics

Course Objectives:

1. To differentiate various modes of heat transfer
2. To formulate the equations for calculating heat flux for conduction, convection, radiation, boiling, condensation
3. To develop the governing equations for designing and analyzing heat transfer equipment

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, countercurrent 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 laminar 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.

Heat transfer to fluids with phase change: Heat transfer from condensing vapors; heat transfer to boiling liquids.

UNIT- IV

Natural convection: Natural convection to air from vertical shapes and horizontal planes, effect of natural convection in laminar-flow heat transfer.

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 semitransparent 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 and heat transfer in packed beds.

Evaporators: Evaporators, performance of tubular evaporators, capacity and economy, multiple effect evaporators, methods of feeding, vapor recompression.

Text Books:

1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc. Graw Hill 7thedn. 2001.

2. Process Heat Transfer, D.Q. Kern, Tata McGraw-Hill, New Delhi, 1997.

Reference Books:

1. Holman, J. P.S. Bhattacharya, Heat Transfer,10thEd., Tata McGraw- Hill(2011).
2. Chemical Engineering, Volume-I, J. Coulson and R.F. Richardson, Pergamon Press.

Course Outcomes:

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

1. Explain the fundamentals of heat transfer and identify principles of different modes of heat transfer
2. Illustrate the various heat exchange equipment and calculate various heat transfer coefficients.
3. Explain the importance of thermal boundary layer and forced convection.
4. Explain in detail about natural convection and radiation.
5. Apply the principle of heat transfer in heat exchanger, evaporator design.

MANAGEMENT FUNDAMENTALS FOR ENGINEERS

II Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.

UNIT I :(a) **Introduction to Management** Evolution of Management, Nature & Scope-Functions of Management-Role of Manager-levels of Management-Managerial Skills - Challenges- Social Responsibility &Ethics.
(b) Planning & Organizing: Planning-Planning Process-Types of Plans-MBO-Organization Design - Organizational Structure- Departmentation–Delegation-Centralization - Decentralization-Recentralization-Organizational Culture-Organizational climate- Organizational change

UNIT II: Human Resource Management –Human Resource Planning - Recruitment & Selection –Types & Process of Selection-Training & Development -Performance appraisal methods- Employee Separation-Stress Management Practices-cross cultural Management-Diversity.

UNIT III: Operation Management- Introduction to Operations Management-Principles and Types of Plant Layout-Methods of production (Job Batch and Mass production) - Method study and Work Measurement-Quality Management - TQM-Six sigma - Inventory Management – EOQ - ABC Analysis - JIT System-Business Process Re-engineering (BPR)- Bench marking.

UNIT IV: Marketing Management- Introduction to Marketing-Functions of Marketing-Marketing vs. Selling-Marketing Mix - Marketing Strategies - Product Life Cycle - Market Segmentation -Types of Marketing - Direct Marketing -Network Marketing - Digital Marketing- Social media marketing - Supply Chain Management (SCM).

UNIT V: Project Management- Introduction to Project Management-steps in Project Management - Project Planning - Project Life Cycle-Network Analysis-Program Evaluation & Review Technique(PERT)-Critical Path Method(CPM) - Project Cost Analysis - Project Crashing - Project Information Systems-Project Risk Management.

Suggested Readings:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Principles of Management, Anastasia H. Cortes, David S. Bright, and Eva Hartmann 2019.
3. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
4. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
5. Industrial Engineering and Management: Including Production Management, T.R.Banga, S.C Sharma, Khanna Publishers.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

ORGANIC CHEMISTRY

II Year B.Tech. II-Sem

L	T	P	C
3	0	0	3

Pre Requisites: **NIL**

Course Objectives: The fundamental basic mechanisms of various types of Chemical reactions and isomerism are necessary to understand the procedures of synthetic techniques. The classification of drugs and mechanism of drug action, and heterocyclics as basic components of various drugs are very important for a chemical engineer.

UNIT-I:

Bond fission: Homolytic and heterolytic fission of a covalent bond. Types of Reagents: Electrophiles, nucleophiles and free radicals. structure, reactivity, characteristics. **Polar effects** – Inductive effect electromeric effect: resonance, hyper conjugation. The influence of these effects on the acidity and basicity of organic compounds. **Oxidising agents** $K_2Cr_2O_7$, $CosO_4$, Lead Tetra acetate, **Reducing agents –** $SnCl_2$, $LiAlH_4$, $NaBH_4$, Ni – H_2/ Pd.

UNIT-II:

Electrophilic reactions: Introduction – Mechanisms and synthetic applications - a) Friedel-Crafts reactions b) Riemer- Tiemenn Reaction c) Beckmann rearrangement **Nucleophillic reactions**: Introduction, mechanisms and applications of a) Aldol condensation b) Suzuki Reaction c) Heck reaction. **Free radical reactions**: a) Halogenation of Alkane b) Addition of HBr to Alkene in the presence of peroxide c) Allylic halogenation using N-Bromo succinimide (NBS)

UNIT-III:

Drugs: Introduction -Classification by pharmacological effects by chemical structure by target system and by site of action. Pharmacophores - Introduction. Mechanism of drug action: action at enzymes and at receptors. Lipenski rule, Introduction to structure-activity relationships. Classification and examples of antihistamines, antibacterial, anti-inflammatory, antifungbal, antibiotics, anti-cancer agents. Chemotherapy.

UNIT -IV:

Green Chemistry: Introduction, principles of Green Chemistry - Green synthesis, atom economy, solvent free reactions, reactions in solid state, microwave assisted organic synthesis- green catalysts. Introduction to phase-transfer catalysis. Ultra sound assisted reactions. Use of Ionic liquids as green solvents. Advantages and limitations.

UNIT-V:

Heterocyclic compounds: Nomenclature-preparation, properties and uses of Pyrrole, Furan, Pyridine, Quinoline and Isoquinoline. IPRs and Patents: - Intellectual property rights, patents, role of patents in drug industry.

Text Books

1. Text book of Organic Chemistry – Morrison and Boyd.
2. Medicinal Chemistry by Ashutosh Khar, New Age Publications.

Reference Books.

1. Heterocyclic Chemistry by T.Gilchrist
2. Heterocyclic Chemistry – J.A.Joule, K.Mills and G.F.Smith

Course Outcomes:

The basic concepts included in the syllabus will help the student

1. To gain knowledge of reactive intermediates, oxidizing and reducing agents.
2. To improve knowledge of principles related to eletrophilic, nucleophilic and free radical reactions.
3. To learn about the mechanism of drug action and structure of drug molecule and its relation with physiological activity.
4. To know about concepts of green chemical reactions and synthetic methods for Heterocyclic compounds.
5. To make the student aware of intellectual properties and patents.

MECHANICAL OPERATIONS LAB

II Year B. Tech. II- Sem

L	T	P	C
0	0	3	1.5

Pre Requisites: Mechanical Operations

Course Objectives:

1. Estimate the average size of the particles in a given feed and verify the various crushing laws using size reduction equipment with various mesh screens.
2. Calculate the thickener area using batch sedimentation data.
3. Calculate the reduction ratio of a given sample in a grinder.

List of Experiments

1. Sampling of an ore from the bulk by
   (i) Coning and quartering method. (ii) Riffle sampler.
2. Determination of average particle size of a given material by sieve analysis.
3. Determine the average particle size of a given sample by optimum sieve analysis
4. Verification of Stoke's Law.
5. Size reduction of the given material using Jaw Crusher and determine the reduction ratio.
6. Size reduction of the given material using Roll Crusher and verification of comminution laws.
7. Size reduction of the given material using Ball Mill and determine the reduction ratio.
8. Calculate the thickener area from the batch sedimentation process under the given conditions.
9. Determine the specific cake resistance and filter medium resistance of a slurry in plate and frame filter press.
10. Calculate the separation efficiency of particles in a mixture using cyclone separator.
11. Determination of recovery percentage of the concentrate by Froth- Floatation process.

Course Outcomes:

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

1. Pick or take a representative amount of sample and conduct sieve analysis.
2. Determine the reduction ratio in crushing and grinding of different materials using various size reduction units.
3. Evaluate the recovery percentage from froth flotation unit and thickener area.
4. Interpret the data and prepare formal lab reports describing the obtained experimental results.
5. Calculate power consumption of crushers by using laws

PROCESS HEAT TRANSFER LAB

II Year B. Tech. II- Sem

L	T	P	C
0	0	3	1.5

Pre Requisites: Process Heat Transfer

Course Objectives:

1. Categorize various heat transfer processes and equipment like heat exchangers and evaporators.
2. Impart the knowledge in heat transfer measurements and different heat transfer equipment.
3. Demonstrate about natural and forced convection.

List of Experiments:

1. Determination of total thermal resistance and thermal conductivity of composite wall.
2. Determination of thermal conductivity of a metal rod.
3. Determination of natural convective heat transfer coefficient for a vertical tube
4. Determination of critical heat flux point for pool boiling of water.
5. Determination of forced convective heat transfer coefficient for air flowing through a pipe
6. Determination of overall heat transfer coefficient in double pipe heat exchanger.
7. Determination of heat transfer coefficient for a helical coil in an agitated vessel.
8. Study of the temperature distribution along the length of a pin-fin under natural and forced convection conditions
9. Estimation of un-steady state film heat transfer coefficient between the medium in which the body is cooled.
10. Determination of Stefan – Boltzmann constant.
11. Determination of emissivity of a given plate at various temperatures.

Course Outcomes:

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

1. Explain the basic heat transfer principles.
2. Calculate the natural and forced convective heat transfer coefficients.
3. Understand the concept of boiling and condensation processes.
4. Calculate Stefan-Boltzmann constant.
5. Calculate the emissivity for a given plate at various temperatures.
6. Interpret the data and prepare formal lab reports describing the obtained experimental results.

ORGANIC CHEMISTRY LAB

II Year B. Tech. II- Sem

L	T	P	C
0	0	2	1

Pre-Requisites: Organic Chemistry Course

Course Objectives:

1. To determine the acid, iodine and saponification value of a given sample.
2. To estimate the glucose and cellulose content in a given sample.
3. To prepare various organic compounds from the given synthesis techniques.

List of Experiments:

1. Determination of Acid value of Coconut oil
2. Determination of Iodine value
3. Determination of Saponification value
4. Estimation of aniline
5. Estimation of available chlorine in bleaching powder
6. Estimation of glucose
7. Determination of capacity of a Cation exchange resin
8. Preparation of soap
9. Preparation of phenol formaldehyde resin – Nylon 6
10. Preparation of benzanilide from benzophenone
11. Cycloaddition of anthracene with maleic anhyhdride

Preparation of drug molecules:

12. Preparation of aspirin from salicylic acid
13. Preparation of paracetamol from *o*-nitrophenol
14. Synthesis of 2-styrylbenzimidazole
15. Synthesis of N arylphthalimide from phthalic anhydride and p.toluidine
16. Synthesis of 2- methyl quinolone from aniline and ethyl acetoacetate
17. Preparation of Phthalimide from Phthalicanhydride using green methodologies.
18. Preparation of hand sanitizer.

Suggested Books:

1. Quantitative and Qualitative analysis in Organic Chemistry- A.I.Vogel.
2. Laboratory Manual of Organic Chemistry -R.K. Bansal

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

1. Interpret the acid, iodine and saponification values for any given sample.
2. Estimate glucose and cellulose content for a given sample.
3. Apply the preparation techniques for soap and resin.
4. Prepare aspirin from the given organic compound and reaction involved in it.
5. Perform various synthesis reactions.
6. Interpret the data and prepare formal lab reports describing the obtained experimental results.

CONSTITUTION OF INDIA

II Year B. Tech. II- Sem

L	T	P	C
2	0	0	0

Course Objectives

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

UNIT-I: History of Making of the Indian Constitution- History of Drafting Committee - Philosophy of the Indian Constitution- Preamble Salient Features

UNIT-II: Contours of Constitutional Rights & Duties - Fundamental Rights

- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

UNIT-III: Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT-IV: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT-V: Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
4. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution

4. Discuss the passage of the Hindu Code Bill of 1956.