CHEMICAL PROCESS CALCULATIONS (17241101)

Category	Title	Code	Credits-3			Theory Paper
Departmental Core-DC	Chemical Process Calculation	17241101	L	T	P	Max.Marks-30 Duration-2hrs.
			3	-	-	

Course Objective:
To understand and apply the basics of calculations related to material and energy flow in the processes.

Syllabus:

Unit-I: Mathematical and Engineering Calculations:- Units and dimensions, conversion units, expression and equations, Dimensional groups and constants, stochiometric and composition relationships, conversion of mass, mass and volumetric reactions, basis of compositions, Excess reactants , degree of completion.
Unit-II: Ideal Gases & vapor Pressure: Behavior of ideal gases, Gaseous mixtures, vapor pressure , Clausius Clapeyron equation, Cox chart, Duhring's plot, Raoult's law, Humidity and saturation, relative humidity, humid volume, dew point, humidity chart and its use.
Unit-III: Material Balance: Crystallization, dissolution, solving material balance problems with and without simultaneous equations, Recycle, bypass and purge calculations
Unit-IV: Energy Balance: Heat capacity, calculation of enthalpy changes, Energy balance with chemical reactions,
Unit-V: Heat of vaporization, Heat of formation, Laws of thermo chemistry, Heat of combustion of fuels, Heat and Theoretical flame temperature, Case study of selected problems.

Course Outcomes: After the completion of this course, Students will be able to:

CO1: Express the composition and density of a mixture in different ways.
CO2: Explain vapor pressure, vapor pressure plots, Raoult's law, and humidity.
CO3: Solve material balance problems without chemical reactions.
CO4: Perform material and energy balance calculations by hand and using a computer package.
CO 5 Analyze analyze the behavior of recycle processes, performing approximate material balances by hand, and setting up calculations for rigorous solution by computer.
CO 6: Solve material balance without chemical reaction with and without recycle.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1		1								1		2
CO 2	3	3	2		1	1						1	1	2
CO 3	3	3	2	2	2	2	2		1		1	2	1	3

CO 4	3	3	2	2	2	2	2			1	1	2	3	3
CO 5	2	3	3	3	1	1	1	1			1	1	3	3
CO 6	2	3	3	3	1	1	1			1	1		1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1.O.A. Hougen, K.M. Watson, R.A. Ragatz (CBS publications New Delhi 1995 edition)- Chemical Process Principles**,** part-I

Reference Books

1.David M. Himmelbau(prentice Hall ,sixth edition Feb. 1999)- BASIC PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING.
2. B.L.Bhatt, S.M. Vora(Tata Mc-Graw –Hill, 1996) STOCHIOMETRY.

COMPUTER PROGRAMMING (17241102)

Category	Title	Code	Credits-2			Theory Paper
			L	T	P	
Engineering Science Course - ESC	Computer Programming	17241102	2	-	-	Max.Marks-30 Duration-2hrs.

Course Objectives:

- To develop the understanding of algorithms, programming approaches and programdocumentation techniques.
- To study the concepts of procedural oriented programming.
- To design and implement basic programming solutions using programming constructs.

Syllabus:

Unit I

Introduction to Programming: Types of Computer Programming Languages, Program Execution and Translation Process, Problem Solving using Algorithms andFlowcharts. Introduction to C++ Programming: Data Types, Constants, Keywords,Variables, Input/Output function, Operators & Expressions, Precedence of Operators.

Unit II

Loops and Decisions: Relational Operators, Decisions statements (if...else, switch…case), Loops (for, while, do…while), nested control statement, Conditional & Logical Operators, Bitwise Operator (AND, OR, NOT, XOR), Other ControlStatements (break, continue, goto).

Unit III

Function and Array: Function (Declaration, Calling, Definition), Passing Arguments to Functions, Passing Constants, Passing Variables, Passing by Value, Returning Values from Function, Recursion. Arrays, Accessing Array Elements, Multidimensional Arrays, Passing Arrays to Functions, Strings.

Unit IV

Pointers & Structure: Pointer, Address-of (&) Operator, Syntax Quibbles,

Pointers and Arrays, Pointers and Functions, Structure, Structure Variable, Accessing Structure Members, Other Structure Features, Structures within Structures, Structures asArguments in function.

Unit V

Memory Allocation and Streams & Files: Dynamic Memory Allocation using New and Delete Operators, File handling concept, Disk File I/O with Streams, Error Handling in File I/O.

RECOMMENDED BOOKS

- C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
- Programming with C++, D Ravichandran, T.M.H.
- Computing Concepts with C++ Essentials, Horstmann, John Wiley.
- The Complete Reference in C++, Herbert Schildt, TMH.
- Fundamentals of Programming C++, Richard L. Halterman.
- Object Oriented Programming in C++, Robert Lafore.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1: design programs for solving various Problems in C++ using appropriate datatypes.

CO2: analyze C++ programs using various control structures.

CO3: apply functions and arrays effectively in C++ to create modular and efficientprograms.

CO4: demonstrate the use of pointers and structures for various purposes to make theprogram dynamic & structured.

CO5: manage memory allocation issues, file and I/O errors.

FLUID MECHANICS (17241103)

Category	Title	Code	Credits-3			Theory Paper
Departmental Core-DC	Fluid Mechanics		L	T	P	Max.Marks-30 Duration-2hrs.
			2	1	-	

Course Objective:
To understand the basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery like pumps and various flow meters.

Syllabus:

Unit –I: Introduction: Properties of fluid, forces on fluid, stresses, the concept of constitution relations, fluid statics, Normal forces in fluid, pressure measurement, forces on submerged bodies, buoyancy, Stability.

Unit-II: Classification of Fluids: Newtonian and Non – Newtonian fluid, Viscosity measurement, Equations of changes: Equation of Continuity & Equation of Motion, Navier stokes equation, concept of Reynolds number and friction factor: friction for rough and smooth pipes, loss of head due to friction in pipes and fittings.

Unit-III: Boundary layer theory, Bernoulli's equation, fluid machinery, pumps, fans, blowers, compressors and vacuum pumps, Power and head requirement for pumps.

Unit-IV: Flow of incompressible fluid in conduits and thin layers, flow past immersed bodies, Dimensional analysis, Buckingham π- Theorem, dimensionless numbers and their significance, similitude criteria.

Unit-V: Measurement of Flow: Fluid flow Measurement pitot tube, orifice meter, venture meter, rotameter, weirs and notches.

Course Outcomes: After the completion of this course, Students will be able to

CO1: Explain the properties of fluids and how they affect fluid motion
CO 2: Identify the equipment needed to measure fluid flow
CO 3: Design piping for fluid flow in different conditions
CO 4: Calculate energy losses when transporting fluids through pipes
CO 5: Choose the right pump for different fluids and conditions
CO 6: Analyze the basic principles of static and dynamic fluid systems

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	1	1		1	1				1	1		2
CO 2	1	3	2	1	1	1						1	1	2
CO 3	3	3	2	2	2	2	2		1		1	2	1	3
CO 4	3	3	2	2	2	2	2			1	1	2	3	3
CO 5	2	3	3	3	1	1	1	1			1	1	3	3
CO 6	2	3	3	3	1	1	1			1	1		1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1.W.L. Mc Cabe & J.C. Smith- UNIT OPERATIONS IN CHEMICAL ENGG- 7rd edition Mc Graw Hill.

Reference Books

1. J.M. Coulson & J.F. Richardson- Chemical Engineering- Vol I & II.
2. B.S. Maney, Zel(SI) Van Nostand & Reinhold- Mechanics of Fluid-ELBS, 1970.
3. I. Grannet- Fluid Mechanics for Engineering and Technology.
4. S.K. Gupta- Momentum Transfer- New Age Publication

MECHANICAL OPERATIONS (17241104)

Category	Title	Code	Credits-3			Theory Paper
			L	T	P	
Departmental Core-DC	Mechanical Operations	17241104	2	1	-	Max.Marks-30 Duration-2hrs.

Course Objective:
To understand basic principles of various mechanical operations & construction and working of the equipments.

Syllabus:

Unit-I: Particulate Solids: Properties of particulate solids, Evaluation of size and shape, surface and population of particles, standard screens and screen analysis of solids. **Size Reduction:** Principles of comminution, size reduction, crushing, grinding, pulverizing and ultra fine size reduction equipment, power requirement in comminution.

Unit-I: Mixing: Mixing of solids, mixing equipment's design and power requirement of mixers, Mixer Effectiveness and Mixing Index.

Unit-III: Separation: Principles of Separation techniques for system involving solids, liquids and gases, Classification, Sedimentation, filtration, separation equipments.

Unit-IV: Transportation and Handling of Solids: Selection and conveying devices for solids: Belt, Chain, Screw- conveyors, elevators and pneumatic conveying devices, Elementary design aspects of the devices

Unit –V: Fluidization & Application: Particulate & aggregative fluidization, Characteristics of fluidized bed due to particle size, size distribution, shape and density, Pressure drop through a fluidized bed, Character of dense phase fluidization as revealed by pressure drop fluctuations, Up flow and down flow fluidization, Fluid Catalytic process, bed drying, Mass transfer in fluidized beds.

Course Outcomes: After the completion of this course, Students will be able to

CO1 **Recognize** the application of Screen Analysis in Industry.
CO2 **Describe** the various methods of size reduction using the various principles.
CO3 **Explain** the separation techniques and equipments.
CO4 **Illustrate** the various process like sedimentation, filtration etc.
CO5 **Classify** the various conveying devices.
CO6 **Illustrate** the fluidization and fluid catalytic process.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1		2	1	1		2	1				1	1		2
CO 2	1	3	2	1		1	1				1	1	1	2
CO 3	3	3	2	1	2	2	2		1		1	2	1	3
CO 4	1	3	2	1	2	2	2			1	1	2	1	3
CO 5	2	3	3	3	1	1	1	1			1	1		3
CO 6		3	1	3	1	1	1			1	1		1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1. Badger & Bencharo- INTRODUCTION TO CHEMICAL ENGG- Tata Mc Grawhill 1998.
2. McCabe Smith- UNIT OPEARATION OF CHEMICAL ENGG, Mc Graw Hill 2001.

Reference Books

1. Coulson & Richordson Vol. 2-CHEMICAL ENGG. New Delhi Asian Book Pvt. Ltd.
2. G.G. Brown- UNIT OPERATIONS-CBS Publications New Delhi 1995.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING (17241105)

Category	Title	Code	Credits-2			Theory Paper
			L	T	P	
Engineering Science Course - ESC	Basic Electrical & Electronics Engineering	17241105	2	-	-	Max.Marks-30 Duration-2hrs.

Course Objective:

- To impart basic knowledge of the DC and AC circuits and their applications.
- To familiarize the students with the basic knowledge of magnetic circuits, transformer, rotating electrical machine and its terminology.
- To make familiarize the students about the working of, various electronic circuits and its importance.

Syllabus:

Unit I - D.C. Circuits Analysis: Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

Unit II –Single-phase AC Circuits: Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor.

Unit III- Magnetic Circuits & Resonance: Magnetic Circuits: Concept of MMF, flux and magnetic reluctance, Self and mutual inductances, Dot convention, coefficient of coupling and coupled circuits. Resonance: Series and Parallel resonance, Bandwidth, Q-factor and selectivity.

Unit IV- Single-phase Transformer & Rotating Electrical Machines: Single phase transformer, Basic concepts, construction and working principal, Ideal Transformer and its phasor diagram at No Load, Voltage, current and impedance transformation, Equivalent circuits and its Phasor diagram, voltage regulation, losses and efficiency, testing of transformers, Construction & working principle of DC and AC machine.

Unit V - Digital Electronics, Devices & Circuits: Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements, operation and conversion, Demorgan's theorem, Logic gates- symbolic representation and their truth table, Introduction to semiconductors, Diodes, V-I characteristic, Bipolar junction transistors and their working, Introduction to CB, CE & CC transistor configurations.

Recommended Books:

1. Basic Electrical and Electronics Engineering, D.P. Kothari &I.J. Nagrath-Tata McGraw Hill

2. Basic Electrical and Electronics Engineering, V N Mittle& Arvind Mittal -Tata McGraw Hill
3. Basic Electrical and Electronics Engineering, S. K Bhattacharya -Pearson
4. Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH
5. Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.
6. Basic Electrical Engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH
7. Integrated Electronics- Millmann& Halkias

Course Outcomes

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

CO 1. Solve dc & ac circuits by applying fundamental laws & theorems
CO 2. Analyze magnetic circuits and resonance characteristics of ac electric circuits
CO 3. Describe the working principle, construction, applications of single phase transformer & rotating electrical machines
CO 4. Select the logic gates for various applications in digital electronic circuits.
CO 5. Explain the characteristics and parameters of Diode and Transistor.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Bachelor of Technology Grading Scheme 2024-2025 SESSION (Flexible Curriculum) [Applicable to B. Tech.]						
S. No.	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**C**
1	**-**	**Universal Human Values& Professional Ethics**	**2**	**0**	**0**	**GRADE**

Mode of teaching: The course is intended to be taught through lectures, discussions, case Studies, practice sessions, and assessment by self, peers, and instructor/teacher.

Mode of Exam:

Course Objectives: The objective of the course is four fold:

1. Sensitization of student towards self, family (relationship), society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Content:

1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:

- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

2: Understanding Harmony in the Human Being:

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of 'I' with the Body

3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society

4: Understanding Harmony in the Nature and Existence - existence as Coexistence:

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of naturerecyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in allpervasive space
- Holistic perception of harmony at all levels of existence.

5: Holistic Understanding of Harmony on Professional Ethics:

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
  a. Ability to utilize the professional competence for augmenting universal human order
  b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
  c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  b. At the level of society: as mutually enriching institutions and organizations

Gender Sensitisation:

- Introduction to Sex, Gender & Culture
- Introduction to Women Studies and Socialisation, including man-woman relationship, work distribution
- A brief review of Feminism, Patriarchy, Feminist Studies, Feminist Ideologies.
- Women and Law Constitutional Provisions and Fundamental rights related to Women.

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

- CO1. to become more aware of their surroundings, society, social problems and their sustainable solutions.
- CO2. to become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).
- CO3. to apply what they have learnt to their own self in different day-to-day settings in real life.
- CO4. to sustain human relationships and human nature in mind.
- CO5. to have better critical ability.
- CO6. to negotiate living in harmony with self and others.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	-	1	1	1	3	2	1	-	1	-	-

CO2	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**3**	**2**	**1**	**-**	**1**	**-**	**-**
CO3	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**3**	**2**	**1**	**-**	**1**	**-**	**-**
CO4	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**3**	**2**	**1**	**-**	**2**	**-**	**-**
CO5	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**3**	**2**	**1**	**1**	**2**	**-**	**-**
CO6	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**-**	**2**	**-**	**-**

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, ExcelBooks, New Delhi, 2010

Reference Books

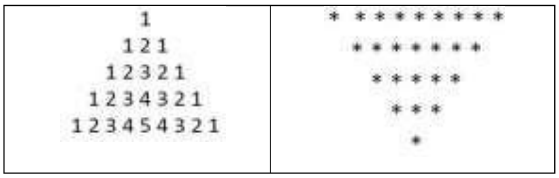
1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. On Education - J Krishnamurthy
6. Siddhartha - Hermann Hesse
7. Old Path White Clouds - Thich Nhat Hanh
8. On Education - The Mother
9. Diaries of Anne Frank - Anne Frank
10. Life and Philosophy of Swami Vivekananda
11. Swami Vivekananda on Himself
12. Small is Beautiful - E. F Schumacher.
13. Slow is Beautiful - Cecile Andrews
14. Economy of Permanence - J C Kumarappa
15. Bharat Mein Angreji Raj - Pandit Sunderlal
16. Mahatma and the Rose
17. The Poet and the Charkha
18. Rediscovering India - by Dharampal
19. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
20. Swaraj by Arvind Kejriwal
21. India Wins Freedom - Maulana Abdul Kalam Azad
22. Ramakrishna ki jeevani - Romain Rolland (English)
23. Vivekananda - Romain Rolland (English)
24. Gandhi - Romain Rolland (English)
25. Autobiography of a Yogi – by Paramhansa Yogananda
26. Gandhi and Question of Science – Sahatsrabudhe

COMPUTER PROGRAMMING LAB (17241106)

Category	Title	Code	Credits-1		
Departmental Laboratory Course-DLC	Computer Programming Lab	17241106	L	T	P
			-	-	2

LIST OF PROGRAMS

1. Write a program to add two numbers and display the result (Hint: declare three variables, take the value of two from user and assign the result into third variable).
2. Write a program to calculate the simple interest.
3. Write a program to swap two numbers.
4. Write a program to find the largest of three numbers using ternary operators.
5. Write a program to find the roots of quadratic equation.
6. Write a program to identify whether the input number is even or odd.
7. Write a program to identify whether the input number is prime number or not.
8. Write a program to calculate the factorial of an input number.
9. Write a program to calculate the Fibonacci series.
10. Write a program to display the following patterns



11. Write a program to add two matrices of the same order.
12. Write a program to arrange given array in increasing & decreasing order using function.
13. Write a program for recursion.
14. Write a program to create student record like name, roll no., grade etc. using structure.
15. Write a program to display the address of a variable.
16. Write a program to manipulate the value of variable using pointers.
17. Write a program to manage student records in a file.
18. Write a program that reads a text file and counts the number of words it contains.

COURSE OUTCOMES

After completing this, the students will be able to:

CO1. apply basic programming concepts.

CO2. develop algorithms and flowchart for a given problem.

CO3. illustrate the concepts of procedural programming.

CO4. implement the concepts of object-oriented programming.

CO5. design suitable programming solutions using procedural/ object-oriented programming paradigms.

CO6. develop computer programs to solve real world problems.

ELECTRICAL & ELECTRONICS ENGINEERING LAB (17241107)

Category	Title	Code	Credits-1		
Departmental Laboratory Course-DLC	Electrical & Electronics Engineering Lab	**17241107**	L	T	P
			-	-	2

LIST OF EXPERIMENTS

1. To verify Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter & measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

Course Outcomes:

After the completion of the lab, the student will be able to –

CO 1.Verify circuit theorems.

CO 2.Perform tests on transformer for determination of losses, efficiency & polarity.

CO 3.Acquire teamwork skills for working effectively in groups

CO 4.Prepare an organized technical report on experiments conducted in the laboratory

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

ENGINEERING CHEMISTRY LAB (17241110)

Category	Title	Code	Credits-1		
Engineering Science Course-ESC	Engineering Chemistry Lab	**17241110**	L	T	P
			-	-	2

Course Objectives: The main objective of the course is to enable the students to become familiar with the concepts of Modern Engineering Chemistry, and impart knowledge on the fundamental concepts of chemistry involved in application of several important engineering materials that are used in the industry/day-to-day life.

UNIT -I Water Analysis

Source and impurities, alkalinity, pH, hardness of water, interrelationship between alkalinity and hardness, degree of hardness, Boiler troubles, Methods of hardness removal, Standards of water for drinking purposes.

UNIT -II Lubricants & Lubrication

Introduction, functions of lubricants, types and classification of lubricants, mechanism of lubrication, physical & chemical properties, testing of lubricants, types of greases, application of lubricants.

UNIT- III Chemical Fuels

Definition and classification of chemical fuels, Requirements of a good fuel. Calorific Value – HCV and LCV. Coal and its Ranking. Proximate and Ultimate analysis of coal. Knocking & Octane and Cetane numbers.

UNIT -IV Polymeric Material

Introduction, types and classification of polymers, Types of polymerization: addition or chain polymerization, condensation polymerization and their mechanism, Preparation of Phenol formaldehyde, Urea formaldehyde Resin.

UNIT- V Analytical Methods

Chromatography- Introduction & Principle of Chromatography, Introduction of Column, Thin layer, paper. Separation of colour pigments by Paper chromatography experiment.

Spectroscopy-Principle Instrumentation and Applications of Ultra-Violet, and Visible Spectroscopy, Absorption law, Verification of Lambert Beer's law, determination of concentration of solute in sample, and determination of λ max of sample solution.

Course outcomes: After studying the course of Engineering Chemistry the student will be able to:

CO1 -Select the best technique for Industrial and domestic water treatment.
CO2 -Describe the types, properties and application of lubricants.
CO3 -Distinguish the chemistry of various fuels and their combustion.
CO4-Describe types, classification properties and applications of polymers and mechanisms of polymerization.
CO5-Explain the concept of chromatography and spectroscopy for various engineering application.

List of Experiments

Subject Name: Engineering Chemistry laboratory
Subject code
B.Tech. (First / Second Sem)

NOTE: At least 10 of the following experiments must be performed during the session.

S.no.	Aim of experiment
1	Determination of Total hardness by Complexometric titration.
2	Determination of temporary and permanent hardness by Complexometric titration.
3	Determination of alkalinity of given water sample by neutralization Titration. (a) OH^- & CO_3^{2-} (b) CO_3^{2-} & $HCO3^-$
4	Determination of percentage of Fe in Iron alloy solution by redox titration.
5	Determination of percentage of Cr in Chromium alloy solution by back titration.
6	Determination of Cu in Copper alloys solution by Iodometric Titration.
7	Determination of Viscosity of given oil sample by Redwood viscometer No.1
8	Determination of Flash & fire points of given oil sample by Pensky Martin close cup Apparatus.
9	Determination of Flash & fire point of given oil sample by Cleveland's open cup Apparatus.
10	Determination of Moisture content, volatile matter content, Ash content and fixed Carbon of a given sample of coal by proximate analysis.
11	Separation of the colour pigment of spinach leaf by paper chromatography**.**
12	Preparation of phenol formaldehyde resin by condensation polymerization.
13	Preparation of urea formaldehyde resin by condensation polymerization.

Course outcomes

Lab CO	Course outcome – Upon successful completion of the course, the student will be able to
CO1	**Develop** experimental skill required for application of chemistry in engineering.
CO2	**Operate** different chemicals and instruments specified in course safely and efficiently.
CO3	**Analyse** water sample, lubricants, fuel, alloys and ores for different properties
CO4	**Function** as a member of a team for problem solving.

MICRO PROJECT -I (17241109)

Category	Title	Code	Credits-1		
Project Based Learning - PBL	Micro Project – I	**17241109**	L	T	P
			-	-	2

List of topics

1. Design and fabrication of a wind tunnel to study the flow around a model of a car or airplane.
2. Investigation of the flow of a fluid through a packed bed of particles.
3. Design and fabrication of a water turbine to study the effects of blade shape on turbine efficiency.
4. Perform the "Float and Sink "experiment at home (with available materials) and interpret the finding.
5. Estimate the factors that affect the settling rate. Calculate/estimate the settling rate for given materials based on experimental study at home.
6. To estimate the angle of repose of different given samples.
7. Design of laminar flow device.
8. Design and fabricate a composite bed filtration unit for water treatment.
9. Design of hydraulic crane.
10. Design of beaker decantation & pipette analysis experiment.
11. Design of a simple water wheel
12. Investigation of flow separation around blunt bodies
13. Working model of a venturimeter.
14. Performing Cumulative and differential screen analysis for a given sample.
15. Building Cox Chart and Duhring's Plot for a given data
16. Building Psychrometric chart for a given system and set of data.
17. Design of Bernoulli's Mist Sprayer.
18. Design of Reynold's Experiment.
19. Demonstrate working of notches.
20. Experimental Determination of terminal settling velocity in the free settling regime.
21. Investigation of dry and wet classification methods.
22. Design of an air cyclone.

COURSE OUTCOMES:

After completion of course students will be able to :

CO1: Formulate problems in the field of flow, separation by reviewing research literature
CO2: Design innovative solutions for complex flow processes, mechanical operations
CO3: Apply appropriate modern engineering and IT tools, to address complex engineering tasks.
CO4: Function effectively as both an individual contributor and a team member or leader demonstrating collaboration and leadership skills.
CO5: Apply engineering ethics and managerial communication principles to effectively manage projects.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1		1	1		1	1	1		1	1		2
CO 2	1	1	2		1	1				1		1	1	2
CO 3	2	3	1	2	2	2	2	1	1	1	1	2	1	3
CO 4	3	1	2	2	2	2	2		3	1	1	2	3	3
CO 5	2	3	3	3	1	1	1	1	2	3	2	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

ORGANIC PROCESS TECHNOLOGY (17241201)

Category	Title	Code	Credits-3			Theory Paper
			L	T	P	
Departmental Core-DC	Organic Process Technology	17241201	3	-	-	Max.Marks-30 Duration-2hrs.

Course Objective:

The purpose of the organic process technology course is to improve knowledge of the chemical processes along with emphasis on recent technological development.

Syllabus:

Unit-I: Pulp and paper industry-Raw Materials, types of pulp and its preparation, Manufacturing of paper, Agro based industries, Fermentation industry, Alcohol by fermentation, Citric acid and Antibiotics like Penicillin.

Unit-II: Intermediates for petrochemicals from petroleum based stocks, phenol, methanol, ethylene propylene, aromatic, toluene and xylene, polymer industries.

Unit-III: Preparation, manufacturing and properties of Fats and oil, manmade fiber; rayon, polyester polyamides and acrylics, cellulose and acetate, Rubber industries, Soap and detergent. Insecticides and pesticides, Dyes and dyes intermediate.

Unit-IV: Carbon Technology: Introduction, Classification of activated carbons, raw materials and manufacture of activated carbons, classification of carbon fibers, precursors for carbon fibers, manufacture of carbon fibers from polyacrylonitrile, manufacture of carbon black by furnace black process, applications.

Unit-V: Nanotechnology: Introduction, properties of Nano particles like optical properties, reactivity, synthesis, Introduction, Structure and properties of carbon Nano-tubes and fabrication of carbon Nano-tubes & applications.

Course Outcomes: After the completion of this course, Students will be able to

CO1: **Explain** the processing of natural products.

CO2: **Describe** microbial processes and edible oil refining process.

CO3: **Elaborate** the processes for producing petrochemicals.

CO4: **Characterize** polymers and elaborate its production processes.

CO5: **Describe** the production processes of fibers.

CO6: Evaluate the different processes from economical aspects.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	1	1	2	1	1	2		2		1
CO2	2	2	2	1		1	2	2	2	1	1	2		1
CO3	2	2	2	2		2	3	1		2		2		
CO4	3	3	2	1		1	1			2		2	1	2
CO5	3	2	1	1			2		2	2		2		1
CO6	3	2	1	1			2		2	2		2		1

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1. Austin, G.T. Shreve's Chemical Process Industries – 5th edition McGraw Hill New York 1984.

2. Dryden C.E., Outlines of chemical technology-3rd edition affiliated East – West Press,New Delhi, 1997.

Reference Books

1. V. B. Gupta & V.K. Kothari- Manufacturing Fiber Technology- Chapman Hall, New York Iedition 1997.
2. V.K. Kothari-Process in Textile, science Technology, Vol –I & II –IAFL publication, S-351Greater Kailash part-I New Delhi.-48 Ed.

CHEMICAL ENGINEERING THERMODYNAMICS (17241202)

Category	Title	Code	Credits-3			Theory Paper
			L	T	P	
Departmental Core-DC	Chemical Engineering Thermodynamics	17241202	2	1	-	Max.Marks-30 Duration-2hrs.

Course Objective:

To understand the basic concepts and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe and predict phase and chemical equilibria.

Syllabus

Unit- I The First law of Thermodynamics and Equations of State: Steady and unsteady closed and flow process, Critical properties corresponding state, Compressibility, P-V-T behavior of pure fluids, Virial-equations, Generalized correlations and eccentric factor.

Unit-II The Second and Third Law of Thermodynamics: Entropy of various systems, Thermodynamics equations, Effect of pressure on specific heat, Joule-Thompson effect, Third law of thermodynamics, Compression of ideal gas, Refrigeration capacity, Carnot cycle, Vapor compression cycle, Air refrigeration cycle.

Unit-III Thermodynamic Properties of Fluids: Thermodynamic properties of homogeneous mixtures, Property relations for systems of variable compositions, Partial properties, Fugacity and Fugacity coefficient in ideal solutions, Properties change of mixing, Activity, Heat effects of mixing process, Excess properties, Activity coefficient of gaseous mixtures.

Unit-IV Phase Equilibria: Criteria of phase equilibrium and stability, Phase equilibrium in single component system, Phase rule, Gibbs-Duhem's equation, Vapor-liquid equilibria.

Unit- V Chemical Reaction Equilibria: Chemical potential, Effect of pressure and temperature on heat of reaction and on free energy, Van't Hoff's equation, Clausius-Clapeyron equation, Chemical Reaction Equilibria and its applications

Course Outcomes: After the successful completion of this course, students will be able to

CO1: infer the fundamental concepts of thermodynamics to chemical engineering applications.

CO2: explain the first and second laws of thermodynamics with their practical implications.

CO3: analyze the processes involving refrigeration and compression.

CO4: classify the thermodynamic properties of solutions with their relationships.

CO5: infer the detail of vapor liquid equilibria and its use in practical situations.

CO6: analyze the chemical equilibrium with thermodynamics for predicting behavior of reacting systems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2					2		2	1	1
CO2	2	2	1	2					1	2		2		
CO3	3	2	2	2	1		1			2		2	1	2
CO4	3	3	2	2	1					1		1	2	1
CO5	3	3	3	2	2		1		1	1	1	2	2	2
CO6	3	2	2	2	1					1		1	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1. Smith J.M. & Van Ness., "Introduction to Chemical Engineering Thermodynamics", McGraw Hill
2. Sandler, S.I., "Chemical Engineering Thermodynamics", John Wiley & Sons
3. Dodge B.F., "Chemical Engineering Thermodynamics", McGraw Hill
4. Narayanan K.V., "Chemical Engineering Thermodynamics", Prentice Hall India Learning Private Limited

Reference Books

1. Balzhiser, Samuels and Eliassen, “Chemical Engineering Thermodynamics”, Prentice Hall.
2. Rao Y.V.C, “Chemical Engineering Thermodynamics”, University Press (I) Ltd., Hyderabad
3. Kyle B.G., “Chemical Process Thermodynamics”, Prentice Hall of India Pvt. Ltd., New Delhi

HEAT TRANSFER OPERATIONS (17241203)

Category	Title	Code	Credits-3			Theory Paper
			L	T	P	
Departmental Core-DC	Heat Transfer Operations	17241203	2	1	-	Max.Marks-30 Duration-2hrs.

Course Objective:

To understand the fundamentals of heat transfer mechanisms in fluids and solids and theirapplications in various heat transfer equipment in process industries.

Syllabus:

Unit – I: Modes of heat transfer one-dimensional and two dimensional, heat rate equations, theory of insulation, critical radius calculations, types of insulation material, conduction through slab, cylindrical and sphere.

Unit-II: Consecutive heat transfer, heat transfer in boundary layer and in film, natural and forced convection, co/ counter /cross current contacting for heat transfer, individual and overall heat transfer coefficient, fouling factor.

Unit- III: Radiative heat transfer, Black body radiation, concept of shape factor, method of determination of shape factor, radiation exchange in enclosure with black surfaces.

Unit-IV: Heat transfer under phase change conditions, boiling and condensation of pure components, heat flux temperature diagram for boiling and condensation under vertical and horizontal surfaces, nucleate and pool boiling, effect of surface condition of condensation, correlation for heat transfer under condensation. Evaporation: Types of evaporators and their applications, single and multiple effect evaporators, Design and operation of forward, backward and mixed feed operations, effect of boiling point elevation and hydrostatic heat vapor recompression.

Unit- V: Heat exchange equipment- General design of shell and tube exchangers, condensers, extended surface equipment, heat exchanger equation – coli to fluid, jacket to fluid, double pipe, shell and finned tube heat exchanger.

Course Outcomes: After the completion of this course, Students will be able to

CO1: Explain the mechanism of heat transfer by conduction, convection and radiation.
CO2: **List** dimensionless Numbers applicable in heat transfer and their physical significance.
CO3: **Illustrate** individual and overall heat transfer coefficient.
CO4: **Explain** all parts of the Heat Exchangers and Evaporators.
CO5: **Analyze** the design of various types of Heat exchangers.
CO6: Analyze the design of various types of Evaporators.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	2	2	1	1	2		2	2	2
CO2	1	2	2	1	1					2		2	2	2
CO3	3	3	2	2	2		1			2		2	3	3
CO4	2	1	2	1			1		1	2		2	1	1
CO5	3	1	2	2	2	1	1	1	2	2	1	2	2	2
CO6	3	1	2	2	2	1	1	1	2	2	1	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1. J. P. Holman – Heat Transfer – P.H.I.

Reference Books

1. Donald Q. Kern- Process Heat Transfer– Tata Mc Graw Hill.
2. Alan J. Chapman- Heat Transfer IV ED. – Collier Mc. Millan.

MASS TRANSFER OPERATIONS – I (17241204)

Category	Title	Code	Credits-3			Theory Paper
			L	T	P	
Departmental Core-DC	Mass Transfer Operations – I	17241204	2	1	-	Max.Marks-30 Duration-2hrs.

Course Objective: The purpose of this course is to introduce the undergraduate students with the most important separation equipments in the process industry, and provide proper understanding of unit operations.

Syllabus:

Unit-I: Diffusion Phenomenon: Molecular and eddy diffusion in gases, liquid and solids, interface mass transfer, Mass transfer theories; film theory, penetration theory and surface renewal theory, Concept of mass transfer coefficient: Individual and film coefficients, overall mass transfer coefficient and their inter relationship. Continuous contact and differential contact.

Unit –II: Absorption: Absorption in continuous contact columns, co- current, counter current and cross current contacting of fluids, Absorption in packed column, calculation ofNTU and HTU, concept of HETP.

Unit –III: Humidification: Humidification: general theory , psychometric chart, fundamental concepts in humidification and dehumidification, wet bulb temperature adiabatic saturation temperature, measurement of humidification calculation of humidification operation, cooling tower and related equipments.

UNIT- IV: Drying: Equilibrium mechanism, theory of drying, drying rate curve, batch and continuous drying for tray dryers, drum dryers, spray and tunnel dryers.

Unit-V: Crystallization: Factor governing nucleation and crystal growth rate, controlled-growthof crystals, super saturation curve, principal and design of batch and continuous type equipment.

Course Outcomes: After the completion of this course, Students will be able to:

CO1: **Explain** the basics of absorption, humidification, drying, crystallization & diffusion.
CO2: **Identify** the necessary information required in design of mass transfer equipment.
CO3: **Analyze** the different cases of diffusion phenomena.
CO4: **Compute** the parameters for mass transfer operations
CO5: **Solve** drying and humidification problems using psychometric charts & equilibrium data.
CO6: **Analyze** favorable conditions for a separation to be carried out.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	1		2		2	2	2
CO2	3	3	3	2	2		1	1	2	2	2	2	3	3
CO3	3	3	2	1	1	1	1			1		2	1	1
CO4	3	3	3	2	2	1	1	1	2	2	1	2	2	2
CO5	2	2	2	1	1					2		2	1	1
CO6	3	3	3	2	2	2	1	1	2	2	1	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Text Books

1. Treybal R. E.–Mass Transfer Operations –3rdEdition, Mc- Graw Hill

Reference Books

1. Mc- Cabe, W.L. Smith J.M.- Unit Operations in Chemical Engineering - 5th edition Tata Mc Graw Hill, New Delhi.
2. Coulson J. M. & Richardson J. F. –Chemical Engineering–Vol.2, 2nd Edition, Oxford, New Delhi

MATRICES, DIFFERENTIAL EQUATIONS & VECTOR CALCULUS (17241205)

Category	Title	Code	Credits-3			Theory Paper
			L	T	P	
Basic Science Course - BSC	Matrices, Differential Equations & Vector Calculus	17241105	3	-	-	Max.Marks-30 Duration-2hrs.

Objective of Course

- To understand the concept Matrices and its applications
- To understand the various aspect of algebraic structures'
- To perceive the transform techniques in engineering problems
- To expose the concept of ordinary and partial differential equations
- To explore the Vector Calculus

Unit 1: Matrix

Matrix, Rank of Matrix, Echelon form, Normal form of matrix, Solution of simultaneous equation by elementary transformation, Consistency of equation,linear dependent vectors and linear independent vectors, Eigen values and Eigen vectors, Cayley Hamilton theorem and its application to find inverse of matrix.

Unit 2: Ordinary Differential equations

Ordinary differential equations of first and higher order, Linear higher order differential equation with constant coefficients, Homogeneous linear differential equation

Unit 3: Second Order Differential equations

Second order differential equations with variable coefficients, Methods: one integral is known, Removable of first derivative, changing of independent variable and variation of parameters & series solution.

Unit 4: Partial Differential equations

Linear and Non-Linear Partial differential equations of first and second order with constant coefficients, Separation of variable method, Application in solution of wave and heat conduction equations (one-dimensional)

Unit 5: Vector calculus

Vector differentiation, Divergence, Gradient and Curl, Directional derivative, Solenoidal and Irrotational vectors, line integration, Vector Integration, Gauss divergence theorem and Stoke's theorem

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Determine the solution of Matrix
CO2	Solve the differential equations by various methods
CO3	Solve Ordinary Differential Equation of Second Order.
CO4	Solve Partial Differential equations application for various engineering problems.
CO5	Use and application of vector calculus

Course Articulation Matrix

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

CO6	2	2	2	2	2								2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Recommended Books:

1. S. Lipschutz and M. Lipson, Linear Algebra (4th Edition), Schaum's Outline series, Mc- Graw Hill.(2009).
2. S. Boyd and L. Vandenberghe, Introduction to Applied Linear Algebra Vectors, Matrices, and Least Squares, University Printing House, Cambridge CB2 8BS, United Kingdom One Liberty Plaza, 20th Floor,New York, NY10006, USA, (2018).
3. E.Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10th Edition (2011).
4. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt. Ltd, 5th Edition (2016).

SUSTAINABILITY & ENVIRONMENTAL SCIENCE (17241212)

Category	Title	Code	Credits - GRADE			Theory Paper
			L	T	P	
Mandatory Audit Course - MAC	Sustainability & Environmental Science	17241212	2	-	-	Max.Marks-30 Duration- 1.5 hrs.

Course Objectives:

To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

SYLLABUS

Unit I

Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural)

Unit II

Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental Issues: Climate change, global warming, ozone layer depletion.

Unit III

Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. **Overview of global environmental policies and frameworks**: Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading.

Unit IV

Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V

Sustainable Energy solutions: New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Introduction to sustainable transportation systems and sustainable water infrastructure.

Course Outcomes:

Upon completion of the course the student will be able to:

CO 1: Explain the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.

CO 2: **Analyze** the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.

CO 3: **Evaluate** the effectiveness of environmental policies and global frameworks in addressing environmental challenges.

CO 4: **Explain** the concepts of sustainability and sustainable development goals.

CO 5: **Apply** various solutions for achieving sustainable development.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Reference Books

1.D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.

2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria& Sons, New Delhi

3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers

4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

FLUID FLOW & MECHANICAL OPERATIONS LAB (17241206)

Category	Title	Code	Credits-1		
Departmental Laboratory Course-DLC	Fluid Flow & Mechanical Operations Lab	**17241206**	L	T	P
			-	-	2

List of Experiments

Experiments to be performed:

Total ten experiments; perform any four experiments from each section.

Section (A): Mechanical Operations

1. Determination of Rittinger's & Kick's constant in respect of the laboratory Jaw Crusher.

2. Determination of effectiveness of screen and perform cumulative analysis of a sample

3. Batch settling study for given slurry and determination of thickener area.

4. Determination of the efficiency of a Ball Mill/Rod Mill for grinding a material of known work index.

5. Study of the operation of a Plate and Frame Filter press in the laboratory.

Section (B): Fluid Mechanics

1. Determination of the discharge coefficient of given Venturi meter, Orificemeter and Rotameter
2. Determination of friction factor and head loss in given pipe assembly.

3. Determination of the discharge coefficient of different notches.

4. Determination of losses through pipes and fittings.

5. Determination of the pressure drop across packed column.

Course Outcomes:

CO 1: Determine the discharge coefficient and use various devices for measuring fluid flow rate.
CO 2: Develop engineering applications involving fluid.
CO 3: Analyze flow systems in terms of mass, momentum, and energy balance.
CO 4: Calculate size reduction ratio, grind ability index using ball mill and jaw crusher.
CO 5: Calculate the effectiveness of a given screen
CO 6: Compute power laws using jaw crusher.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	1	-	-	2	-	1	1	1	1
CO2	3	2	1	1	-	1	1	-	1	-	-	1	-	-
CO3	2	2	1	2	-	1	1	-	-	-	-	1	-	-
CO4	2	3	2	2	1	1	-	1	2	-	1	1	-	2
CO5	2	3	3	2	1	1	-	1	2	-	1	1	-	2
CO6	2	3	3	2	1	1	-	1	2	-	1	1	-	2

PROBLEM SOLVING THROUGH PYTHON PROGRAMMING (17241207)

Category	Title	Code	Credits-1		
Departmental Laboratory Course-DLC	Problem Solving Through Python Programming	**17241207**	L	T	P
			-	-	2

COURSE OBJECTIVES

- To develop the understanding of algorithms, programming approaches and program documentation techniques in Python.
- To study the concepts of procedural and object oriented programming techniques in Python.
- To design and implement basic programming solutions using Python programming constructs.

Unit I

Introduction to Python: Formal and natural languages, Downloading and installing Python. Problem - solving methods and algorithm development. The first program, Variables, expressions, keywords, Operators, Expressions and statements, Interactive mode and script mode, Order of operations. Datatypes: Numeric, string, list tuple, dictionary, set.

Unit II

Function, ways of passing arguments to functions, user defined and inbuilt functions, lambda function. Control Statements: Conditional and unconditional branching, while loop, for loop, loop control statements, range function. Numeric, String, list, tuple, dictionary and set manipulation operations using loops and inbuilt manipulation functions. Packages and modules in python.

Unit III

Exception and File Handling: Errors vs exceptions, Exceptions handling with try block, handling multiple exceptions, writing your own exceptions, file handling modes, reading, writing and appending a file, Handling file exceptions.

Unit IV

Object oriented programming: Characteristics and features of OOPS, Classes and objects, constructors and destructors, defining member variables and functions, visibility modes, static members.

Unit V

Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, polymorphism in python. Inheritance: Introduction, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath. Association,

Aggregation and composition. Array manipulation and visualization using numpy and matplotlib libraries.

RECOMMENDED BOOKS

- Python Crash Course: A Hands-On, Project-Based Introduction to Programming, By Eric Matthes.
- Learn Python the Hard Way: third Edition T.R. Padmanabhan, Programming with Python, Springer, first Ed., 2016.
- Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning, first Ed., 2012.

COURSE OUTCOMES

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

CO1. explain basic syntax and building blocks in python programming language.

CO2. solve computational problem using python programming language

CO3. hands on experience to online coding tools like colab.

CO4. design a program utilizing the features of object oriented concept.

CO5. analyze some of the libraries available for solving problems.

CO6. apply skill of identifying appropriate python constructs for problem solving.

LIST OF PROGRAMS

1. Write a program to demonstrate different number data types in python.
2. Write a program to perform different arithmetic operations on numbers in python.
3. Write a program to create, concatenate and print a string and accessing substring from a given string.
4. Write a python program to create, append and remove lists in python.
5. Write a program to demonstrate working with tuples in python.
6. Write a program to demonstrate working with dictionaries in python.
7. Write a python program to find the factorial of a number using recursion.

8. Write a program to swap two integers without using a third variable. The swapping must be done in a different method in a different class.
9. Write a program to count total number of uppercase and lowercase characters in file
10. Write a python program to define a module and import a specific function in that module to another program.

COURSE OUTCOMES

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

CO1. solve the computational problems using python language.

CO2. apply python lists, tuples, dictionaries for representing compound data.

CO3. design a program utilizing the features of object oriented concept.

CO4. construct the Python code for real-world problems using the libraries.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

MICRO PROJECT -II (17241209)

Category	Title	Code	Credits-1		
Project Based Learning - PBL	Micro Project – II	**17241209**	L	T	P
			-	-	2

List of topics

1. Synthesize organic derivatives from a primary compound.
2. Synthesize and characterize a polymer using emulsion polymerization.
3. Perform the hydrolysis of esters to form soaps (of varying composition) and glycerol.
4. Study the heat transfer characteristics of a heat exchanger.
5. Design a pitot tube to calculate the flow rate of a fluid in a pipe.
6. Develop a flow visualization set-up to observe and analyze laminar and turbulent flow regimes.
7. Assess the mixing performance of different types of impellers in a stirred tank using dye or tracer studies.
8. Compare the drying efficiency of methods such as oven drying, air drying, and microwave drying for a sample of wet powder.
9. Crystallize a compound from different solvents to compare the size and purity of the crystals obtained.
10. Design Stefan's Apparatus to study temperature affects on the diffusion rate of a solute.
11. Study the diffusion of a solute between two immiscible liquids.
12. Conduct case studies of real industrial processes, such as distillation or absorption, using thermodynamic data. Evaluate process efficiency and propose improvements.
13. Perform rate of diffusion loss of drinking water from available extinct water bodies data of a zone which can be rehabilitated.
14. To develop and study hand dryers as an application of humidification-dehumidification aiming to enhance drying efficiency and user comfort.
15. Design and test systems inspired by biological heat exchange processes and evaluate their performance in practical applications.

COURSE OUTCOMES:

After completion of course students will be able to:

CO1: Identify and formulate problems in the field of organic processes, heat and mass transfer by reviewing research literature

CO2: Design innovative solutions for organic processes, flow, heat and mass operations

CO3: Create, select, and apply appropriate modern engineering and IT tools, to address engineering tasks.

CO4: Effectively function as both an individual contributor and a team member or leader demonstrating collaboration and leadership skills.

CO5: Apply engineering ethics and managerial communication principles to effectively manage projects.

Course Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 – Substantially

ENGINEERING PHYSICS LAB (17241210)

Category	Title	Code	Credits-1		
Engineering Science Course-ESC	Engineering Physics Lab	**17241210**	L	T	P
			-	-	2

Course Objectives: The main objective of the course is to enable the students to become familiar with the key areas of physics that are fundamental to emerging technologies and impart knowledge about Quantum mechanics, Lasers, Fiber Optics, Holography, Superconductor, Nano materials, Dielectric materials.

Unit I-Quantum mechanics
Planck's quantum hypothesis, Wave-particle duality of radiation, de-Broglie matter waves, Compton effect, Phase and group velocity, Heisenberg uncertainty principle and its applications.

Unit II -Lasers,
Properties of lasers, the basic process of lasers, Population-inversion, classification of lasers, working of He-Ne, Ruby, Nd: YAG and CO_2 lasers, Applications of Lasers in Communication, Medical and Industry.

Unit III- Fiber Optics,
Light guidance through optical fibers, the qualitative idea of critical and acceptance angle, types of fibers, numerical aperture, V-Number, intermodal &material dispersions in fiber.

UNIT IV Semiconductors & Nanomaterials :
Semiconductor basics P type-N type, Fermi function, Junction Diodes, LED and its working principle, Transistor.
Nanomaterials: Basic principle of nano science and technology, Quantum confinement effect and applications and Properties of quantum dots and Carbon nano tubes, Two-dimensional materials, Metal nano-particles.
UNIT-V Dielectrics Materials
Polar and Non-Polar Dielectrics, Dipole moment and Polarization, Dielectric constant& Polarization, Relation between electric field vectors E, P and D. applications of dielectrics.

Course outcomes: After studying the course of Engineering Physics the student will be able to:
CO1-Explain the quantum physics and applies it to the behaviour of a system at the microscopic level and solve the problems.
CO2-Interpret the requirements classification, properties and application of laser
CO3-Describe the basic concepts about optical fibers
CO4- Explain the principle, types, properties and application of semiconductors and nano-materials
CO5- Apply the knowledge of characteristic of Dielectrics and Piezoelectric materials

List of Experiments

Subject Name: Engineering Physics laboratory

Subject code

B.Tech. (First / Second Sem)

NOTE: At least 10 of the following experiments must be performed during the session.

S.No.	Aim of Experiment
1	To determine the specific charge (e/m) of an electron by Thomson method.
2	To measure the planks constant using light emitting diode.
3	To determine the energy band gap of a given sample material.
4	To measure the dielectric constant of a substance by resonance method.
5	To study and verify the outputs of various logic gates
6	To study the input and output characteristics of a transistor in common BASE/Emitter/collector (anyone) configuration
7	To study the V-I characteristics of semiconductor diode
8	To study V-I Characteristics of LED
9	To determine the numerical aperture of given optical fiber using optical fiber kit.
10	To determine the wavelength of laser light with laser educational kit.
11	To measure the optical power attenuation in the given optical fiber.
12	To determine the V-number of given optical fiber using optical fiber kit.

Course outcomes

Lab CO	Course outcome – Upon successful completion of the course, the student will be able to
CO1	**Develop** experimental skill required for application of Physics in engineering.
CO2	**Operate** different instruments specified in course safely and efficiently.
CO3	**Demonstrate** the working principles in optics, semiconductors, Quantum Physics.
CO4	**Function** as a member of a team for problem solving.

LANGUAGE LAB (17241211)

Category	Title	Code	Credits-1		
Humanities and Social Sciences including Management Courses - HSMC	Language Lab	**17241211**	L	T	P
			-	-	2

Course Objectives:

- The course intends to build the required communication skills of the students to communicate effectively in real-life situations like starting a talk and be comfortable using English language.
- It aims at teaching students to appreciate English language through the study of scientific, creative, and academic text.
- The course is designed to acquaint students with structure of English language used in literature, functional varieties, figurative language, and verbal concomitance.
- The students are expected to enrich their knowledge of language, culture, and ethics through this course.

Course Contents:

Unit I: Communication [CO1, CO2]
Communication: Approaches, Elements, Verbal and Nonverbal Communication; Barriers to Communication; Johari Communication Window.
Unit II: Listening[CO1, CO2]
Listening: Factors Affecting Listening and Improving Listening.
Unit III: Speaking: [CO2, CO3, CO5]
Public Speaking&Delivering Presentation.
Unit IV: Reading: [CO3, CO4, CO5]
Reading Passages &Comprehension:Steps and Methods.
Unit V: Writing: [CO4]
Writing: Essentials of good writing; Drafting CV/biodata/Résumé)

***Reading Material** for story and poetry is to be selected by concerned teacher in class.

Language Laboratory:
The objective of the language lab is to expose students to a variety of listening and speaking drills. This would especially benefit students who are deficient in English and it also aims at confidence building for interviews and competitive examinations. The Lab is to cover following syllabus.
1. Communication lab exercises as specified in Lab Manual
2. Listening skills (using Marc Hancock, CUP).
3. Speaking skills
4. Oral presentation.

Laboratory Tasks:

- A Separate Lab Manual is attached as Annexure-III

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

CO1 → Speak clearly effectively and appropriately in a public forum to a variety of audiences and purposes. (LOT1)
CO2 → Prepare oral dialogues and arguments within the Engineering Profession effectively. (LOT2)
CO3 → Demonstrate knowledge and comprehension of major text and traditions in language as well as its social, cultural, and historical context. (LOT3)
CO4 → Read a variety of Text analytically to demonstrate in writing and/or speech the interpretation of texts. (HOT4)
CO5 → Interpret text written in English assessing the results in written and oral arguments using appropriate material for support. (LOT3)

Reference Books: -

- *Understanding Human Communication — By Ronald Alderman by OUP*
- *Communication Skills for Engineers — Pearson Education.*

- *Practical English Grammar by Thomson Martinet — Oxford University Press*
- *A Handbook of Language laboratory by P Sreekumar — Cambridge University Press.*