ITEM -2

To review & finalize the syllabi for all courses of B. Tech I Semester (for batch admitted in 2024-25) under the flexible curriculum along with their COs.

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Department of Chemical Engineering
CHEMICAL ENGINEERING

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.

Department of Chemical Engineering
CHEMICAL ENGINEERING

COMPUTER PROGRAMMING (17241102)

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

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.

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CHEMICAL ENGINEERING

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

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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

</div>

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

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CHEMICAL ENGINEERING

MECHANICAL OPERATIONS (17241104)

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

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.

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CHEMICAL ENGINEERING

BASIC ELECTRICAL & ELECTRONICS ENGINEERING (17241105)

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

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

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		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

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- 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

ITEM -3

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses and Micro Project-I to be offered in B.Tech. I semester along with their COs.

Department of Chemical Engineering

CHEMICAL ENGINEERING

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

```
       1              * * * * * * * * *
      121              * * * * * * * *
     12321              * * * * *
    1234321              * * *
   123454321               *
```

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.

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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.

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CHEMICAL ENGINEERING

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

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Department of Chemical Engineering
CHEMICAL ENGINEERING

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.

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CHEMICAL ENGINEERING

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.

Department of Chemical Engineering

CHEMICAL ENGINEERING

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