क्रमांक...३.३.१./अ.मं./पाठ्यक्रम/2023   बिलासपुर, दिनांक 2 6 OCT 2023

प्रति,

विभागाध्यक्ष,
केमिकल इंजीनियरिंग विभाग,
गुरू घासीदास विश्वविद्यालय,
बिलासपुर (छ.ग.)

विषय :–अनुमोदित पाठ्यक्रम का प्रेषण विषयक ।
संदर्भ :–बैठक दिनांक 06.10.2023 के संदर्भ में ।

महोदय,

उपरोक्त विषयांतर्गत लेख है कि विश्वविद्यालय के विद्यापरिषद की स्थायी समिति की बैठक दिनांक 16.10.2023 में विषय क्रमांक 02 के अधीन बी.टेक केमिकल इंजीनियरिंग विभाग के द्वारा एनईपी के अंतर्गत संचालित द्वितीय वर्ष (तृतीय एवं चतुर्थ सेमेस्टर) के पाठ्यक्रम एवं अंक योजना सत्र 2023–24 का अनुमोदन किया गया है।

अनुमोदित पाठ्यक्रम इस पत्र के साथ संलग्न कर आवश्यक कार्यवाही हेतु प्रेषित है।

विद्यापरिषद ने यह भी निर्णय लिया है कि संबंधित विभाग के विभागाध्यक्ष यह सुनिश्चित करेंगे कि प्रस्तावित पाठ्यक्रम एवं अंक योजना प्रभावी अध्यादेश के प्रावधानों के अनुरूप हो ।
सुलभ संदर्भ हेतु विद्यापरिषद के निर्णय की छाया प्रति भी संलग्न है ।

सहायक–कुलसचिव (अका0)

प्रतिलिपि:–

1. परीक्षा नियंत्रक,गुरू घासीदास विश्वविद्यालय बिलासपुर को सूचनार्थ प्रेषित ।
2. उप/सहायक कुलसचिव परीक्षा/गोपनीय विभाग की ओर पाठ्यक्रम की एक–एक छायाप्रति संलग्न कर आवश्यक कार्यवाही हेतु प्रेषित ।
3. कार्यालय प्रति ।

सहायक–कुलसचिव (अका0)

विद्यापरिषद की स्थायी समिति की बैठक दिनांक 16.10.2023 के कार्यवृत्त का अंश।)

अ.अ.वि.क्र.2   अध्ययन मण्डल केमिकल इंजीनियरिंग विभाग के द्वारा एनईपी के तहत संचालित बी.टेक कार्यक्रम के तीसरे एवं चौथे समेस्टर का प्रारूयक्रम एवं अंक योजना उपलब्ध कराया गया। प्राप्त अनुशंसाओं पर विचार करते हुए स्थायी समिति ने यह निर्णय लिया कि प्रस्तावित पाठ्यक्रम एवं अंक योजना का अनुमोदन किया जाय।

स्थायी समिति ने यह भी निर्णय लिया कि संबंधित विभाग के विभागाध्यक्ष यह सुनिश्चित करेंगे कि प्रस्तावित पाठ्यक्रम एवं अंक योजना प्रभावी अध्यादेश के प्रावधानों के अनुरूप हो।

उपरोक्त निर्णयानुसार आवश्यक कार्यवाही हेतु प्रेषित।

signature
18/10/2023

स.कु.स.(अका.)

signature

उपरोक्त पाठ्यक्रम अनुमोदन पश्चात विभागाध्यक्ष को भेजे जाने वाले पत्र की स्वच्छ प्रति हस्ताक्षरार्थ प्रस्तुत।

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स.कु.स.(अका.)

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26/10/23

श्री रावते

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SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Ordinance 2009, No. 3 of 2009)

SCHEME FOR EXAMINATION (Effective from Session 2023-24)
B. TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING
SECOND YEAR, THIRD SEMESTER (NEP)

S. No.	Subject Code THEORY	Subject Name	L	T	P	CIA	SEA	TOTAL	Credits
01.	CHUCTT1	Fluid Mechanics	3	1	0	40	60	100	4
02.	CHUCTT2	Chemical Engineering Thermodynamics	3	1	0	40	60	100	4
03.	CHUCTT3	Material & Energy Balances	3	0	0	40	60	100	3
04.	CHUCTK1	Process Utilities & Safety	3	0	0	40	60	100	3
	CHUCTK2	Water Treatment and Management							
05.	AMUCTE1	Mathematics-III	3	0	0	40	60	100	3
06.	CHUCTO1	Engineering Materials	3	0	0	40	60	100	3
	CEUCTO1	Green Buildings							
	MEUCTO1	Introduction to Thermodynamics							
	IPUCTO1	I. C. Engine							
	CSUCTO1	Data Structure With C++							
	ITUCTO1	Computer Organization & Architecture							
	ECUCTO1	Data Communication							
PRACTICAL									
01.	CHUCLT1	Basic Chemical Engineering Lab	0	0	2	25	25	50	1
02.	CHUCLT2	Fluid Mechanics Lab	0	0	2	25	25	50	1
		Total	18	2	4	290	410	700	22

CIA – Continuous Internal Assessment
SEA – Semester End Assessment

Total Credits – 22
Total Marks – 700
Total Periods / Week - 24

CIA-Shall be two class test (CT) I & II each 15 marks, 05 marks for assignment, surprise test, quiz etc. and 05 marks attendance
CH-Chemical Engineering, CE-Civil Engineering, ME-Mechanical Engineering, IT-Information Technology
IP-Industrial and Mechanical Engineering, CSE-Computer Science & engineering,
EC-Electronics and Communication Engineering

BoS Held on 06-10-2023

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Ordinance 2009, No. 3 of 2009)

SCHEME FOR EXAMINATION (Effective from Session 2023-24)

B. TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING

SECOND YEAR, FOURTH SEMESTER (NEP)

S. No.	Subject Code THEORY	Subject Name	Periods L	T	P	CIA	SEA	TOTAL	Credits
01.	CHUDTT1	Particle and Fluid Particle Operations	3	0	0	40	60	100	3
02.	CHUDTT2	Inorganic Chemical Technology	3	0	0	40	60	100	3
03.	CHUDTT3	Numerical Methods in Chemical Engineering	3	0	0	40	60	100	3
04.	CHUDTK1	Process Instrumentation	3	0	0	40	60	100	3
	CHUDTK2	Fluidization Engineering							
05.	CHUDTO1	Energy and Environment	3	0	0	40	60	100	3
	CEUDTO1	Remote Sensing & GIS							
	MEUDTO1	Introduction to Fluid Mechanics							
	IPUDTO1	Automobile Engineering							
	CSUDTO1	Introduction to Information Science							
	ITUDTO1	Computer Network							
	ITUDTO2	Fundamentals of Python Programming							
	ECUDTO1	Introduction to Electronic Devices & Circuits							
	ESUDTO1	Effective Technical Communication							
PRACTICAL									
01.	CHUDLT1	Particle and Fluid Particle Operations Lab	0	0	2	25	25	50	1
02.	CHUDLT2	Numerical Methods in Chemical Engineering Lab	0	0	2	25	25	50	1
03.	CHUDPV1	Mini Project	0	0	4	50	50	100	2
		Total	15	0	8	300	400	700	19

CIA – Continuous Internal Assessment SEA – Semester End Assessment	Total Credits – 19 Total Marks – 700	Total Periods / Week - 23

CIA-Shall be two class test (CT) I &II each 15 marks, 05 marks for assignment, surprise test, quiz etc. and 05 marks attendance
CH-Chemical Engineering, CE-Civil Engineering, ME-Mechanical Engineering, IT-Information Technology
IP-Industrial and Mechanical Engineering, CSE-Computer Science & engineering,
EC-Electronics and Communication Engineering

BoS Held on 06-10-2023

B.TECH. CHEMICAL ENGINEERING IVTH SEMESTER SYLLABUS (NEP)

CHUDTT1   Particle and Fluid Particle-Operations   [L:3, T:0, P:0]

Objectives

Objective of this course is to introduce students to the numerous industrial operations dealing with the particulate solids, their handling in various unit operations, and those in which particle fluid interactions are important.

Contents:

Unit I : Solids Properties: Solid particle characterization: Particle size, shape and their distribution, Screen analysis, standard screens; Relationship among shape factors and particle dimensions; Specific surface area; Measurement of surface area.

Unit II : Storage and Transportation, Size reduction : Types of storage equipment, Bin, Silo, Hoper, etc. Transport of fluid solid systems: mechanical conveying, pneumatic and hydraulic conveying. Major equipment's- Crushers, grinders, ultrafine grinders, laws of communition, Close circuit and open circuit grinding.

Unit III : Fluid-Solid Separation: Sedimentation: Elutraition, Classification and sedimentation, Free Settling, hindered settling, flow of solids through fluid, Stoke's law, Richardson-Zaki equation, design of settling tanks, Centrifugal separation, design of cyclones and hydrocyclones, filter bags, venture scrubber, electrostatic Precipitator.

Unit IV : Mechanical separation and Filtration: Industrial screen; their capacity and effectiveness. Types of filtration, principle of filtration, plate and frame filter, leaf filter, rotary drum filter, etc.

Unit V : Agitation and Mixing: Application of agitation, Agitation equipment, Types of impellers – Propellers, Paddles and Turbines, Flow patterns in agitated vessels, Prevention of swirling, Standard turbine design, Power correlation and power calculation, Mixing of solids, Types of mixers –, Muller mixers, Mixing index, Ribbon blender, Internal screw mixer.

Suggested Text Books

1. W. McCabe, J. Smith, & P. Harriott. Unit Operations of Chemical Engineering, 6th edition, McGraw Hill.

2. Coulson and Richardson's Chemical Engineering, Vol. 2, Butterworth-Heinemann, 5th edition 2002.

Suggested References Books

1. M. J. Rhodes, "Introduction to Particle Technology", 2nd edition, John Wiley, Chichester; New York.

2. T. Allen, "Powder Sampling and Particle Size Determination", Elsevier.

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3. H. Masuda, K. Higashitani, H. Yoshida, "Powder Technology Handbook",CRC, Taylor and Francis.

4. D. Vollath, Nanomaterials: An Introduction to Synthesis, Properties and Applications, 2nd Ed., Wiley.

Course Outcomes

Students will be able to

1. Know the significance and usage of different particulate characterization parameters, and methods to estimate them.

2. Comprehend the forces and laws of size reduction and explain the working principle of size reduction equipment, understand the different storage and transportation techniques for the solid particles.

3. Deduce the expression for different laws for flow of fluids through solids and compare different equipment for fluid-solid separation.

4. Analyse filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage.

5. Deduce expression for power requirements in agitation and mixing and compare different mixing devices.

CO-PO Mapping															
CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2								2	-	2
CO2	2	2	1	1	1								1		-
CO3	3	3	3	2	2								2		-
CO4	3	2	3	2	2								2		-
CO5	2	1	1	1	1								2		-
1-Weak, 2- Moderate, 3-Strong															

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ctives

Contents:

Unit-I: Sulfur and Sulfur Chemicals : Sulfur, Sulfuric acid, SCSA, DCDA processes, Sodium thiosulfate, Alums.

Marine Chemical Industries : Common salt, Chemicals from sea bittern.

Unit-II: Industrial Gases and Selected Inorganic Chemicals : Manufacture and use of Hydrogen, Carbon dioxide, Acetylene, Oxygen, Nitrogen and inert gases, Inorganic chemicals: Barium, boron, chromium, lithium, manganese.

Unit-III: Fertilizers : Status of industry, Grading and classification of fertilizers, Raw materials, Hydrogen production, Fixation of nitrogen, Synthesis, Ammonia based fertilizers, Phosphoric acid, Phosphatic and other fertilizers: SSP, TSP, UAP, DAP and nitro-phosphate, Potash fertilizers, NPK, Corrosion problems and Materials of construction, Bio-fertilizers.

Unit-IV: Soda Ash : Manufacturing, Special materials of construction, Solvay and modified Solvay process, Environmental consideration, Corrosion problems and materials of construction.

Chlor Alkali Industry : Electrochemistry of brine electrolysis, Current efficiency, Energy efficiency, Diaphragm cells, Mercury cells, Mercury pollution and control, Caustic soda, Chlorine, Hydrochloric acid, Corrosion problems and materials of construction

Unit-V: Cement, Glass and Refractory: Manufacturing, Environmental consideration, Corrosion problems, Engineering problems and materials of construction.

Suggested Text Books :
1. R.N. Shreve & I. A. Brink, "Chemical Process Industries"
2. Chem Tech I, II, III, IV- IIT. Madras
3. Dryden Co. M. G. Rao and M. Sitting, "Outlines of Chemical Technology".

Course Outcome:
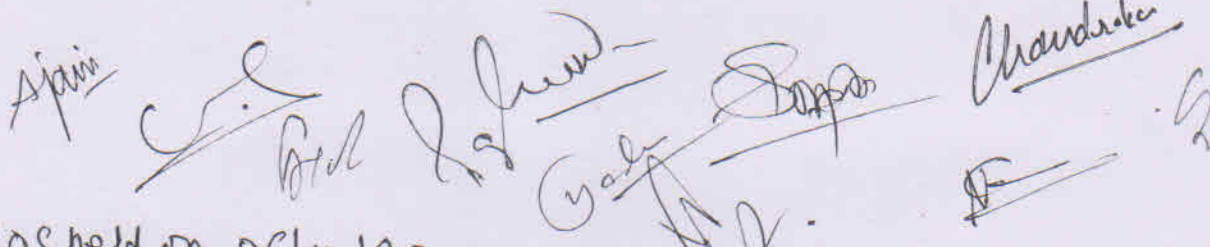
Students would be able to
1. Impart the basic concepts of chemical technology.
2. Develop understanding about unit process and unit operations in various industries.
3. Describe the processes involved in manufacturing of various inorganic chemical and various chemical reactions involved in the process.
4. Draw the process flow diagrams and understand the major engineering problems encountered in the processes.
5. Explain important process parameters such as raw materials, environmental considerations, MOC, etc..

CO-PO Mapping

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

Weightage: weak-01, moderate-02, strong-03

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CHUDTT3   Numerical Methods in Chemical Engineering |L:3, T:0, P:0|

Objectives

The objective of this subject is to introduce students to numerical methods used to solve engineering problems, in particular chemical engineering problems, using numerical methods and computer programming.

Contents

Unit I : Error Analysis : Introduction of Errors and their Analysis, types of errors, numerical problems on error analysis, curve fitting: method of least squares, fittings of straight line and parabola and by method of moments.

Unit II : Numerical Solution of Algebraic and Transcendental Equations : Secant Method, Regula-falsi Method, Newton Raphson Method, Solution of a system of simultaneous linear algebraic Equations Direct method: Gauss elimination Method, Iterative methods, Gauss Seidel Iterative method.

Unit III : Calculus of Finite Differences : Finite differences, Difference formula, operators and relation between operators. Inverse Operator, Interpolation with equal intervals: - Newton's forward and backward interpolation formula. Interpolation with Unequal intervals: - Lagrange's interpolation.

Unit IV : Numerical Differentiation and Integration : Numerical Differentiation Newton's forward and Backward difference interpolation formula. Numerical Integration: Trapezoidol rule, simpson is $(1/3)^{rd}$ and $(3/8)^{th}$ rule, Boole's rule, Weddle rule.

Unit V : Numerical Solution of Ordinary Differential Equation: Taylor series method, Euler's method, Modified Euler method Runge's method Runge Kutta method.

Suggested Text Books

1. Jain & Iyngar Numerical Methods for Scientific and Engineering Computations.
2. G. S. Rao, Numerical Anlysis.
3. B. S. Grewal, Numerical Methods in Engineering and Science.
4. H. K. Das, Advance Engineering Methods.
5. V. Rajaraman, Computer Oriented Numerical Methods

Course Outcomes

Upon completion of this course, the students will be able to solve chemical engineering problems involving linear and non-linear equations and solve ordinary differential equations.

CO-PO Mapping															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	1							2		
Weightage : 1-Slightly; 2-Moderate; 3-Strongly															

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CHUDTK1   **Process Instrumentation**   **[L:3, T:0, P:0]**

Objectives

The course is to introduce the students to learn the basics of instrumentation, various process variables based instruments. Fundamentals of different measuring devices related to various process parameters such as temperature, level, pressure, flow, pH, humidity and compositions. Impart basic knowledge of transmitters, transducers, control valves, PLC

Contents:

Unit-I: Introduction: Static and dynamic characteristics of instrumentation and their classification, Process variables, Elements of measuring system and their functions.

Unit-II: **Transmitters & Transducers :** Signal transmission analog, digital, Electronic and pneumatic Transmitters, active and passive transducers

Unit-III: Measuring Instruments: Principles, Construction and operations of instruments for the measurement of various process variables such as temperature, pressure, flow, liquid level, humidity, viscosity and composition.

Unit-IV: **Controllers & Regulators:** Principles and construction of electro- pneumatic controllers, Multiplexers, final control elements such as pneumatic control vale, Stepper motor.

Unit-V: Data Acquisition & Analysis : Data acquisition system and intelligent instruments, Instrumentation of process equipment such as distillation column, Chemical reactors, heat exchanger etc.

Suggested Text Books :

1. S.K. Singh, Industrial Instrumentation and Control, 3rd edition, McGraw-Hill (2008).
2. William C. Dunn, Fundamentals of Industrial Instrumentation and Process Control, McGrawHill (2005).
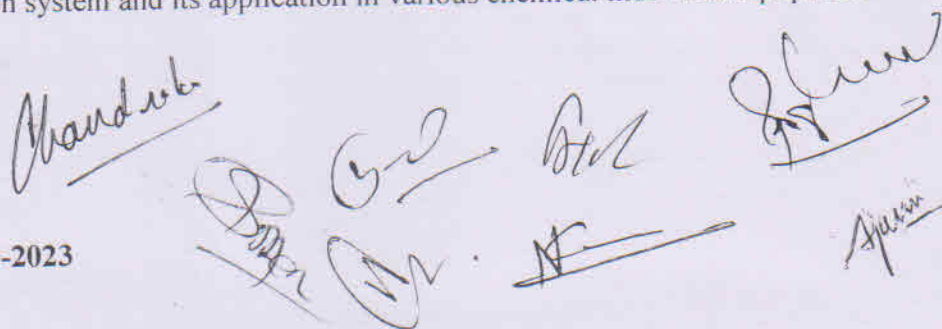
Reference Book:

1. Patranabis, D, "Principles of Industrial Instrumentation", Tata McGraw-Hill Publishing Co. Ltd.
2. Beckwith, T.G., Marangoni, R.D. and Lienhard, J.H., "Mechanical Measurements", Addison Wesley.
3. Jain, R.K., "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi
4. Johnson, C.D., "Process Control Instrumentation Technology", Pearson Education, Inc.

Course Outcome:

Students would be able to understand

1. The basics of process instrumentations
2. The application of various process variables used in process industries
3. Fundamental of transmitters and transducers
4. The different type of controller and actuator
5. Data acquisition system and its application in various chemical industries equipment

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CHUDTK2   Fluidization Engineering   [L:3, T:0, P:0]

Objectives To impart the fundamental knowledge of Fluidization and understand the different aspects of fluidized bed systems applied in various industries.

Contents:

Unit-I: Phenomenon of Fluidization, Advantages and disadvantages of fluidization compared to conventional processes, Classification of various industrial beds, Industrial applications of fluidized beds in mineral processing, coal and biomass gasification & combustion FCC petroleum refining, pharmaceuticals, cement and other solid handling systems, Fluidized Bed Drying.

Unit-II: Gross behavior of fluidized beds-Minimum fluidizing velocity and pressure drops; Voidage, Design of distributors, Effect of temperature and pressure on fluidized bed, Elutriation and entrainment Transport disengaging height.

Unit-III: Bubbles in dense beds-Davidson Model, stream of bubbles, Bubbling bed models, Geldart classification, Different regimes of Fluidization, Davidson's model, Variation of Bubbling bed and Circulating Fluidized beds.

Unit-IV: Emulsion phase, Turn-over rate of solids, Residence Time Distribution of Solids, Diffusion model of solids movement, Interchange coefficient of solid into and out of wake.

Unit-V: Flow Pattern of Gas through fluidized beds, diffusion model for gas flow; two region models, evaluation of interchange coefficients, Heat and Mass transfer in Fluidized Beds.

Suggested Text Books :

1. Fluidization Engineering by D. Kunii and O. Levenpiel, Butterworth-Heinemann, Elsevier.
Reference Book:

1. Fluidization by J. F. Davidson and D. Harrison, Academic Press.
2. Fluidization and Fluid Particles Systems by F.A. Zenz and D. F. Othmer, Reinhold Publishing.
3. Handbook of Fluidization and Fluid-Particle Systems, by W. C. Yang, CRC Press. Course
Outcome: Students would be able to

1. Describe fluidization and its recommendation in various industries exploiting its various advantages evaluating the heat and mass transfer aspects.
2. Apply model equations for fluidized beds for application in various industries.
3. Able to understand various fluidization characteristics like minimum fluidization velocity, complete fluidization velocity and transport disengage height.

CO-PO Mapping															
CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
CO2	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
CO3	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
Weightage: weak-01, moderate-02, strong-03															

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Energy and Environment   [L:3, T:0, P:0]

Objectives

The objectives of this course are to introduce the basics of environment & ecosystem, different sources of pollution, its control measures and various energy resources. The course gives awareness about global environmental issues.

Contents:

Unit-I

Introduction to Energy, Sources of Energy, Scenario of Energy, Conservation of Energy, Energy audit, Possibilities for energy storage or regeneration

Unit-II: Conventional and non-conventional energy sources and their uses. Fossil fuels - past, present & future, Remedies & alternatives for fossil fuels - Solar, Wind, Biomass, Hydrogen, Geothermal, Ocean and Hydro energy.

Unit-III : Components of environment and their relationship, impact of technology on environment, environmental degradation.
Global Environmental Issues: climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, and holocaust; Social Issues and the Environment.

Unit-IV : Overview of Environmental Pollution: Sources, effects, and control measures.

Unit-V: Environmental Legislation: Environmental protection laws in India; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Issues involved in enforcement of environmental legislation; Public awareness; Case studies.

Suggested Text Books :

1. Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha Second edition,2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.
2. Dr. Suresh K Damecha, Environemental Studies, S K Kataria & Sons, New Delhi.
3. R. Rajagopalan, Environemental Studies, Oxford University Press.
4. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey Brack, Energy and the Environment, wiley Publication

Reference Book:

1. Wright Richard and Nebal Bernard, Environmental studies, Prentice Hall, New Jersey.
2. U K Khare, Basics of Environmental Studies, Tata McGrawHill
3. Daniel B Botkin& Edward Akeller, Environmental Sciences, John Wiley & Sons

Course Outcome:
Students would be able
1. To comprehend components of environment and ecosystem and to get aware about environmental degradation.
2. To identify different types of pollutions and control measures.
3. To create awareness about global environmental issues.

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4. To understand various energy sources and its related issues.

CO-PO Mapping

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

Weightage: weak-01, moderate-02, strong-03

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CHUDLT2 Numerical Methods in Chemical Engineering Lab [L:0, T:0, P:2]

Objective:

The course would enable students to write their own computer programs using programming languages like C and commercial software like Matlab. Hands-on experience will be provided to apply these computer programs to solve problems in different areas of chemical engineering e.g. fluid flow, heat and mass transfer, chemical reaction engineering etc.

List of Experiments:

1. Write a program in 'C' to find simple interest
2. Write a program in 'C' to calculate sum of three numbers
3. Write a program in 'C' to calculate number of months and days
4. Write a program in 'C' to find whether a year is leap year or not
5. Write a program in 'C' to convert the given temperature in Fahrenheit to Celsius
6. Write a program in 'C' to find whether a number is odd or even
7. Write a program in 'C' to calculate factorial of a given number
8. Write a program in 'C' to find the real roots of a quadratic equation
9. Write a program in 'C' to for Secant Method
10. Write a program in 'C' and 'MATLAB' to for Newton Raphson Method
11. Write a program in 'C' to for Regula falsi Method
12. Write a program in 'C' and 'MATLAB' to for Gauss Elimination and Gauss Seidal Methods
13. Write a program in 'C' to for Lagrange's Interpolation
14. Write a program in 'C' and 'MATLAB' to for Simpson's Rule
15. Write a program in 'C' and 'MATLAb' to for Euler's Method and Runge-Kutta Method

Any other experiments may be added further, if needed.

Course Outcome:

Students will be able to solve chemical engineering problems involving Linear and non-linear equations and solve ordinary differential equations using programming languages like C and software like MATLAB.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3								2	2	

1-Weak, 2- Moderate, 3-Strong

BoS held on 05/10/2023

CHUDLT1   Particle and Fluid Particle Operations Lab   [L:0, T:0, P:3]

Objectives:

1. To understand the working and importance of various mechanical operations used in process industry.
2. To apply principles of basic sciences and chemical engineering for designing various size reduction, size separation and filtration equipment.

List of Experiments

1. To verify different laws of crushing for size reduction solid particles by Jaw crusher, roll crusher, and ball mill.
2. To find out the Effectiveness of Triple deck Vibrating Screen.
3. To determine the average diameter of a mixture of solid particles of using sieve analysis.
4. To determine the collection efficiency of cyclone separator for separating dust particles from air.
5. To determine the filter medium resistance and specific cake resistance of plate and frame filter press.
6. To determine the efficiency of elutriator for separating the particles in different size fractions.

Outcomes:

At the end of the laboratory course students will be able

1. To apply the principles of unit operations through experimentation.

2. To demonstrate the ability to understand the various mechanical operation equipments used in chemical and allied process industry.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1		1			1				2	2	
CO2	1	2	1	1		1			1				2	2	

1-Weak, 2- Moderate, 3-Strong

BoS Held on 06-10-2023

Engineering Materials

[L:3, T:0, P:0]

Objectives

1. To provide the understanding of material selections for construction to execute a task for a particular application, its properties and behaviour at different circumstances.
2. Properties, behaviour and maintenance of various engineering materials.

Contents

Unit I : Crystalline and Non-Crystalline Materials : Crystalline state, Atomic bonding, Bravias lattices, Miller indices, Structure of some common inorganic compounds, Structural imperfections. Economic, environmental and social issues of material usage.

Unit II : Mechanical Properties : Mechanical properties of materials and their variation with temperature, importance and limitations of these properties on material selection for a particular application. Failure of materials: Failure of materials under service conditions.

Unit III : Corrosion : Mechanism of corrosion, Types of corrosion, Factors influencing corrosion, Methods of corrosion control, Inhibition and other precautionary measures.

Unit IV : Non-Ferrous Metals : Copper, Brasses, Bronze, Aluminium, their mechanical properties, Workability and applications, Corrosion resistance. Non-metallic materials of construction.

Unit V : Phase diagram : Phase rules, Equilibrium phase diagram, cooling curves and their relations to properties of metals and alloys, Iron-carbon equilibrium diagram. Response of materials to chemical environment.

Suggested Text Books

1. Introduction to Materials Science for Engineers by James F. Shackelford, Pearson.
2. Elements of Materials Science and Engineering by L.H.Van Vlack, Pearson.
3. Materials Science and Engineering by V. Raghavan, PHI Learning Private Limited.
4. Materials Science for Engineers by L. H. VanVlack, Addison-Wesley Publishing Co.
5. Chemistry of Engineering Materials by A. M. Sikkander and T. N. Balu, Raj Publications.
6. Corrosion, Prevention and Control by K.S. Rajagopalan, Scientific Surveys Limited.
7. Corrosion Engineering by M. G. Fontana, McGraw Hill Education.

Reference Book :

1. Perry's Chemical Engineers' Handbook by D. W. Green and R. H. Perry, McGraw Hill Publication.

CO-PO Mapping															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						2	2						1		
CO2						2	2						1		
Weightage : 1-Slightly; 2-Moderate; 3-Strongly													1		

BoS Held on 06-10-2023

Course objective:

The course covers the hands on experience of basic principle of viscosity, adsorption, solid handling, gravity settling, drag coefficient etc.

1. Determine the adsorption coefficient of coal and sawdust samples.
2. Determine the Bulk density and angle of repose at different moisture of given sample.
3. To determine the bed void fraction of given sample.
4. Determine the relative humidity using wet and dry bulb temperature.
5. Determine the percentage of heavy and light particle of given sample.
6. Determine the drag coefficient of given sample.
7. Determine the flash point and cloud point of given sample.
8. Determine the viscosity of given sample using redwood viscometer.

Outcomes: At the end of the laboratory course students will be able

1. To understand the factors affecting to flow in industrial point of view.
2. To understand how the conveyer belt shifting the materials from one place to another place in industry.
3. To understand how gravity settling, adsorption are implemented in industry.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										2	1	
CO2	3	2	1										2	1	
CO3	3	2	1										2	1	
Weightage:3weak-01, moderate-02, strong-03															

BoS Held on 06-10-2023

Objective:

The objective of this course is to give the students the practical exposure of the theory and concepts of the subject fluid mechanics. The course will provide the knowledge of different flow meters and pressure measurement through the experiments. It will also help in understanding the theoretical concepts through experiments.

List of Experiments:

1. To determine the coefficient of discharge of the given Venturimeter.
2. To determine the coefficient of discharge of the Orificemeter connected in between a pipe line.
3. To determine the coefficient of discharge of the Rotameter.
4. To determine the velocity of the flowing fluid and coefficient of the given pitot tube.
5. Study and verification of the Bernoulli's theorem.
6. Experimental determination of hydraulic coefficients.
7. To measure the pressure using manometer.
8. To determine the type of flow and Reynold's number through Reynold's experiment.

Course Outcome:

- The students will be able to visualise the concepts.
- The students will understand about different components of the flow system.
- The students will be able to operate different meters.
- The students will be able to measure and calculate different flow parameters.

CO-PO Mapping

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

Weightage:3weak-01, moderate-02, strong-03

BoS Held on 06-10-2023

Mathematics-III [L:3, T:0,P:0]

Course Objective: Basic concepts of statistics, curve fittings, Laplace transform and Fourier transform.

Unit I : Introduction to statistics, mathematical statistics, frequency distribution, exclusive and inclusive class intervals, type of series, graphical representation: histogram, frequency polygon, measure of central tendency, various types of averages, skewness and kurtosis.

Unit II : Curve fittings by method of least square- straight line parabola correlation-scatter cliagrem's Karl Pearson's coefficient of correlation. Limits for correlation coefficient, rank correction. Regression linear regression, equation to the line of regression. Regression coefficient, angle between two lines of regression.

Unit III : Laplace Transforms: Transforms of elementary functions and periodic functions, transforms of derivatives and integrals, evaluation of integrals by Laplace transforms, inverse Laplace transforms, convolution theorem, application to differential equations, unit step and unit impulse function.

Unit IV: Fourier Transforms: Fourier integrals and Fourier transforms, finite Fourier sine and cosine functions, F- transforms, convolution theorem of F-transforms.

Unit V: Relation between Fourier and Laplace transforms, application of transforms to boundary value problems

Suggested Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. M. Ray, H. S. Sharma & C. C. Chaudhary, "Mathematical Statistics", Ram Prasad Publications.
3. H K. Das, Higher Engineering Mathematics, S Chand 2014.

COURSE OUTCOMES:

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

1. Analyze and apply measures of location and measures of dispersion grouped and ungrouped series.
2. Apply discrete and continuous probability distributions to various business problems.
3. Apply the Laplac transformation in various chemical engineering problems.
4. Apply the Fourier transformation in various chemical engineering problems.

CO-PO Mapping

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

1-Weak, 2- Moderate, 3-Strong

BoS Held on 06-10-2023

CHUCTT1   Fluid Mechanics   [L:3, T:1, P:0]

Objectives

The objective of the course is to introduce the mechanics of fluids (fluid statics and fluid dynamics), relevant to chemical engineering operations. The course will impart the knowledge of basic concepts of kinematics of flow, different forces on fluids, flow measurement, flow transportation and types of flow.

Contents:

Unit-I: Fluid Static & Applications: Hydrostatic equilibrium, hydrostatic equilibrium in centrifugal field and its applications in chemical engineering like manometers decanters.
Fluid low Process: velocity gradient and shear, types of fluids, concept of viscosity , kinematic viscosity, nature of flow- laminar, turbulent, Reynolds number, boundary layer formation and separation

Unit-II: Basic Equations for Fluid Flow: Mass balance & momentum balance equations. Bernoulli's equation without and with corrections for solid boundaries, kinetic energy, friction factor, pump work.

Unit-III: Incompressible Fluids Flow Through Pipes, flow characteristics- shear stress. friction factor, laminar flow for newtonian fluids, Hagen poisecuille equation, laminar flow for non-newtonian liquids, turbulent flow through pipes and close channels and its characteristic equations, friction factor and its dependence on roughness, Reynolds number, friction factor for flow through channels of non-circular cross section - concept of equivalent diameter. Frictional losses due to sudden change in velocity or direction of flow: expansion, contraction, effect of fittings, flow of liquids in thin layers.

Unit-IV: Transportation of Fluids: pipe fitting like bends, elbows, flanges, tee and different types of valves, seals for moving parts, pumps. NPSH, power requirement, types of pumps - centrifugal & positive displacement, trouble shooting in operation - priming & cavitation, characteristic curves - head /capacity/power/efficiency, capacity- head flow and head work relationship. Metering of fluids: variable head meters- venturi meter & orifice meter, variable area meter - rotameter. insertion meters - pilot tube.

Unit-V: Differential analysis: mass and momentum balances. Navier -Stokes equation, unidirectional flow, viscous flow. Stokes law, skin drag and pressure drag, potential flow. Potential function, solution of Laplace equation.

Suggested Text Books :

1. I. M. White. Fluid Mechanics. Tata-McGraw Hill.
0. Wilkes. Fluid Mechanics for Chemical Engineers. Prentice Hall of India.
R. W. Fox. P. J. Pritchard & A. T. McDonald, Introduction to Fluid Mechanics, Wiley-Indial
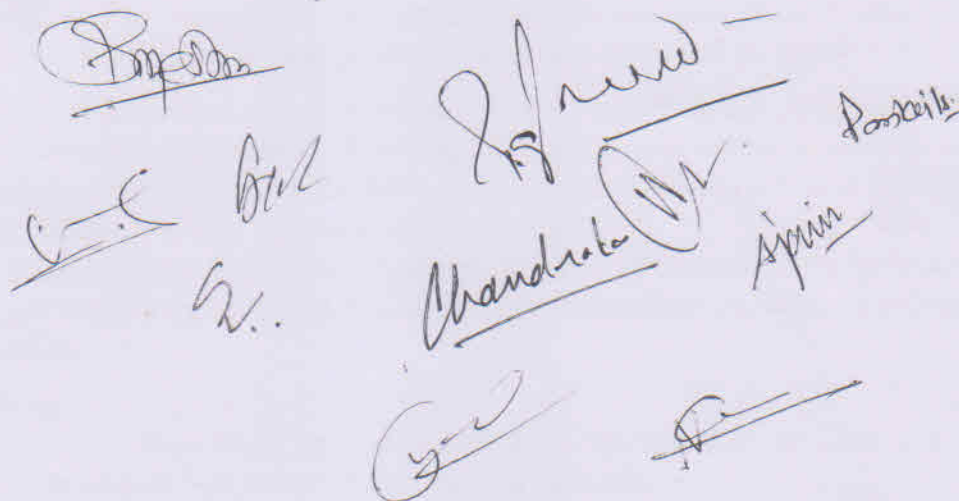
Reference Book:

BoS Held on 06-10-2023

1. V. Gupta & S. K. Gupta, Fundamentals of Fluid Mechanics, New Age International.
2. W.L. McCabe, J. C. Smith & P. Harriot. Unit Operations of Chemical Engineering. McGraw-Hill International Edition

Course Outcome:

1. Students will demonstrate the knowledge of the fundamentals of fluid mechanics and its application.
2. Students will be able to calculate velocity profiles by simplification of equations of motion in simple 1-D flows moreover, will develop the understanding of Bernoulli's equation
3. Students will be able to determine and analyze the type of flow, different flow characteristics and calculate different losses.
4. Students will apply the knowledge of Bernoulli's equation in its application part in form of different flow meters as well as will develop the understanding of transportation of fluid.
5. Students will be able to understand the kinematics of flow, viscous flow and to solve related problems.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									2	1	
CO2	3	3	1	2									2	1	
CO3	3	3	2	2									2	1	
CO4	3	3	2	2									2	1	
CO5	3	3	2	2									2	1	
Weightage: weak-01, moderate-02, strong-03													2	1	

BoS Held on 06-10-2023

Chemical Engineering Thermodynamics [L:3, T:1, P:0]

Objectives

Principles and application of law of thermodynamics, phase equilibria, introduce the concepts of multicomponent mixture, properties of solutions and reaction equilibria.

Contents:

Unit-1: Basic concepts and definitions of work, heat, energy, system & its types, types of processes. P-V-T relations of fluids: graphical representation of P-V-T behavior, mathematical representation of P-V-T behavior (Ideal gas law, van der Waals, Beattie-Bridgeman, Benedict-Webb-Rubin, Redlich-Kwong, Virial equation of state), Generalized compressibility factor correlation, equations of state (Redlich-Kwong, Soave-Redlich-Kwong, Peng-Robinson, Lee-Kesler, Virial coefficient correlation)

Unit-II: Basic concepts of laws of Thermodynamics: Zeroth law. First & Second laws, Calculation of internal energy, enthalpy, heat capacities, application of first law for open and closed systems, throttling process. Heat engine, heat pump, refrigerator, Kelvin and Clausious statement, criteria of irreversibility, Carnot theorem, Carnot cycle, Clausious inequality, Entropy and its principle.

Unit-III: Thermodynamic Potentials : Postulates, Intensive properties, criteria of equilibrium, free energy functions and their significances in phase and chemical equilibria, Euler relation, Gibbs-Helmholtz equation, Gibbs free energy minimum principle. Maxwell relations, various TdS equations, Cp and Cv relations. Clausisus – Clapeyron equations and estimation of thermodynamic properties by using equations, graphs and tables.

Unit-IV: Multicomponent Mixtures : Partial molar properties, partial molar Gibbs free energy, Chemical potential and its dependence on temperature and pressure, fugacity and its calculation, dependence of fugacity on temperature & pressure, Gibbs phase rule and its significance.

Unit-V: Properties of Solutions : Ideal solutions (Lewis Randall Rule) phase equilibrium, excess properties, Gibbs-Duhem relation, activity & activity coefficient, dependence of activity coefficient on temperature and composition, excess Gibbs free energy models : UNIQUAC and UNIFAC methods, Margules, Van laar, Wilson and NRTL equations, Herny's Law.

Chemical Reaction Equilibrium: Equilibrium constants in terms of measurable properties, Variation of equilibrium constants with temperature and pressure, adiabatic reactions, equilibrium in homogeneous & heterogeneous reactions.

Suggested Text Books :

1. J. M. Smith, H.C. Van Ness and M.M. Abbott, "Introduction to Chemical Engineering Thermodynamics", 7th edition, McGraw-Hill International Edition, 2005.

2. Y. V. C. Rao, "Chemical Engineering Thermodynamics", University Press, Hyderabad, 1997.

3. K V Narayanan, "A Textbook of Chemical Engineering Thermodynamics", Prentice Hall Of India, New Delhi 2011

Reference Book:

1. R.C. Srivastava, "Thermodynamics a core course", 3rd edition, PHI publication, India, 2007.
2. Engineering Thermodynamics by P. K. Nag, Tata McGraw Hill.

Course Outcome:

BoS Held on 06-10-2023

...dents would be able to

1. To calculate volume of the gas and solid at given condition.
2. Apply mass and energy balances to closed system, open systems, and problems involving liquefaction, refrigeration and different power cycles
3. Understand and calculate the various thermodynamics potentials.
4. Estimate the partial molar properties of gases and liquids and application of various equation of state.
5. Evaluate the equilibrium constant for chemical reactions.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	4	-	-	-	-	-	-	-	-	2	-	-
CO2	1	2	-	4	-	-	-	-	-	-	-	-	2	-	-
CO3	1	2	-	4	-	-	-	-	-	-	-	-	2	-	-
CO4	1	2	-	4	-	-	-	-	-	-	-	-	2	-	-
CO5	1	2	-	4	-	-	-	-	-	-	-	-	2	-	-

Weightage: weak-01, moderate-02, strong-03

BoS Held on 06-10-2023

material and Energy Balances

CTT3   Material and Energy Balance ~~Calculations~~   [L:3, T:0, P:0]

Objectives

The course will serve as a basis for all further chemical engineering courses that are part of the curriculum.

Contents:

Unit-I: Unit and its conversion, physical quantities in chemical engineering, Dimensionless groups, Stoichiometric principles and compositions, "basis" of calculations, Gas laws, Partial pressure and pure component volume, Mole concept and mole fraction, Weight fraction, Concentration, Molarity, Molality and Normality.

Unit-II: Humidity and Saturation, humid heat, humid volume, dew point, humidity chart and its use.

Unit-III: Material Balances: Without chemical reaction with recycle, bypass and purge, unsteady state material balance.

Unit-IV: Material Balance: With chemical reaction with recycle, bypass and purge.

Unit-V: Energy balance: heat capacity, calculation of enthalpy changes, Hess's Law of constant heat summation, Heat of dilution, Heat of formation, Heat of neutralization and heat of combustion, Energy balance with and without chemical reaction, adiabatic flame temperature.

Suggested Text Books :

1. Hougen, O. A., Watson, K. M., Ragatz, R. A., "Chemical Process Principles, Part I Material & Energy Balances", Second Edition, CBS Publishers& Distributors, 2004
2. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.
3. K.V. Narayanan and B. Lakshmikutty "Stoichiometry & process calculations, Prentice hall of India

Suggested Reference Books :

1. S. N. Saha, "Chemical Process Engineering Calculation", DhanpatRai Publication Co. (Pvt.) Ltd., New Delhi
2. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
3. Venkataramani, V., Anantharaman, N., Begum, K. M. Meera Sheriffa, "Process Calculations", Second Edit ion, Prentice Hall of India.

Course Outcome:

Students would be able to

1. Develop mastery over units and dimensions and compositions relevant to chemical engineering.
2. Be able to explain the basics of Humidity and Saturation and solve problems related to humidification.
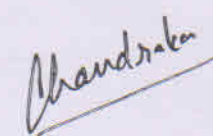
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3. Be able to solve problems based on material balance without chemical reaction and involving concepts like recycle, bypass and purge.
4. Be able to solve problems based on material balance without chemical reaction and involving concepts like recycle, bypass and purge.
5. Be able to solve problems based on energy balance with and without chemical reaction.

CO-PO Mapping

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

Weightage: weak-01, moderate-02, strong-03

BoS Held on 06-10-2023

Process Utilities and Safety [L:3, T:0, P:0]

Objective:

To understand the basic knowledge about various process utilities applied in the chemical process industry and problems related to hazards & safety.

Contents:

Unit-I: Introduction: Role and types of process utilities in process industries. Heat Transfer Media: Characteristics properties, Classification, Selection and their industrial application.

Unit-II: Steam System: Generation and application in chemical process plants, Design of efficient steam heating systems, Condensate utilization, Flash steam. Steam Traps: Types and characteristics.

Unit-III: Water: Characteristic and conditioning for process industries e.g., steam piping, boiler feed, cooling etc., Recycling of process water.

Unit-IV: Introduction to process safety: Accidents and loss statistics, Nature of the accidents / hazardous process.

Toxicology: Toxic material and biological response, Dose responses relationship and models, Threshold dose and its definition. Material safety data sheets and industrial hygiene evaluation.

Safety Devices: Personal safety devices and general hygiene management, Storage and ventilation.

Unit-V: Fire and Explosion: Definition, Flammability characteristics and explosion, Design to prevent fires and explosions by inverting, purring, ventilation, sprinkler systems, Static electricity controls, Relief and relief sizing in vapour/gas, Liquid and runway reaction services.

Suggested Text Books :

1. High Temperature Heat Carrier by A. V. Chechetckin, Pergammon Press.
2. Efficient use of Steam by P. M. Goodal, Guilford
3. Chemical Process Safety: Fundamentals with applications by A. Crowl Daniel and F.L.Joseph, PHI Publications.

Reference Book:

1. Handbook of Heat Transfer Media by P. L. Geiringer, Van Nostrand Reinhold Inc.,U.S.

Course Outcome:

Students would be able to

1. Evaluate the requirements of process utilities in process industries.
2. Calculate the steam requirement and its applications as utility.
3. Explain fire and explosion and its prevention methods.

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1	1									2		
CO2	2	2	1	1									2		1
CO3	2	1	1	1									2		1
Weightage: 1-Slightly; 2-Moderate; 3-Strongly													2		1

BoS Held on 06-10-2023

CHUCTK2   **Water Treatment and Management**   **[L:3, T:0, P:0]**

Objectives

- To introduce the water management principles related to process plants.
- To focus on the wastewater transport system and the theory for the wastewater treatment process.
- To analyze water quality parameters and their impact on human and environmental health.

Contents:

Unit I: Introduction to Water Treatment and Management, Importance of water treatment and management, Water cycle and its relevance to water management.

Unit II: Water Quality Assessment, Water quality parameters (physical, chemical, biological), Sampling techniques, water borne diseases and analysis methods.

Unit III: Drinking Water Standards and Regulations, water act, National and international drinking water standards, Regulatory frameworks and compliance,.

Unit IV: Water Treatment Processes, Screening and pre-treatment b. Coagulation, flocculation, and sedimentation, Filtration (slow sand, rapid sand, membrane), Disinfection (chlorination, UV, ozone), Desalination and water softening.

Unit V: Sustainable Water Management, Water conservation and efficiency, Integrated water resource management, Rainwater harvesting and storm water management

Suggested Text Books :

1. Water Conservation, Management and Analysis by V. Madireddi and Subba Rao, Read worthy Publications (Pvt) Ltd
2. Protection and Conservation of, Water Resources by Hadrian F. Cook, John Wiley & SonsInc.
3. Water Resources, Conservation and Management by S.N. Chatterjee, Atlantic Publishers &Dist.
4. P.C.Bansil "Water Management in India", Concept Publishing company, New Delhi, First Edition. 2004.
5. G.S.Bridie and J.S.Bridie "Water Supply and Sanitary Engineering", Dhanpat Raj Publishing company (P) Ltd., New Delhi, 7th Edition, 2003.

Course Outcome:

Students would be able to

1. Evaluate the performance of industrial boilers.
2. Choose methods for waste minimization and water conservation.

CO-PO Mapping													PSO		
CO	PO														
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1						2	2						1		
CO2						2	2						1		
Weightage : 1-Slightly; 2-Moderate; 3-Strongly															

BoS Held on 06-10-2023