SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY

Scheme of Teaching and Evaluation 2022-2023 (As per NEP-2020)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
(Effective from the Academic Year 2022–2023)

I-SEMESTER BTech Mechanical/IP/Chemical/Civil Engineering

S.N.	Course Code	Course Title	Teaching Hours/week			Examination				Credits
			Theory/lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIA Marks	SEA Marks	Total Marks	
			L	T	P					
1	AMUATB1	Engineering Mathematics - A	3	1	-	03	40	60	100	4
2	CYUATB3	Engineering Chemistry	3	-	-	03	40	60	100	3
3	ECUATE4	Basic Electrical and Electronics Engineering	3	-	-	03	40	60	100	3
4	FOUATC2	Environmental Science and Ecology	2	-	-	03	40	60	100	2
5	CSUATE5	Computer Programming	3	-	-	03	40	60	100	3
6	LAUATC1	Indian Constitution	1	-	-	01	50	-	50	1
7	CYUALB3	Engineering Chemistry Laboratory	-	-	2	03	25	25	50	1
8	CSUALE5	Computer Programming Laboratory	-	-	2	03	25	25	50	1
9	IPUALL2	Engineering Workshop Practices	-	-	2	03	25	25	50	1
10	PEUALS2	Sports and Yoga	-	-	2		25	25	50	1
		Total	**15**	**1**	**08**	**25**	**350**	**400**	**750**	**20**

Note: AM:Mathematics, PP:Physics, ME: Mechanical Engineering, IP: Industrial & Production Engineering, CE: Civil Engineering, CS: Computer Sc. & Engg., IT: Information Technology, PE: Physical Education, FO: Forestry, LA: Law, NS: NSS, U: Undergraduate, T: Theory, L: Laboratory,

BASIC SCIENCE (B)	ENGINEERING SCIENCE (E)	SKILL ENHANCEMENT COURSE (L)	HUMANITIES SCIENCE (H)	MANDATORY COURSE (C)	EXTRA-CURRICULAR ACTIVITIES (S)
1. Mathematics – A 2. Physics 3. Chemistry 4. Mathematics - B	1. Engineering Mechanics 2. Introduction to Information Technology 3. Basic Electrical Engineering 4. Basic Electrical and Electronics Engineering 5. Computer Programming 6. Basic Communication Engineering	1. Engineering Graphics 2. Engineering Workshop Practices	1. English for communication 2. Human Values and Ethics	1. Indian Constitution 2. Environmental Science & Ecology	1. NSS 2.Sports and Yoga

Credit Definition:

- ➢1-hour lecture **(L)** per week per semester = **1Credit**
- ➢1-hour tutorial **(T)** per week per semester = **1Credit**
- ➢2-hour Practical/Drawing**(P)** per week per semester = **1 Credit**

- **Four credit** courses are to be designed for **50** hours of Teaching-Learning process.
- **Three credit** courses are to be designed for **40** hours of Teaching-Learning process.
- **Two credit** courses are to be designed for **30** hours of Teaching-Learning process.
- **One credit** courses are to be designed for **15** hours of Teaching-Learning process

Note: The above is applicable only to THEORY courses

AICTE Activity Points to be earned by students admitted to B.Tech., programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be spread over the years, any time during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) donot affect SGPA/CGPA and shall not be considered for vertical progression.

Eligibility for UG Certificate:

A. **Undergraduate Certificate course will be offered by all departments of SoS(E&T), GGV.**
B. **For applicability of UG Certificate, the candidate who wants to exit after completing 1st year (02 semesters) BTech degree with 10 credits of skill-based courses lasting two months, including atleast 06 credits job specific internship/apprenticeship with NHEQF level 5/UCF level 4.5.**
C. **A student shall report to the concerned Head on or before the date notified by the Department/School/University, if he/she is interested to exit with UG Certificate**

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	AMUATB1	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	04
Subject:	ENGINEERING MATHEMATICS - A	3	1	-	15	15	10	40			

Differential Calculus

UNIT-1:
Leibnitz theorem, Roll's theorem, Lagrange's theorem, Mean value theorem, Expansions of functions by McLaurian and Taylor's series, Tangents and normal, Maxima and minima

UNIT-2:
Indeterminate forms, Asymptotes, Radius of curvature, Partial differentiation, Total differentiation

Integral Calculus

UNIT-3:
Reduction formulae, Curve tracing, Area, Volume, Length, Surface area, Double and triple integrals, Gamma and beta function.

Differential Equations

UNIT-4:
Differential equations of first order, Linear differential equation of higher order with constant coefficient, Equations reducible to linear equations with constant coefficients, Cauchy's homogeneous linear equations, Application of linear differential equations, Simultaneous differential equations.

UNIT-5:
Series solution of differential equations about ordinary point, Partial differential equations, linear homogeneous partial differential equations, application of partial differential equations: One dimensional heat equation and wave equation.

Recommended Books:

1. N.P. Bali, A Textbook of Engineering Mathematics, Laxmi publications, 10th edition, 2016.
2. H.K. Das, Higher Engineering Mathematics, S. Chand, 2014
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th edition

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	CYUATB3	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	ENGINEERING CHEMISTRY	3	-	-	15	15	10	40			

Course Objectives:

The objective of this Course is to:

- To make aware and enrich the the students about the basic concept and understanding of chemical concepts of basic Chemistry and spectroscopictechniques.

Course Content:

UNIT-1: I Concept of Quantum Energy and Spectroscopy: Quantization of Energy, Regions of spectrum. Electronic Spectroscopy: Electronic Transition, Woodward Fieser rules for calculating λ_{max} of conjugated dienes & α, β-unsaturated carbonyl compound, various shifts in λ_{max} and intensities. Infra-Red Spectroscopy: Conditions for Infra-Red Spectroscopy, Molecular vibrations & factors affecting Infra-Red frequencies.

UNIT-2: Chemical Bonding in Molecules: Introduction of chemical bonding, VSEPER Theory, V.B.Theory and Molecular Orbital Theory. Energy level diagrams of diatomic molecules and ions.

UNIT-3: Concept of Chirality, Enantiomers, Diastereomers,Meso-compounds and Racemic mixtures. Conformation of Acyclic hydrocarbons (Ethane, Propane & n-Butane) and cyclic hydrocarbon (Cyclohexane), Plane of symmetry, Centre of symmetry, Absolute and Relative Configuration (R &S, D & L and E & Z).

UNIT -4: Reactivity of Organic Molecules, Factors influencing acidity, basicity and nucleophilicity of molecules, kinetic vs thermodynamic control of reactions.

UNIT -5: Strategy for Synthesis of Organic Compounds: Reaction intermediates: Stability of Free Radicle, Carbocation and Carbanion. Introduction to reaction eg. Elimination and Substitution, Mechanisms of some named reactions.

Course Outcomes- At the end of the course the students will be able to understand and solve the practical problems of their higher Engineering classes on the basis of understanding of Chemistry developed in their B. Tech. I sem classes.

Textbooks/References:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai PublicationCo.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015edition.
3. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition(second).
4. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015edition.
5. A textbook of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., LatestEdition
6. Applied Chemistry by H.D. Gesser, SpringerPublishers
7. Textbook of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press,IIM
8. B. Siva Shankar, "Engineering Chemistry", Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.
9. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand & Co, New Delhi, 12th Edition, 2006.
10. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5th Edition, 2013.
11. R. P. Mani, K. N. Mishra, "Chemistry of Engineering Materials", Cengage Learning, 3rd Edition, 2015.

14/12/22 14/12/22 14/12/22 14/12/22

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	ECUATE4	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	3	-	-	15	15	10	40			

Course Learning Objectives:

- To provide knowledge for the analysis of DC and AC circuits.
- To explain the working principle, construction, applications of Transformer
- Study of DC machines and AC machines.
- To impart knowledge of analog and digital electronics

Unit-I: DC CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Ohm's Law, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Mesh & nodal analysis, Star- Delta Transformation.

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

Unit-II: AC CIRCUITS

Representation of sinusoidal waveforms, average and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections. Three-phase power measurement- Two- Wattmeter method.

UNIT-III: ELECTRICAL MACHINES

Construction, classification, ideal and practical transformer, equivalent circuit, losses in transformers, tests, voltage regulation and efficiency.

Introduction to DC Machines and three phase Induction Machine

Unit-IV: ANALOG and DIGITAL ELECTRONICS

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Introduction to Bipolar Junction Transistor.

Binary Number System, Logic Gates, Combinational circuits, Boolean Algebra, De Morgan's Theorem, Half and Full Adders,

UNIT V: Simulation and analysis of DC and AC circuits. Testing on single phase transformer. Demonstration of DC and AC machines. Basic analog and digital applications

Suggested Text / Reference Books:

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(iii)B L Theraja & AK Theraja,"A Textbook of Electrical Technology- Vol-I & II, S. CHAND &Co ltd, 2013.
(iv) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(v) Jacob Millman, Christos Halkias, Chetan Parikh, "Millman's Integrated Electronics - Analog and Digital Circuit and Systems", 2nd Edition 2017
(vi) Robert L Boylestad, Louis Nashlsky," Electronics devices and circuit theory", Pearson 11th edition 2013
(vii) M. Morris Mano ," Digital Logic and Computer Design", Pearson, 2004.

Course Outcomes:

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

- Analyze DC and AC circuits.
- Understand the working principle of Transformer, DC and AC machines.
- Understand the characteristics and working of diodes and transistors.
- Understand the basics of digital circuits and its importance.

14/12/22 14/12/22 14/12/22

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	FOUATC2	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	02
Subject:	ENVIRONMENTAL SCIENCE AND ECOLOGY	2	-	-	15	15	10	40			

Course Content

UNIT – I

Introduction: Environment - Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, Economic & Social Security.

Definition, Scope and basic principles of ecology and environment, Fundamentals of Ecology and Ecosystem – Structural and Functional Components. Food chain & Food webs. Ecological pyramids; Energy flow

UNIT – II

Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures.

UNIT-III

Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods.

UNIT – IV

Natural Resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water, Mineral resources, Forest Wealth, Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle.

UNIT-V

Energy – Different types of energy, Conventional sources & Non Conventional sources of energy: solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.

Text Books

1. Fundamentals of Ecology (3rd Ed.) 2001- MC Dash, Tata - McGraw Hill, New Delhi.
2. Introduction to Environmental Engg. (1991). - GM Masters, Prentice Hall of India.
3. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
4. R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies",Wiley India Private Ltd., New Delhi.
5. R Rajagopalan, "Environmental Studies – From Crisis to Cure",Oxford University Press, 2005,
6. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	CSUATE5	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	COMPUTER PROGRAMMING	3	-	-	15	15	10	40			

Course Objectives:

- To understand the basic of Idea ofAlgorithm.
- To understand the programing concept of Arithmetic expressions and BasicAlgorithms
- To learn the Functions and Structure ofarray.

Course Content:

UNIT-1: Introduction to Programming
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -
Idea of Algorithm:steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples.From algorithms to programs; source code, variables (with data types) variables and memory locations,Syntax and Logical Errors in compilation, object and executablecode.

UNIT-2: **Arithmetic expressions and precedence**
Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching Iteration and loops, **Arrays** (1-D, 2-D), Character arrays and strings

UNIT-3: Basic Algorithms
Searching,concept of binary search etc, Basic Sorting Algorithms Bubble sort etc,Finding roots of equations, introduction of Algorithm complexity

UNIT-4: Function
Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference binary search etc.
Recursion functions Recursion, as a different way of solving problems. Example programs, such as, Finding Factorial, Fibonacci series, etc.

UNIT -5: Structure
Structures, Defining structures and Array of Structures
Pointers Idea of pointers, defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

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

- Develop the algorithm and programmers for various applications using Arithmetic expressions, arrays, pointers andFunctions.

Textbooks/References:

1. Byron Gottfried, Schaum's Outline of Programming with C,McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, TataMcGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India

14/12/22 14.12.22 14/12/22

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	LAUATC1	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	-	50	01
Subject:	INDIAN CONSTITUTION	1	-	-	20	20	10	50			

Course Learning Objectives:

- To the importance of preamble of the constitution of India.
- To understand the fundamental rights and duty as a citizen of India.
- To understand the functioning of union and state government and their inter-relationship.

Course Content:

UNIT 1: Introduction: Constitution-meaning of the term, Sources and constitutional theory, Features, Citizenship. Preamble.

UNIT 2: Fundamental Rights and Duties: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy

UNIT 3: Union Government: Structure of Indian Union: Federalism, Centre-State relationship President: Role. Power and position, Prime Minister and council of ministers, Cabinet and Central Secretariat, Lok Sabha. Rajya Sabha

UNIT 4: State Government: Governor: Role and position, Chief Minister and council of ministers, State Secretariat

UNIT 5: Relationship between Centre and States: Distribution of Legislative Powers, Administrative Relations, Coordination between States

Textbooks/References:

1. Constitution of India, V.N. Shukla
2. The Constitutional Law of India, J.N. Pandey
3. Indian Constitutional Law. M.P. Jain

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

- Describe the salient features of the Indian Constitution
- List the Fundamental Rights and Fundamental Duties of Indian citizens
- Describe the Directive Principles of State Policy and their significance

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CYUALB3	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING CHEMISTRY LABORATORY	-	-	2	25	--	25			

Course Objectives:

The Lab sessions would help in learning:

- Application of iodometrically& titration inlab.
- Recognition of different chemicalreaction.
- Advanced lab methods like Spectrophotometry andchromatography

Course Content:

Group – A:

1. Standardization of sodium thiosulphate solution by standard potassium dichromate solution.
2. To determine the Normality and Strength (g/L) of given Ferrous Ammonium Sulphate solution 'A' using standard Ferrous Ammonium Sulphate (N/30) solution 'B' taking KMnO4 solution as an intermediate.
3. To determine the concentration of hypo solution ($Na_2S_2O_3.5H_2O$) iodometrically with given Iodine (N/50) solution.
4. Find out the Temporary hardness of given water sample using 0.01M EDTA solution,buffer solution (pH-10) and EBT as an indicator.
5. To determine chloride ion in a given water sample by Argentometric method (Mohr'smethod)

Group – B:

6. Preparation of Urea Formaldehyde resin.
7. Acetylation of Primary Amine: Preparation ofAcetanilide.
8. Base Catalyzed Aldol Condensation: Synthesis of dibenzalpropanone.
9. [4+2] Cycloaddition Reaction: Diels-Alde reaction.
10. Preparation of aspirin and calculate its yield.

Group – C:

11. To calculate the λ_{max} of a given compound using UV-visible spectrophotometer.
12. To separate the metallic ions by paper chromatography.
13. To determine the surface tension of a liquid by stalagmometer.
14. To determine the percentage composition of the given mixture consisting of two liquids A and B (non- interacting system) by viscosity method.
15. To determine the relative viscosity of given liquids by Ostwald's viscometer.

Note: At least two Experiments from each group must be performed.

Course Outcomes- On completion of the course, the students will be able to handle the chemicals of synthesis as well as titration that will ultimately make them efficient and develop their future chemistry laboratory skills

14/12/2022

14/12/22

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CSUALE5	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	COMPUTER PROGRAMMING LABORATORY	-	-	2	25	--	25			

Course Learning Objectives:

- To learn the Branching and logical expressions andLoops
- To learn the Arrays andFunction
- To understand the Numerical methods andRecursion

Course Content:

The laboratory should be preceded or followed by a tutorial to explain the approach or Algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical Integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

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

- Utilization of Branching and logical expressions and Loops, Arrays and Function and Numerical methods and Recursion for writing the programmes for various engineering applications

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	IPUALL2	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING WORKSHOP PRACTICES	-	-	2	25	--	25			

Course objectives:

- To impart student knowledge on various hand tools for usage in engineering applications.
- Be able to use analytical skills for the production of components.
- Design and model different prototypes using carpentry, sheet metal and welding.
- Make electrical connections for daily applications.
- To make student aware of safety rules in working environments.

Course Content:

1. Study of M/C tools in lathe machine
   Demonstration of different operations of lathe machine
   Practice of facing plain turning, taper turning etc

2. Study of Carpentry tools, equipments and different jobs
   Practice of Lap joints, Butt joints, T-Lab joints

3. Practice of Lap joint, Butt Joint, T-joint

4. Preparation of ¥ shape, square shape, work pieces as per the given specification

5. Replacement of fuse, condenser of fan/motor and fan regulator;
   Installation of switch board with wiring;
   Concepts of measuring instruments.

6. Identification of various electronics components and their terminals;
   Study of logic gates AND, OR, XOR and NOT, NAND, NOR;
   Study of Basic ICs.

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

- Make half lap joint, Dovetail joint and Mortise &Tenonjoint
- Produce Lap joint, Tee joint and Butt joint using Gas welding
- Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools
- Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair casewiring

Textbooks/References:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of WorkshopTechnology", Vol. I 2008 and Vol. II 2010, Media promoters and publishersprivate limited,Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition,2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008. (iv)Roy A. Lindberg, "Processes and Materials of Manufacture", 4thedition, PrenticeHallIndia, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc-Graw Hill House,2017.

14/12/22

14.12.22

SPORTS & YOGA

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ES Assessment	Grand total	Credits
Subject Code:	PEUALS2	L	T	P	Attendance	Activities	TOTAL			
Subject:	SPORTS AND YOGA	-	-	2	5	20	25	25	50	01

Physical Fitness Tests

- AAHPER youth fitness test
- Cooper's 12 Minute run-walk test

General Introduction of games and sports

Fundamental skills, history and development of the following games and sports:

- Athletics
- Batminton
- Basketball
- Cricket
- Football
- Hockey
- Handball
- Kabaddi
- Kho-kho
- Volley-ball
- Yoga

Note:

1. Each student will have to clear one of the physical fitness tests by the end of the semester.
2. One project is to be prepared by the students at least for two games.

References:

1. Barron H M, McGhee R (1997) A Practical Approach to Measurement in Physical Education.
2. Kansal D K (1996), Test and Measurement in sports and physical education, New Delhi, D V S Publication

14/12/22

14/12/2022

14.12.22

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(Effective from the Academic Year 2022–2023)

II-SEMESTER BTech Mechanical/IP/Chemical/Civil Engineering

S.N.	Course Code	Course Title	Teaching Hours/week			Examination				Credits
			Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIA Marks	SEA Marks	Total Marks	
			L	T	P					
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2	PPUBTB2	Engineering Physics	3	1	-	03	40	60	100	4
3	ITUBTE2	Introduction to Information Technology	3	-	-	03	40	60	100	3
4	ELUBTH1	English for Communication	3	-	-	03	40	60	100	3
5	CEUBTE1	Engineering Mechanics	3	-	-	03	40	60	100	3
6	ME UBTH2/CH UBTH2/ IP UBTH2/CEUBTH2	Human Values and Ethics	1	-	-	02	50	-	50	1
7	PPUBLB2	Engineering Physics Laboratory	-	-	2	03	25	25	50	1
8	CEUBLE1	Engineering Mechanics Laboratory	-	-	2	03	25	25	50	1
9	MEUBLL1	Engineering Graphics	1	-	3	03	25	25	50	3
10	NSUBLS1	NSS	-	-	2	01	25	25	50	1
Total			**17**	**2**	**09**	**27**	**350**	**400**	**750**	**24**

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BASIC SCIENCE (B)	ENGINEERING SCIENCE (E)	SKILL ENHANCEMENT COURSE (L)	HUMANITIES SCIENCE (H)	MANDATORY COURSE (C)	EXTRA-CURRICULAR ACTIVITIES (S)
1. Mathematics – A 2. Physics 3. Chemistry 4. Mathematics - B	1. Engineering Mechanics 2. Introduction to Information Technology 3. Basic Electrical Engineering 4. Basic Electrical and Electronics Engineering 5. Computer Programming 6. Basic Communication Engineering	1. Engineering Graphics 2. Engineering Workshop Practices	1. English for communication 2. Human Values and Ethics	1. Indian Constitution 2. Environmental Science & Ecology	1. NSS 2.Sports and Yoga

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The activities can be spread over the years, any time during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) donot affect SGPA/CGPA and shall not be considered for vertical progression.

Eligibility for UG Certificate:

A. **Undergraduate Certificate course will be offered by all departments of SoS(E&T), GGV.**
B. **For applicability of UG Certificate, the candidate who wants to exit after completing 1st year (02 semesters) BTech degree with 10 credits of skill-based courses lasting two months, including atleast 06 credits job specific internship/apprenticeship with NHEQF level 5/UCF level 4.5.**
C. **A student shall report to the concerned Head on or before the date notified by the Department/School/University, if he/she is interested to exit with UG Certificate**

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	AMUBTB4	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	04
Subject:	ENGINEERING MATHEMATICS - B	3	1	-	15	15	10	40			

UNIT-1:**Linear Algebra**
Vector space, linear dependence and linear independence of vectors, linear transformations, rank and inverse by elementary transformations, system of linear equations – consistency and inconsistency, eigen value and eigen vectors, Caley-Hamilton theorem and its application to find the inverse.

UNIT-2: **Theory of equations**
Polynomial and polynomial equations, division algorithm, roots of equations, remainder theorem, factor theorem, synthetic division, fundamental theorem of algebra, multiplication of roots, descarte's rule of sign, Descarte's method.

UNIT-3: **Vector Calculus**
Vector functions, differentiation of vectors, velocity and acceleration, scalar and vector fieldm gradient of scalar field, directional derivative, properties of gradient, divergence of vector, curl of vector, point function, properties of divergence and curl, integration of vector function, line integral, surface integral, Green's theorem, gauss theorem, Stoke's theorem (without proof) and their simple applications,

UNIT-4: **Complex Number**
Complex numbers and its properties, conjugate complex numbers, standard form of complex numbers, De-Moivre's theorem, Roots of complex numbers, exponential function of complex variable, circular form of complex variable, Hyperbolic function of complex numbers, Logarithmic function of complex numbers.

UNIT-5: **Infinite Series**
Sequence, convergent, divergent, oscillating sequence, infinite series, behavior of infinite series, ratio test, root test, comparison test, Raabe's test, Logarithmic test.

Recommended Books:

1. N.P. Bali, A Textbook of Engineering Mathematics, Laxmi publications, 10th edition, 2016.
2. H.K. Das, Higher Engineering Mathematics, S. Chand, 2014
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th edition

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	PPUBTB2	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	04
Subject:	ENGINEERING PHYSICS	3	1	-	15	15	10	40			

Course Objectives:

- To know the basic principles, effects and applications such as physical, optical parameters used for engineering applications.
- To learn about various laws and applications of electromagnetic theory.
- To know the basic structure, working principles and applications of lasers and optical fibre communication.
- To know the basics of semiconductor physics, semiconductor materials and devices and its characterization for advance technological applications
- To familiarize the basis of quantum theory and to make students to solve the physical problems for advancement of the technology.

Course Content:

Unit1: Optics: Interference and Diffraction
Introduction, Young's experiment theory of interference, Coherent and non-coherent sources, Fresnel's Bi- prism and Newton's ring experiment.
Diffraction of light, Fresnel and Fraunhofer's diffraction, diffraction due to plane diffraction grating.

Unit2 Electromagnetic Theory
Coulomb's law electrostatics field and potential, electric flux, Gauss' law, Poisson's and Laplace's equation. Equation of continuity for charge conservation, Ampere's and Faraday's laws, Maxwell's Electromagnetic equations.

Unit3 Laser and Fiber optics
Introduction, elementary idea of spontaneous and stimulated emission, active medium population inversion, Einstein's coefficients, Types of lasers and important applications of lasers.
Introduction to optical fibers, basic principles of optical fiber, critical angle numerical aperture, maximum acceptance angle, classification of optical fiber.

Unit4 Semiconductor physics and Devices
Formation of energy in solids, Energy band gap of metals, insulators and semiconductors, classification of semiconductor: Intrinsic and Extrinsic semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Electrical conductivity in conductors and semiconductors, working of P-N junction diodes and bipolar junction transistor.

Unit5 Introduction to Quantum Mechanics
Introduction to QuantumMechanics, photoelectric effect, Compton effect, wave-particle duality, uncertainty principle, wave function, De-Broglie waves, phase and Group velocity, Davisson and Germer experiment, Schrodinger wave equation, particle in a box (I-Dimensional)

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

- Student's ability to understand the basic principles and applications of physical optics for physical parameters measurements such as length, thickness, aperture size etc.
- Student's will be able to design, characterized the lasers and optical fibers and their effective

utilization in optical communications, imaging etc.

- Students demonstrate appropriate competence and working knowledge of laws of electromagnetic theory and semiconductor physics and devices for their advanceapplications

Textbooks/References:

1. Applied physics-I and II By Navneet Gupta, Dhanpat Rai &Co.
2. Engg. Physics by S.K.Srivastava and R.A. Yadav, New Age Pub. NewDelhi
3. Engg. Physics by Uma Mukherjee, NarosaPublication.
4. Engg. Physics by M.N. Avadhanulu, S. ChandPub.
5. Electricity and Magnetism by Rangwala and Mahajan, Tata McGraw Hill.1998
6. Concepts of Physics Part-II by H.C.Verma, BharatiBhawan (P&D),1998
7. Modern physics by Beiser, McGraw Hill Inc. New York, Publication1995
8. Modern physics by Mani and Mehta, East-West PressPvt.Ltd.1998
9. Introduction to Electrodynamics, DavidGriffith
10. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-HillInc.(1995).
11. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons.Inc.2007).
12. S.M. Sze, Semiconductor Devices: physics and Technology, Wiley(2008)
13. Yariv and p.yeh, Photonics Optical Electronics in Modern Communications, Oxford University press, New York(2007)
14. P. Bhattacharya, Semiconductor Optoelectronic Devices, prentice Hall of India(1997)
15. Online course: "Semiconductor Optoelectronics" by M. R. Shenoy onNPTEL.
16. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak onNPTEL.

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	ITUBTE2	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	INTRODUCTION TO INFORMATION TECHNOLOGY	3	-	-	15	15	10	40			

Course Objective

1. To illustrate the concepts of cyber security and familiar and aware with various cybercrimes attack and their prevention.
2. To describe the different services model of Cloud Computing and understand Understanding of different evaluating computer model of cloud computing.
3. To relate theoretical concepts with problem solving approach in IoT and assess the comparative advantages and disadvantages of Virtualization technology.
4. To provides the basic knowledge of use appropriate storage and access structures. the student must be able to analyse familiar with the machine learning algorithms and applications of various data science.
5. To integrate classroom learning into an everyday communicative activity in distributed system. Familiar with various web services activity.

Course Content:

Unit 1: -Cyber Security Fundamentals Security Concepts: Authentication, Authorization, Non-repudiation, Confidentiality, Integrity, availability. Cyber Crimes and Criminals: Definition of cyber-crime, types of cyber-crimes and types of cyber-criminals.

Unit 2: **-Cloud Computing Fundamentals**: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

Unit 3: -Internet of Things–Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IOT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

Unit 4. Data Science: -Introduction and Importance of Data Science, Statistics, Information Visualisation, Data Mining, Data Structures, and Data Manipulation, Algorithms used in Machine Learning, Data Scientist Roles and Responsibilities. Data Acquisition and Data Science Life Cycle.

Unit 5: -Evaluation and Emergence of Web Services – Evaluation of Distributed Computing, Core Distributed Technologies, Challenges in Distributed System, and Introduction to web services, Web Services Architecture, Basic steps of implementing web services

Course Outcome:

1. Ability to learn about cybercrimes and how they are planned.
2. Ability to understand the cloud computing concepts and services model.

14/12/22 14/12/22

3. Ability to understand Internet of Things –Definition and Characteristics of IoT.
4. Explain how data is collected, managed and stored for data science. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists
5. Understand the details of web services Evolution of Distributed Computing.

Textbooks/References:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group
3. Cloud Computing Principles and Paradigm by Rajashekar Buyya, James Broberg, Andhrz M. Wiley 2011.
4. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
5. Mining of Massive Datasets, by Leskovec, Rajaraman, and Ullman.

R. Nagappan, R.Scokzylas, R.P. Sriganesh, Developing Web Services, Wiley India.

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	ELUBTH1	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	ENGLISH FOR COMMUNICATION	3	0	-	15	15	10	40			

Course Learning Objectives

- To build up word power, to brush up the knowledge of English grammar, to develop good writing and speaking skills in the students

Course Content:

Unit 1: -Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

Unit 2: -Basic WritingSkills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

Unit 3: -Identifying Common Errors inWriting

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies,Clichés

Unit 4: -Nature and Style of sensibleWriting

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

Unit 5: -WritingPractices

Comprehension, Précis Writing, Essay Writing.

Oral Communication (This unit involves interactive practice sessions in LanguageLab)
ListeningComprehension
Pronunciation, Intonation, Stress andRhythm
Common Everyday Situations: Conversations andDialogues
Communication atWorkplace
Interviews
Formal Presentations

Course Outcome:

At the end of the course students will be ablelearn a lot of new words. They also learnt the particularities and peculiarities of English grammar. As a result, they could speak and write English with theleast possible error

Textbooks/References:

1. Practical English Usage. Michael Swan. OUP.1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007 (iii)On Writing Well. William Zinsser. Harper Resource Book.2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press.2006.
4. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press.2011.
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford UniversityPress

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	CEUBTE1	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	ENGINEERING MECHANICS	3	0	-	15	15	10	40			

UNIT – I

INTRODUCTION: Basic idealization of mechanics, particle, rigid body, mass, time, continuum, force, force system, system of units, principle of transmissibility of forces, principle of superposition.

COPLANAR CONCURRENT FORCE SYSTEM: Resultant of forces. Resolution of forces, Composition of coplanar concurrent, parallel and non-concurrent forces, Moment of a force, Varignon's theorem, free body diagram, equilibrant, equilibrium of particles and rigid bodies.

Self-Study Component: Application of triangle and polygon Law, vector method of resolution and Composition of forces.

UNIT – II

SUPPORT REACTIONS: Types of loads and types of supports, statically determinant beams, Numerical problems on support reactions for beams with point loads (normal and inclined), uniformly distributed load, uniformly varying load and moment.

FRICTION: Introduction, types of friction, laws of friction, angle of friction, angle of repose , cone of friction, characteristics of dry friction, application –body on horizontal plane and inclined plane and ladder friction.

Self-Study Component: Numerical problems on support reaction of beams loaded with trapezoidal loads, Support reactions for Compound beams and wedge friction - numerical problems.

UNIT – III

CENTROID AND CENTRE OF GRAVITY: Introduction to centroid and centre of gravity, Centroid of rectangular, triangular, circle, semicircle, quarter circle lamina and sector from first principles. Numerical problems on Centroid of composite lamina.

Self-Study Component: Determining Centroid for Composite Lamina with openings.

UNIT – IV

MOMENT OF INERTIA: Introduction, radius of gyration, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, moment of inertia of standard geometrical figures by first principles. Numerical problems on moment of inertia of composite sections.

Self-Study Component: Determining moment of Inertia of Composite sections with reference to given axis.

UNIT – V

DYNAMICS: Introduction to dynamics, Classification, linear and curvilinear motion- projectiles, centripetal and centrifugal forces, banking/super elevation.

Introduction to work, power and energy, impulse – numerical problems.

Self-Study Component: Concept of motion with varying acceleration. Collision of elastic bodies.

Text Book(s):

1. S.S Bhavikatti, A text on elements of Civil Engineering and mechanics, New age International publishers, 2015.
2. R.S. Khurmi, A text book of engineering mechanics, S. CHAND & COMPANY LTD.

Reference Book(s):

1. Ramamrutham S: A text book of applied mechanics, Dhanpatrai and sons
2. S. Rajashekaran, G Shankar Subramanian: Engineering Mechanics- Statics and Dynamics, Vikas Publishing House 1999.
3. Ferdinand Beer and Johnson F.R (Jr) Mechanics for Engineers, Tata Mc Graw-hill Publishing comp. Ltd New Delhi.

14/12/22

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	MEUBTH2 (for Mech) CHUBTH2 (for Chem) IPUBTH2 (for IPE) CEUBTH2(for Civil)	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	-	50	01
Subject:	HUMAN VALUES AND ETHICS	1	-	-	20	20	10	50			

COURSE OBJECTIVE:

1. To create an awareness on Engineering Ethics and Human Values.
2. To understand social responsibility of an engineer.
3. To appreciate ethical dilemma while discharging duties in professional life.

COURSE OUTCOME:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the role of a human being in ensuring harmony in society and nature.
4. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

COURSE CONTENT:

UNIT I: Introduction to Value Education

1. Value Education, Definition, Concept and Need for Value Education.
2. The Content and Process of Value Education.
3. Basic Guidelines for Value Education.
4. Self exploration as a means of Value Education.
5. Happiness and Prosperity as parts of Value Education.

UNIT II: Harmony in the Human Being

1. Human Being is more than just the Body.
2. Harmony of the Self ('I') with the Body.
3. Understanding Myself as Co-existence of the Self and the Body.
4. Understanding Needs of the Self and the needs of the Body.
5. Understanding the activities in the Self and the activities in the Body.

UNIT III: Harmony in the Family and Society and Harmony in the Nature

1. Family as a basic unit of Human Interaction and Values in Relationships.
2. The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love.
3. Comprehensive Human Goal: The Five Dimensions of Human Endeavour.
4. Harmony in Nature: The Four Orders in Nature.
5. The Holistic Perception of Harmony in Existence.

UNIT IV: Social Ethics

1. The Basics for Ethical Human Conduct.
2. Defects in Ethical Human Conduct.

3. Holistic Alternative and Universal Order.
4. Universal Human Order and Ethical Conduct.
5. Human Rights violation and Social Disparities.

UNIT V: Professional Ethics

1. Value based Life and Profession.
2. Professional Ethics and Right Understanding.
3. Competence in Professional Ethics.
4. Issues in Professional Ethics – The Current Scenario.
5. Vision for Holistic Technologies, Production System and Management Models.

TEXT BOOKS

1.A.NTripathy, New Age International Publishers, 2003.
2.Bajpai. B. L , , New Royal Book Co, Lucknow, Reprinted, 2004
3.Bertrand Russell Human Society in Ethics & Politics

REFERENCE BOOKS

1.Corliss Lamont, Philosophy of Humanism
2.Gaur. R.R. ,Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3.Gaur. R.R. ,Sangal. R ,Bagaria. G.P, Teachers Manual Excel Books, 2009.
4.I.C. Sharma . Ethical Philosophy of India Nagin & co Julundhar
5.Mortimer. J. Adler, – Whatman has made of man
6.William Lilly Introduction to Ethic Allied Publisher

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	PPUBLB2	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING PHYSICS LABORATORY	-	-	2	25	--	25			

Course Objectives:

- To learn and perform the various practical related to optical components characterization, semiconductor material and devices characterization and know their applications in advance areas such as communication, industries, defence, navigationetc.

Course Content:

LIST OF PRACTICALS:

1. 1. To determine the wavelength of sodium light with help of Fresnel'sBi-prism.
2. To determine the refractive index and dispersive power of the material of prism with the help of spectrometer.
3. To determine the sodium light by Newton's ringmethod.
4. To determine the wavelength of sodium light by plane diffraction grating usingspectrometer.
5. To demonstrate the diffraction pattern and determine the wavelength of different colours of mercury (white) light using plane diffraction grating andspectrometer.
6. To determine the wavelength and number of line per cm on a diffraction grating using semiconductor laserdiode.
7. To determine the specific rotation of sugar solution with the help ofpolarimeter.
8. Determine the width of the single slit and diameter of circular aperture using Fraunhofer diffraction pattern produced by semiconductor laserdiode.
9. To determine the energy band gap (E_g) of a semiconductor material using P-N junctiondiode.
10. To determine the e/m ratio by the Thomson'smethod.
11. To study the P-N junction diode characteristics, in forwarded and reverse biasconditions.
12. To study the Zener diodecharacteristics.
13. To study the characteristics and gain of Transistor in C-B and C-Emode.
14. Determine the Planck'sconstant.

Course Outcomes: On completion of the course, the students would be able to:

- Know about basic optical facts and phenomenon, characterization of optical components anddevices
- To know the basic semiconductor materials and devices and theirapplications
- To know how the performance of semiconductor devices can beimproves.

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CEUBLE1	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING MECHANICS LABORATORY	-	-	2	25	--	25			

Course Objectives:

- To perform the practical giving basic understanding to fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- To perform the practical giving basic understanding to fundamental application of mechanics like screw jack, winchcrab and simple wheel and axle

Course Content: List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

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

- Verify the fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- Analyze the friction coefficient between two surfaces
- Calculate the efficiency of screw jack, winch crab and wheel and axle

14/12/22

14/12/2022

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	MEUBLL1	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING GRAPHICS	1	-	3	25	--	25			

Course Learning Objectives:

- To learn the basic of Engineering Drawing and Orthographic Projections
- To learn the Sections and Sectional Views of Right Angular Solids
- To learn the Isometric Projections covering and overview of Computer Graphics

UNIT 1:Introduction Engineering Graphics and Engineering Curves: Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction. Engineering Curves - Conic Sections, Special Curves-Cycloids, Epicycloids, Hypocycloids, Involutes and trochoid.

UNIT 2:Projection of Points, Straight lines and Planes: Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes. Projections of regular planes, inclined to both planes

UNIT 3:Projections Solids: Introduction, Type of solid, Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P.

UNIT 4: Section of Solids and Development of Surfaces: Sectioning of regular solids - Section planes perpendicular to one plane and parallel or inclined to other plane - Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

UNIT 5: Isometric Projections and Orthographic Views: Principles of Isometric Projections-Isometric Scale- Isometric Views Conventions-Plane Figures, Simple and Compound Solids. Conversion of isometric views to orthographic views. Conversion of orthographic views to isometric projections, vice-versa. Introduction to perspective projection.

Computer Aided Drafting: Introduction to computer aided drafting package to make 2-D drawings. Demonstration purpose only - not to be included in examinations.

Textbooks/References:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. CAD Software Theory and User Manuals

Course Outcomes:

1. At the end of the course, the student shall be able to
2. Draw engineering curves, orthographic projections of lines, planes and solids.
3. Draw sections of solids including cylinders, cones, prisms and pyramids.
4. Make development of surfaces, Orthographic and Isometric projections
5. Overview of Computer Graphics.

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SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE Viva/ Assessment	Grand total	Credits
Subject Code:	NSUBLS1	L	T	P	Attendance	Activities	TOTAL			
Subject:	NSS	-	-	2	5	20	25	25	50	01

S.N.	PROGRAM HEADS	HOURS/SEM
1	Cleaning program	06
2	Plantation	06
3	Health Camp/Special Days celebration	10
4	Awareness program/Ralley	06

14/12/2021

14/12/2021

गुरू घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)

(केन्द्रीय विश्वविद्यालय अधिनियम 2009, कमांक 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

(A Central University established by the Central University Act., 2009 NO.25 of 2009)

Web Site – www ggu.ac.in,ph. No. 07752-260342, fax No. 07752-260148,154

क्रमांक 339 / अ.मं. / पाठ्यक्रम / 2023 बिलासपुर, दिनांक 26 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 कमांक 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)

प्रतिलिपिः–

1. परीक्षा नियंत्रक,गुरू घासीदास विश्वविद्याालय 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)

Chemical Engg Deptt Rec No... DL 31/10/23 GGV Bilaspur

विद्यापरिषद की स्थायी समिति की बैठक दिनांक 16.10.2023 के कार्यवृत्त का अंश (1)

अ.अ.वि.क्र2 अध्ययन मण्डल केमिकल इंजीनियरिंग विभाग के द्वारा एनईपी के तहत संचालित बी.टेक कार्यक्रम के तीसरे एवं चौथे समेस्टर का पाठ्यक्रम 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।

18/10/2023

स.कु.स.(अका.)

20.10.23

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

26/10/23

स.कु.स.(अका.)

20.10.23

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	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	CIA	SEA	TOTAL	
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	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	CIA	SEA	TOTAL	
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.

BOS held on 06/10/23

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															

BoS held on 06/10/23

DTT2 **Inorganic Chemical Technology** [L:3, T:0, P:0]

ctives

ontents:

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

BOS held on 06/10/17

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															

BOS Meeting 06/10/23

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

BoS Held on 06-10-2023

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															

BOS held on 06/10/2023

AUDTO1 **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.

BOS held on 06/10/2023

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															

BoS held on 06/10/23

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 06/10/2023

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															

BoS Held on 06-10-2023

Basic Chemical Engineering Lab [L:0, T:0, P:2]

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

Fluid Mechanics Lab [L:0, T:0, P:2]

Objectives:

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

B.TECH. CHEMICAL ENGINEERING III[RD] SEMESTER SYLLABUS (NEP)

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.
2. 0. Wilkes. Fluid Mechanics for Chemical Engineers, Prentice Hall of India.
3. R. W. Fox. P. J. Pritchard & A. T. McDonald,Introduction to Fluid Mechanics,Wiley-Indial

Reference Book:

BoS Held on 06-10-2023

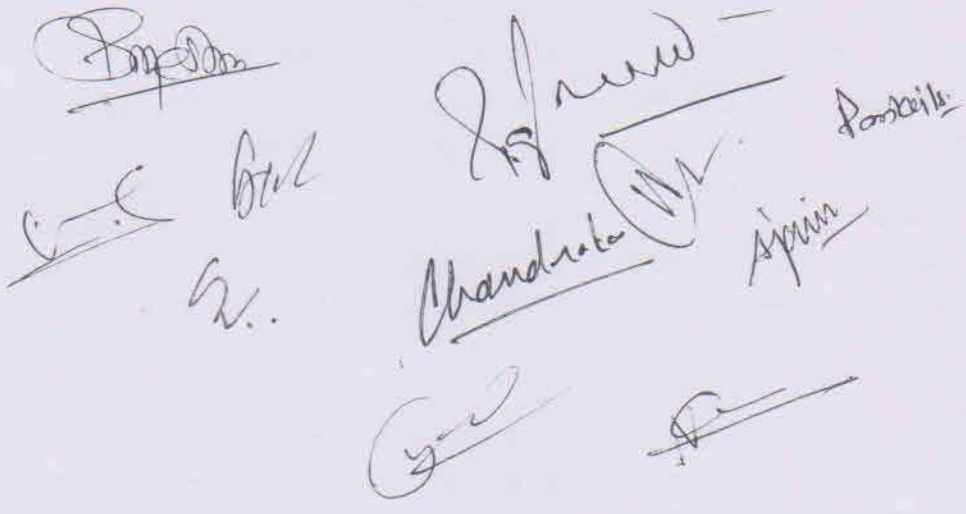
1. V. Gupta & S. K. Gupta, Fundamentals of Fluid Mechanics, New Age International.
2. W.L. McCabe, J. C. Smith & P. Harriot. Unit Operations of Chemical Engineering. MeGraw-Hill International Edition

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

CTT2 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-I: 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

students 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]**

jectives

he 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.

BoS Held on 06-10-2023

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		1
CO2	2	2	1	1									2		1
CO3	2	1	1	1									2		1

Weightage: 1-Slightly; 2-Moderate; 3-Strongly

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															
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															

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 2022-23)

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

THIRD YEAR, FIFTH SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
	THEORY					Sessional			
			L	T	P	IA	ESE	TOTAL	
01.	CH305TPC07	Heat Transfer	3	1	0	30	70	100	4
02.	CH305TPC08	Mass Transfer-I	3	1	0	30	70	100	4
03.	CH305TPC09	Chemical Reaction Engineering-I	3	1	0	30	70	100	4
04.	CH305TPC10	Process Equipment Design-I	3	1	0	30	70	100	4
05.	CH305TPE1X		3	0	0	30	70	100	3
06.	CH305TPE2X		3	0	0	30	70	100	3
PRACTICAL									
01.	CH305PPC05	Heat Transfer Lab	0	0	3	30	20	50	1.5
02.	CH305PPC06	Chemical Reaction Engineering Lab	0	0	3	30	20	50	1.5
		Total	18	4	6	240	460	700	25

IA – Internal Assessment

ESE - End Semester Examination

Total Credits – 25

Total Marks – 700

Total Periods / week - 28

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
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SCHEME FOR EXAMINATION (Effective from session2022-23)

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

THIRD YEAR, SIXTH SEMESTER (AICTE)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
	THEORY					Sessional			
			L	T	P	IA	ESE	TOTAL	
01.	CH306TPC11	Mass Transfer-II	3	1	0	30	70	100	4
02.	CH306TPC12	Process Dynamics and Control	3	1	0	30	70	100	4
03.	CH306TPC13	Chemical Reaction Engineering-II	3	1	0	30	70	100	4
04.	CH306TPE3X		3	0	0	30	70	100	3
05.	CH306TMC02	Essence of Indian Knowledge Tradition	3	0	0	30	70	100	3
06.		Open Elective	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH306PPC07	Mass Transfer Lab	0	0	3	30	20	50	1.5
02.	CH306PPC08	Process Dynamics and Control Lab	0	0	3	30	20	50	1.5
		Total	18	3	6	240	460	700	24

IA – Internal Assessment
Total Marks – 700

ESE - End Semester Examination
Total Periods / week - 27

Total Credits – 24

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)

DEPARTMENT OF CHEMICAL ENGINEERING

List of Professional Elective Courses (Fifth and Sixth Semester)

S.No.	Semester	Course No.	Subjects
01.	V	CH305TPE11	Engineering Materials
02.		CH305TPE12	Polymer Technology
01.	V	CH305TPE21	Inorganic Chemical Technology
02.		CH305TPE22	Fluidization Engineering
01.	VI	CH306TPE31	Organic Chemical Technology
02.		CH306TPE32	Fuel Combustion Energy Technology

List of open electives for 6th semester B.Tech students

S.No	Course code	Course name	Offered by
1	CH206TOE01	Industrial utilities and safety	Chemical
2	CE206TOE01	Metro systems and Engineering	Civil
3	CS206TOE01	Object Oriented Programming with C++	CSE
4	EC206TOE01	Introduction to electronic devices and circuits	ECE
5	IP206TOE01	Operation Research	IPE
6	IT206TOE01	Computer Graphics	IT
7	ME206TOE01	Automobile Engineering	MECH

B.Tech. V Semester

CH305TPC07 **Heat Transfer** **[L:3, T:1, P:0]**

Objectives

1. To provide a fundamental understanding of heat transfer by conduction, convection and radiation.
2. To understand the fundamental laws, their correlations, and applications.
3. To study the general design of heat exchanger, evaporator, and condenser.

Contents:

Unit-I: Introduction to three modes of heat transfer, Derivation of heat balance equation-steady one-dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, approximate solution to unsteady conduction heat transfer by the use of Heissler charts.

Unit-II: Heat convection, boundary layers, Forced convection, Natural convection, Dimensionless parameters for forced and free convection heat transfer, Correlations for forced and free convection, Approximate solutions to laminar boundary layer equations (momentum and energy), Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

Unit-III: Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.

Unit-IV: Heat Transfer Equipment: Types of heat exchangers, General design of parallel and counter-current, Double pipe and Shell and Tube heat exchanger, Analysis and design of heat exchangers using both LMTD and ε- NTU methods, Similarity between heat and mass transfer.

Unit-V: Heat Transfer with phase change: Evaporation- Types of evaporators and fields of their applications, Single and multiple effect evaporators: their design and operation, Vapour recompression, Heat transfer from condensing vapours, Heat transfer to boiling liquids. Boiling and Condensation heat transfer, Pool boiling curve

Text Books :

1. Unit Operations of Chemical Engineering by W. L. McCabe, J. C. Smith and P. Harriot, McGraw Hill Education.
2. A Heat Transfer Textbook, Third Edition, by John H. Lienhard IV and John H. Lienhard V, Phlogiston Press, Cambridge, Massachusetts, U.S.A.

Reference Book:

1. Fundamentals of Momentum, Heat and Mass Transfer by J. R. Welty, C. E. Wicks, R. E. Wilson and G. L. Rorrer, John Wiley & Sons.
2. Principles of Heat Transfer, Seventh Edition, by Frank Kreith, Raj M. Manglik, Mark S. Bohn, Global Engineering, Cengage Learning, Stamford, USA.

3. Fundamentals of Heat and Mass Transfer, Frank P. Incropera, David P. Dewitt, Theodore L. Bergman, Adrienne S. Lavine, John Wiley & Sons; 6th edition.
4. Heat Transfer-A Practical Approach, Yunus A. Cengel, McGraw Hill, Second Edition.

Course Outcome:

Students would be able to

1. Analyze the steady state and unsteady state heat transfer by conduction.
2. Calculate heat transfer coefficients for forced and natural convection.
3. Explain and calculate the heat transfer by radiation.
4. Design and analyze the double pipe and shell and tube heat exchanger performance for co-current and counter-current flows.
5. Analyze the heat transfer equipment involving phase change.

CH305TPC08 **Mass Transfer-I** **[L:3, T:1, P:0]**

Objectives

1. To provide the understanding of mass transfer operations and equipments.
2. To impart the understanding of separation processes such as diffusion, distillation and absorption.

Contents:

Unit-I: Constitutive laws of diffusion; unsteady state diffusion, molecular diffusion in gases and liquids, Diffusion velocities, Convective mass transfer, interphase mass transfer and mass transfer coefficients, mass transfer correlations.

Unit-II: Phase Equilibria: Vapor-liquid equilibrium curves and boiling point diagram, Volatility, Solubility of gases, Enthalpy-concentration diagrams. Equilibrium Stage Operations Principles, Determination of number of ideal stages for two-component systems by graphical and absorption factor methods.

Unit-III: Flash distillation, differential distillation, steam distillation, Azeotropic distillation and Extractive distillation, Continuous distillation with rectification, Reflux ratio, Minimum reflux ratio, calculation of number of plats – Lewis sorel method, McCabe Thiele method.

Unit-IV: Fenske equation, Optimum reflux ratio, Analysis of fractionating column by enthalpy concentration diagram method, Plate efficiencies, Packed Column, Height Equivalent to Theoretical Plate.

Unit-V: Gas Absorption: Design of packed towers, Principles of absorption, Rate of absorption, Two film theory, Overall coefficients, HTU method, Interrelation between heat transfer, momentum transfer and mass transfer.

Suggested Text Books :

1. Principles of Mass Transfer and Separation Processes by B. K. Dutta, PHI Learning Private Limited.
2. Mass Transfer Operations by R. E. Treybal, McGraw Hill.
3. Diffusion - Mass Transfer in Fluid Systems by E.L. Cussler, Cambridge University Press.
4. Principles of Unit Operations by A. S. Foust, A. L. Wenzel, C. W. Clump, L. Maus and L. B. Anderson, John Wiley & Sons.

Course Outcome:

Students would be able to

1. Explain the basics of mass transfer and related laws.
2. Identify the concepts of phase equilibrium in mass transfer related problems.
3. Understand the molecular diffusion phenomena and binary separation principles of distillation and absorption operation.

4. Solve problems related to distillation, diffusion and absorption and mass transfer equipment.
5. Design plate /packed column for adsorption and distillation operation.

CH305TPC09 Chemical Reaction Engineering-I [L:3, T:1, P:0]

Objectives

To impart the knowledge of the kinetics and thermodynamics of single and multiple reaction and the effect of temperature and pressure on reaction systems.

Contents:

Unit-I: Kinetics of Homogeneous Reactions: Kinetics and thermodynamics of chemical reactions, Kinetics of homogenous reactions rate theories, Analysis of rate equations.

Unit-II: Interpretation of Batch Reactor Data: Irreversible reactions, Total pressure method of kinetic studies, Analysis of complex rate equations, Complex reactions, Chain reactions, Variable volume reactions, Rate constants and equilibrium.

Unit-III: Ideal Reactor for Single Reaction: Ideal batch reactors, Steady state mixed flow reactor, Steady state plug flow reactor, Size comparison of single reactors, Multiple-reactor system.

Unit-IV: Design for Multiple Reaction: Introduction to multiple reaction, Qualitative treatment of product distribution and reactor size for parallel reactions, Reversible first order reactions in series, Favourable contacting patterns for irreversible reactions in series (First order &followed by first order).

Unit-V: Temperature and Pressure Effects: Single reaction, General graphical design procedure, Optimum temperature progression, Heat effects- adiabatic and non-adiabatic operations.
Multiple reactions: Temperature and vessel size for maximum production.

Suggested Text Books :

1. Chemical Reaction Engineering by O. Levenspiel, John Wiley & Sons.
2. Elements of Chemical Reaction Engineering by H. S. Fogler, Prentice Hall.
3. Chemical and Catalytic Reaction Engineering by J. J. Carberry, Dover Publications.
4. Chemical Reactor Analysis and Design by G. F. Froment, K. B. Bischoff and J. D. Wilde, Wiley.

Reference Book:

1. Reaction Kinetics for Chemical Engineers by S. M. Walas, Butterworths Publishers.

Course Outcome:

Students would be able to

1. Develop rate of reaction for homogeneous reactions.
2. Interpret batch reactor data and design ideal reactors for single and multiple reactions.
3. Describe different aspects of design for multiple reactions.
4. Explain the effect of temperature and pressure on reaction rate.

CH305TPC10 Process Equipment Design-I [L:3, T:1, P:0]

Objectives

To impart knowledge of various process pressure vessel
To understand the various supports which used in pressure vessel
To understand the chemical engineering principles applicable to mechanical process design for various pressure vessels and standard codes for design of chemical plant equipment.

Contents:

Pressure and Storage Vessels: Design of pressure and storage vessels and their supports. End closures, Flat plates, Flanged, Dished, Hemispherical, Ellipsoidal and conical ends.

Suggested Text Books :

1. Introduction to Chemical Equipment Design (Mechanical Aspects) by B.C. Bhattacharya, Chemical Engineering Education Development Center.
2. Process Equipment Design by L.E. Brownell and E.H. Young.
3. Design of Process Equipment Design by M.V. Joshi and V.V. Mahajan, MacMillan, India
4. Chemical Engineering by J. M. Coulson and J. F. Richardson, Vol-I, MacMillan, Newyork.
5. Process Equipment Design by S.D. Dawande, Dennet & Co.

Reference Books:

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

Course Outcome:

Students would be able to

1. Determine the various parameter of pressure vessel
2. Design of different kind of closure used in pressure vessel
3. Understand the design of storage vessels and their supports.

CH305TPE11 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 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.

Course Outcome:

Students would be able to

1. Explain different types of materials and their mechanical properties and limitations.
2. Explain types of corrosion and various methods to control them.
3. Describe phase diagram and its significance.

CH305TPE12 Polymer Technology [L:3, T:0, P:0]

Objectives

To develop the abilities required for production, processing, properties testing and Environmental effects of polymers and its manufacturing Industries.

Contents:

Unit-I: Introduction to Polymer Science: Classification of polymer and functionality, Polymerization, Polymer structure, Molecular weight distribution and thermal transition types.

Unit-II: Polymer Synthesis: Step and Chain growth polymerization and its kinetics, Copolymerization and its kinetics, Reaction mechanism of synthetic Polymer.

Unit-III: Conformation, Solution and Molecular Weight: Thermodynamics of polymer solution, Flory Huggins theory, Process of polymer dissolution, Nature of polymer molecules in solution, Measurement of molecular weight, Osmometry, Light scattering,GPC, and Viscosity of dilute polymer solution.

Unit-IV: Solid State Properties : Amorphous state, Glass transition temperature, Glassy solid and glass transition, The crystalline state, Crystal melting temperature, Degree of crystallinity & its effect on properties of polymer.

Unit-V: Polymer Degradation & the Environmental Effect: Polymer stability and types of degradation. The management of plastics and its effect on environment, biodegradation.

Suggested Text Books :

1. Polymer Science & Technology by J. R. Fried, Prentice Hall.
2. Outlines of Polymer Technology: Manufacture of Polymers by R. Sinha, PHI Learning Private Limited

Course Outcome:

Students would be able to

1. Describe types of polymerization and synthesis
2. Explain kinetics and thermodynamics of polymerization.
3. Apply mechanisms of polymer degradation and environmental effect.

CH305TPE21 Inorganic Chemical Technology [L:3, T:0, P:0]

Objectives

To develop the abilities required for production, processing, flowsheeting and Environmental effects of inorganic chemical Industries.

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 & J. 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 chemicals 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.

CH305TPE22 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:

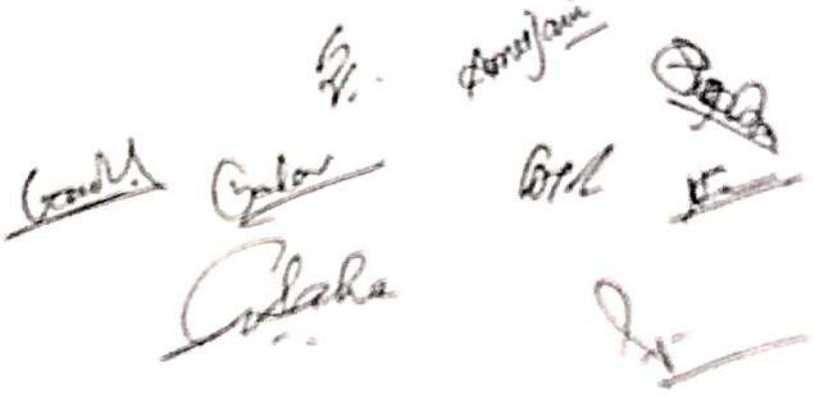
1. Fluidization by J. F. Davidson and D. Harrison, Academic Press.
2. Fluidization and Fluid Particles Systems by F.A. Zenz and D. F. Othmer, Reinhold Publishing.

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.



CH305PPC05 **Heat Transfer Lab** **[L:0, T:0, P:3]**

Objectives

To provide the knowledge of working of heat transfer equipment and the application of heat transfer correlations.

Content:

1. Determine the dirt factor of a parallel and counter flow double pipe heat exchanger.
2. Determination of dirt factor of a shell and tube heat exchanger.
3. Study of thermal conductivity of a metal bar.
4. Calculation and comparison of heat transfer coefficient for drop-wise and film-wise condensation.
5. Study the unsteady state heat transfer.

Outcomes:

Students would be able to

1. Handle the heat transfer equipment and calculate the heat transfer coefficients.
2. Apply the heat transfer correlations for calculating the heat transfer rate.

CH305PPC06 Chemical Reaction Engineering Lab [L:0, T:0, P:3]

Objectives

To impart knowledge on kinetics and design of reactors.

Contents:

1. Kinetic studies in a Batch reactor.
2. Kinetic studies in a Plug flow reactor.
3. Kinetic studies in a CSTR.
4. Kinetic studies in a PFR.
5. Study of temperature dependence of rate constant

Course Outcome:

Students would be able to

1. Get a sound working knowledge on different types of reactors.
2. Maintain the kinetic parameters of various reactions.
3. Use the batch reactor data to determine the order of reactions.
4. Use the relevant parameters for the design of reactors.
5. To select suitable reactor for various applications.

B.Tech. VI Semester

CH306TPC11 **Mass Transfer-II** **[L:3, T:1, P:0]**

Objectives

1. To provide basic knowledge of fundamental mass transfer operations and mechanisms.
2. To understand the mass transfer in LLE, leaching, drying, crystallization, adsorption and humidification operation.

Contents:

Unit-I: Humidification Operations: Definitions, Humidity chart and its use in measurement of humidity and calculations of humidification operations, Adiabatic humidification, Design of Cooling Towers.

Unit-II: Leaching: Equipment, Principles of leaching, Calculation of number of ideal stages, Stage efficiency

Unit-III: Liquid- Liquid Extraction: Equipment, Principles of extraction, Panchon-Savorit method, Counter-current extraction using reflux application of McCabe method, Extraction in packed and spray column.

Unit-IV: Crystallization: Principles, yield of crystals, Super solubility curve, Crystal growth, Equipment and application of principles to design.
Adsorption: Fixed bed adsorbers, break through; Ion-Exchange.

Unit-V: Drying: Equipment, Principles, Mechanism and theory of drying, Calculation of drying time.

Suggested Text Books :

1. Principles of Mass Transfer and Separation Processes by B. K. Dutta, PHI Learning Private Limited.
2. Mass Transfer Operations by R. E. Treybal, McGraw Hill.
3. Diffusion - Mass Transfer in Fluid Systems by E.L. Cussler, Cambridge University Press.
4. Principles of Unit Operations by A. S. Foust, A. L. Wenzel, C. W. Clump, L. Maus and L. B. Anderson, John Wiley & Sons.

Course Outcome:

Students would be able to

1. Explain the basics of humidification, drying, leaching, crystallization and adsorption.
2. Identify the mechanisms of mass transfer, formulate rate equations.
3. Solve problems related to humidification, drying, leaching and crystallization.
4. Design equipment for humidification, drying, leaching and crystallization.

CH306TPC12 Process Dynamics and Control [L:3, T:1, P:0]

Objectives

1. To provide fundamental knowledge on process control strategies.
2. To impart knowledge on a theoretical analysis of open loop and closed loop systems.

Contents:

Unit-I: Process Control : Importance of process control in chemical plants and systems, Various types of Control systems viz. open loop and closed loop control, feedback and feed forward control, servo and regulator control; Importance of dynamic behaviour of processes in process control, Physical and block diagram representation of control system, Use of Laplace transformation in analysis of control systems.

Unit-II: Simple System Analysis: Laplace transformation and transfer function, Block diagrams, Linearization, First and higher order systems, Interacting and non-interacting systems, Distributed and lumped parameters systems, Dead time.

Unit-III: Linear Open Loop Systems: Response of first order, second order and higher order systems, Linearization of non-linear systems, Transportation lag. Linear Closed Loop Systems: Study of various control system and their components viz. controllers, final control elements, Measuring instruments, Closed loop transfer functions, Transient response of simple control system, Stability criterion and analysis.

Unit-IV: Root Locus, Stability Criterion and Transient Response: Transient response analysis form root locus, Application of root locus to control system, Routh stability criterion.

Unit-V: Frequency Response Analysis: Design of control system by frequency response, Closed loop response by frequency response, Frequency response technique: Phase margin and gain margin, Bode stability criterion; Nyquyist stability criterion, Controller tuning: Ziegler-Nichols method, Cohen-Coon method, Introduction to advanced controllers: cascade control, feed forward control, Introduction to artificial intelligence.

Suggested Text Books :

1. Process Systems Analysis and Control by D.R. Coughanowr and S. LeBlanc, McGraw-Hill.
2. Process Dynamics and Control by D.E. Seborg, T.F. Edgar and D.A. Mellichamp, John Wiley.
3. Chemical Process Control: An Introduction to Theory and Practice by G. Stephanopoulos, Pearson Education.

Course Outcome:

Students would be able to

1. Evaluate dynamic behaviour of first and second order system.
2. Determine the process stability in Laplace domain.
3. Analyze open-loop systems and linear closed loop systems.
4. Develop working knowledge of control system by frequency response.

CH306TPC13 Chemical Reaction Engineering - II [L:3, T:1, P:0]

Objectives

1. To give fundamental knowledge on principles of non-ideal flow pattern and age distribution of chemical reaction systems
2. To understand the fluid-particle reaction and fluid-fluid reaction behaviour
3. To understand basic principles of catalyst and various catalyst synthesis methods
4. To understand the adsorption characteristics of catalyst.

Contents:

Unit-I: Basics of Non-Ideal Flow: Age distribution of fluid, the RTD, Conversion in nonideal flow reactors, Models for non-ideal flow- dispersion model, Chemical reaction and dispersion, Tank in series model.

Unit-II: Mixing of Fluids: Self mixing of single fluid, degree of segregation, Early and late mixing, Mixing of two miscible fluids.

Unit-III: Fluid Particle Reactions: Un-reacted core model: Diffusion through gas film and ash layer control, Chemical reaction control, Rate of reaction for shrinking spherical particles, Determination of rate controlling step.

Unit-IV: Fluid-Fluid Reactions: Kinetic regimes for mass transfer and reaction, Rate equations for various regimes, Film conversion parameter, Application to design, Reactive and extractive reactions.

Unit-V: Catalysis: Heterogeneous catalysts, Adsorption on solid surface, Physical properties of catalysts, Preparation of catalyst, Steps in catalytic reactions synthesizing the rate law.

Suggested Text Books :

1. Chemical Engineering Kinetics by .M. Smith
2. Chemical Reaction Engineering by Octave Levenspiel
3. Chemical Reaction Engineering by H. Scott Fogler
4. Principles of Reaction Engineering by S.D. Dawande, Central Techno Publications
5. Chemical Engineering by J. M. Coulson and Richardson, Volume IV.

Course Outcome:

Students would be able to

1. Understand the principles of non-ideal flow pattern and RTD
2. Determine the behaviour of fluid-particle and fluid-fluid reaction system
3. Synthesis of catalyst with various methods
4. Basics of adsorption characteristics of catalyst.

CH306TPE31 Organic Chemical Technology [L:3, T:0, P:0]

Objectives

To study process technologies of various organic process industries such as oil, soap, polymer and cellulose.

Contents:

Unit-I: Oils & Fats : Status and scope, Major oils seeds production in India, Expression, Solvent extraction, Energy & solvent requirements, Mineral, seeds and other oil bearing materials, Hydrogenation of oils, Corrosion problems and materials of construction of equipments.

Unit-II: Soaps & Detergents: Raw materials, Manufacture of detergents, Active detergent matter, Biodegradability, Fat splitting, Purification of fatty acids, Soap manufacture, Total fatty matters (TFM), Glycerin manufacture, Materials of construction.

Unit-III: Cane Sugar: Cane production & varieties, Manufacturing equipment &technology, Cane sugar refining, Bagasses utilization, Energy requirements and conservation, Environmental considerations, Khandsari technology, Molasses based industries, Materials of construction.

Unit-IV: Polymers: Status and scope, Applications, Classification of polymers, Degree and modes of polymerization, Molecular weight and it distribution, Selected industrial polymerization including plastics, Synthetic rubber and polymeric foams, Synthetic fibres. Penicillin: Manufacturing process, Scope and applications.

Unit-V: Regenerated Cellulose: Growth of industry, Raw materials, Pretreatment, Pulping, Manufacture of paper, Recovery of chemicals, Environmental considerations, viscose rayon.

Varnishes and Paints: Scope and applications, Types of coatings, General manufacturing procedure, Environmental considerations.

Suggested Text Books :

1. Shreve's Chemical Process Industries by G. T. Austin, Tata McGraw Hill Publications.
2. Dryden's Outlines of Chemical Technology by M. G. Rao and M. Sittig, East-West Press.

Reference Book:

1. Handbook of Oil & Colour, Chemists Association OCCA.

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 organic chemicals 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.

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CH306TPE32 Fuel Combustion Energy Technology [L:3, T:0, P:0]

Objectives

To understand the basics of various types of solid, liquid and gaseous fuels, basic principles of their combustion processes, its appliances, the fundamentals of the applied sciences dealing with various types of conventional and non-conventional energy resources.

Contents:

Unit-I: Solid Fuel : Classification of fuel, Origin, Composition, Characteristics and analysis of coal washing & storage of coal, Physical & chemical processing of coal, Various classification systems of coal briquetting, Carbonization, Gasification of coal. Liquid fuels: Origin, composition, characteristics and classification of crude oil, crude oil processing cracking and reforming, storage and handling of liquid fuel.
Gaseous fuel: Classification of gaseous fuel, Natural gas, Coal gas, Coke oven and blast furnace gas, producer gas, water and Carburetted water gas

Unit-II: Fuel Combustion Calculation: Fundamentals of various combustion calculations with numerical examples.

Unit-III: Combustion Process: General Principles of combustion, Flame, Draught, Limits of In flammability, Types of combustion Process- Surface, Submerged, Pulsating, Slow combustion.

Unit-IV: Energy Conservation: Energy consumption pattern in various sectors, various ways of energy conservation in various process industries including petroleum.

Unit-V: Non – Conventional Energy Technologies : General principles with applications and technology of Biomass Energy, Solar Energy, Geothermal Energy, Wind Energy, Nuclear Energy, Hydal, Tidal and Ocean Energy.

Suggested Text Books :

1. Elements of Fuel Combustion & Energy Engineering by S.N. Saha, Dhanpat Rai Publication Co. Pvt. Ltd. New Delhi.
2. Fuels and Combustion by S. Sarkar, Orient Longman, Hyderabad.

Course Outcome:

Students would be able to

1. Analyze solid, liquid, gaseous fuels and their characterization.
2. Compute fuel combustion calculation in industries with recommendation of better combustion processes in relation to better efficiency and pollution control technologies.
3. Study and recommend the various energy conservation routes in various industries.
4. Study and recommend the alternative sources of energies including the renewable energies in view of energy conservation to utilize them effectively.

CH306TMC02 Essence of Indian Knowledge Tradition [L:3, T:0, P:0]

Objectives:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

Content:

- Basic structure of Indian Knowledge System, Introduction to traditional knowledge, definition of traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics.
- Modern Science and Indian Knowledge System.

- Traditional knowledge in different sectors; Traditional knowledge and engineering, Traditional medicine system, TK in agriculture.

- Protection of traditional knowledge, the need for protecting traditional knowledge significance of TK Protection, legal framework and TK; the scheduled tribes and other traditional forest dwellers (Recognition of Forest Rights) Act, 2006, plant varieties protection and farmer's rights act, 2001 (PPVFR Act); the biological diversity act 2002 and rules 2004, the protection of traditional knowledge bill, 2016

Suggested Text/Reference Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
9. P R Sharma (English translation), Shodashang Hridayam

Course Outcomes:

Ability to understand , connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

CH306TOE01 Industrial Utilities and Safety [L:3, T:0, P:0]

Objectives

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.

CH306PPC07 **Mass Transfer Lab** **[L:0, T:0, P:3]**

Objectives

To provide the knowledge of working of mass transfer equipment's and the application of mass transfer operations.

Contents:

1. Determination of diffusion coefficient of organic vapour in air.
2. Determination of the vapour liquid equilibrium (VLE).
3. Study of the characteristics of steam distillation.
4. To Verify Rayleigh equation for distillation.
5. Determination of absorption of CO_2 in a packed column.
6. Study of the solid-liquid extraction method.
7. Study of the liquid-liquid extraction method.

Study of the operation of fluidized bed dryer.

Course Outcome:

Students would be able to

1. Handle the mass transfer equipment's.
2. Understand molecular diffusion and Apply mass transfer operations for separation of mixture.

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CH306PPC08 Process Dynamics and Control Lab [L:0, T:0, P:3]

Objectives:

Students will learn about the fundamental concepts, difficulties, methodologies, and applications of process control in order to govern a variety of processes.

Contents:

Introduction: A historical point of view Process control incentives, control system synthesis Process variables are classified and defined.

Mathematical Modeling & Experiments: Mathematical modelling is required and used. Parameters that are lumped and distributed Analogies, chemical and electrical systems. Determine the transfer function of non-interacting tank control, find the transfer function of liquid level control system, determine the nature U-tube manometer and determine transfer function of mercury glass thermometer.

Realization of Control Modes: Realization of different control modes like P, I, D, In electric, pneumatic, hydraulic controllers.

Laboratory Work: Simulation of different control modes and Experiments around Basic Process RIG.

Course Outcome:

Students will be able to

1. Demonstrate a fundamental understanding of process control after completing the course.
2. Create a mathematical model of a variety of chemical reactions.
3. Describe the various control modes and how they are used to control various operations.
4. Describe how electric, hydraulic, and pneumatic controllers function.

XXXXXX

Minutes of Meeting

The scheduled meeting of members of Board of Studies (BoS) of Department of Chemical Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur was held today (June 28, 2023) in blended mode (online and offline). The agenda of the meeting was as follows:-

1. Approval of Scheme & Syllabus of B.Tech. Final Year (VII & VIII Semester) of Chemical Engineering (w.e.f. Session 2023-24).
2. Approval of Departmental Vision and Mission.
3. Review of COs of B.Tech. Chemical Engineering Subjects, as required.
4. Review of Scheme & Syllabus of M.Tech. (All Semester) of Chemical Engineering (w.e.f. Session 2023-24)

Following members were present in the meeting:

1. Dr. Raghwendra Singh Thakur, Chairman-BoS , Associate Prof. and Head, Dept. of Chemical Engg.
2. Prof. (Mrs) A B Soni, External Expert Member-BoS, Prof., Dept. of Chemical Engg., NIT Raipur
3. Er. Arvind Verma, External Industry Expert, Special Invitee-BoS, Senior Manager-Process, Nu-Vista (NUVOCO Cement), Baloda Bazar
4. Dr. Anil Kumar Chandrakar Member-BoS, Associate Prof., Dept. of Chemical Engg.
5. Dr. Saurabh Meshram, Member-BoS, Assistant Prof., Dept. of Chemical Engg.
6. Dr. Amit Jain, Invited Member, Associate Prof., Dept. of Chemical Engg.
7. Dr. Neeraj Chandraker, Invited Member, Assistant Prof., Dept. of Chemical Engg.
8. Dr. Anuradha N. Joshi, Invited Member, Assistant Prof., Dept. of Chemical Engg
9. Dr. Gautam Prasad Dewangan, Invited Member, Assistant Prof., Dept. of Chemical Engg.
10. Mr. Vishnu Prasad Yadav, Invited Member, Assistant Prof., Dept. of Chemical Engg.
11. Dr. Sandeep Dharmadhikari, Invited Member, Assistant Prof., Dept. of Chemical Engg.
12. Dr. Ghoshna Jyoti, Invited Member, Assistant Prof., Dept. of Chemical Engg.
13. Dr. Pankaj Kumar, Invited Member, Assistant Prof., Dept. of Chemical Engg.

Following decision has been made in the meeting.

1. The committee discussed the scheme and syllabi of B. Tech Fourth year (VII and VIII semesters) at length and after incorporating the changes, as identified by the BoS members, the final scheme and syllabi is to be sent to the external BoS members for their formal consent.

28/06/23

2. Two open elective courses, Waste To Energy (CH207TOE02) in B.Tech. VII Semester and Project Engineering Economics and Management (B.Tech. CH208TOE03) in B.Tech. VIII Semester, are to be offered by the department of chemical engineering.
3. Vision and Mission of the Department was finalized after discussion in the meeting.
4. Discussion was made on M. Tech. Scheme and Syllabus to modify and implement the changes in next BoS likely to be held in August 2023.

Dr. Raghwendra Singh Thakur

Prof. (Mrs) A B Soni

Er. Arvind Verma

Dr. Anil Kumar Chandrakar

Dr. Amt Jain

Dr. Saurabh Meshram,

Dr. Neeraj Chandraker

Dr. Anuradha N. Joshi

Dr. Gautam Prasad Dewangan

Mr. Vishnu Prasad Yadav

Dr. Sandeep Dharmadhikari

Dr. Ghoshna Jyoti

Dr. Pankaj Kumar

Department of Chemical Engineering
School Of Studies of Engineering & Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Vision and Mission

Department Vision

The vision of the department is to establish itself as one of the best study centers of Chemical Engineering education to produce proficient, entrepreneurs, and researchers to serve the needs of the industry and society.

Department Mission:

- To produce career-ready Chemical Engineers with high standards of ethical and social values and entrepreneurial skills.
- To develop the research culture in fundamental and application-oriented problems to cater the societal and industrial needs.
- To build strong relationship between academia, industry and other institute of repute.

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

SCHEME FOR EXAMINATION (Effective from Session 2023-24)

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

FOURTH YEAR, SEVENTH SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH407TPC14	Process Equipment Design-II	3	0	0	30	70	100	3
02.	CH407TPC15	Transport Phenomena	3	0	0	30	70	100	3
03.	CH407TPE4X	Professional Elective-IV	3	0	0	30	70	100	3
04.	CH407TPE5X	Professional Elective-V	3	0	0	30	70	100	3
05.	XX207TOEXX	Open Elective-II	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH407PPC09	Vocational Training Viva cum Seminar	0	0	4	30	20	50	2
02.	CH407PPC10	Minor Project	0	0	6	30	20	50	3
		Total	15		10	210	390	600	20

IA – Internal Assessment

Total Marks – 600

ESE - End Semester Examination

Total Periods / Week – 25

Total Credits – 20

28/06/2023

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

SCHEME FOR EXAMINATION (Effective from Session 2023-24)

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

FOURTH YEAR, EIGHTH SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH408TPC16	Process Equipment Design-III	3	1	0	30	70	100	4
02.	CH408TPE6X	Professional Elective-VI	3	0	0	30	70	100	3
03.	XX208TOEXX	Open Elective-III	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH408PPC11	Major Project	0	0	12	120	80	200	6
		Total	9	1	12	210	290	500	16

IA – Internal Assessment

ESE - End Semester Examination

Total Credits – 16

Total Marks – 500

Total Periods / Week - 22

28/02/2023

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

DEPARTMENT OF CHEMICAL ENGINEERING

List of Professional Elective Courses (Seventh and Eighth Semester)

S.No.	Semester	Course No.	Subjects
01.	VII	CH407TPE41	New Separation Processes
02.		CH407TPE42	Water Conservation and Management
03.		CH407TPE43	Process Modeling and Simulation
01.	VII	CH407TPE51	Petroleum Refinery Engineering
02.		CH407TPE52	Process Utilities and Safety
03.		CH407TPE53	Design and Development of Catalyst
01.	VIII	CH408TPE61	Environmental Engineering
02.		CH408TPE62	Optimization Techniques
03.		CH408TPE63	Petrochemical Technology

28/06/2023

List of Open Elective Courses (Seventh and Eighth semester)

S.NO.	SEMESTER	COURSE NO.	SUBJECTS	DEPARTMENT CODE
01.	VII	CH207TOE02	WASTE TO ENERGY	CH
02.		ME207TOE02	PRINCIPLES OF MANAGEMENT	ME
03.		EC207TOE02	CMOS DIGITAL VLSI DESIGN	EC
04.		CE207TOE02	GREEN BUILDING AND SUSTAINABLE MATERIALS	CE
05.	IT207TOE01	~~IT207TOE02~~	MACHINE LEARNING	IT
06.	CS207TOE01	~~CS207TOE02~~	GIS & REMOTE SENSING	CS
07.	IP207TOE02	~~IP207TOE21~~	MANUFACTURING PROCESSES-I	IP
01.	VIII	CH208TOE03	PROJECT ENGINEERING ECONOMICS AND MANAGEMENT	CH
02.		ME208TOE03	SUPPLY CHAIN MANAGEMENT	ME
03.		EC208TOE03	INTRODUCTION TO IOT	EC
04.		CE208TOE03	INFRASTRUCTURE PLANNING AND MANAGEMENT	CE
05.	IT208TOE01	~~IT208TOE03~~	SOFT COMPUTING	IT
06.	CS208TOE01	~~CS208TOE03~~	ARTIFICIAL INTELLIGENCE	CS
07.	IP208TOE03	~~IP208TOE41~~	ADVANCED MANUFACTURING PROCESSES	IP

28/06/2023

Program Outcomes

PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering comm Modules and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1	The students of the programme will have a strong foundation in mathematics, basic sciences and chemical engineering to meet the current demands in professional world with cutting-edge research in chemical and allied engineering disciplines.
PSO2	Graduates would be equipped with a working knowledge in professional courses such as process economics, project engineering, industrial safety and sustainable development to work in the conventional as well as frontier area of Chemical Engineering which enables them suitable for chemical industries.
PSO3	Graduates of chemical engineering will be able to communicate in a professional setting, including soft skills, technical writing, presentation, and management skills making them employable to industries.

B.Tech. VII Semester

CH407TPC14 **Process Equipment Design - II** [L:3, T:0, P:0]

Objectives

1. To understand the Chemical Engineering Principles applicable to design heat transfer equipment.
2. To apply standard codes for design of heat transfer equipment.
3. To justify the suitable heat transfer equipment for the particular heat duty.

Contents

Design of Heat Transfer Equipment's: Double Pipe Heat Exchanger, Shell and Tube Heat Exchanger, Vertical & Horizontal Condensers and Evaporators.

The candidates will be allowed to use the following reference book in the examination hall:

1. Hand book of Chemical Engineering J. H. Perry
2. Tubular Heat Exchange Manufacture Association Manual
3. Process Heat Transfer by D.Q. Kern
3. ISI Codes.

Candidates have to bring their own copies of the above books and they will be not supplied by the university or the examination centers.

Suggested Text Books

1. Process Heat Transfer by D. Q. Kern
2. Heat Transmission by McAdams
3. Unit Operations of Chemical Engineering by McCabe Warren, L Smith Julian and Harriot Peter, Fifth Edition, McGraw Hill Inc.
4. Chemical Engineering by J. M. Coulson and Richardson, Volume-1

Course Outcomes

Students would be able to

1. Ability to process design of double pipe heat exchanger.
2. Ability to process design of shell and tube heat exchanger.
3. Ability to process design of condensers and evaporators.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	-	-	-	-	-	-	3	2	-
CO2	3	3	3	2	2	1	-	-	-	-	-	-	3	2	-
CO3	3	3	3	2	2	1	-	-	-	-	-	-	3	2	-

B.Tech. VII Semester

CH407TPC15 **Transport Phenomena** [L:3, T:0, P:0]

Objectives

To impart knowledge about individual and simultaneous momentum, heat and mass transfer, model development along with appropriate boundary conditions.

Contents

Unit-I: Introduction to Transport Phenomena: Similarity between momentum, heat and mass transfer, The continuum hypothesis, Basic laws of fluid motion, Newton's second law of motion, Principle of balance between momentum, Heat and mass transfer, Principles of conservation of momentum, mass and energy

Unit-II: Momentum Transport Phenomena: Momentum transport in laminar flow: Newton's law of viscosity, Science of rheology, Prediction of viscosity and its dependence on temperature, pressure and composition, Boundary conditions, Shell balance approach for stress distribution and velocity profiles, Introduction to time derivatives and vector analysis, Equation of continuity and equation of motion and their application in fluid flow problems.

Unit-III: Unsteady State Momentum Transport: Flow near a wall suddenly set in motion, Momentum transport phenomena in turbulent flow, Definitions of friction factors, friction factor for flow in tubes, around spheres and through packed bed column.

Unit-IV: Energy Transport Phenomena: Energy transport in laminar flow: Fourier's law of heat conduction, Prediction of thermal conductivities and its dependence on temperature, Pressure and composition, Boundary conditions, Shell balance approach, Types of heat sources, Principle of extended surfaces, Types of cooling fans, Free and forced convection. Unsteady state heat transport, Unsteady state heat conduction in solids, Heating of semi-infinite slab, Heating of finite slab, Application.

Unit-V: Mass Transport Phenomena: Definitions of concentration, Velocities and mass fluxes, Fick's law of diffusion, Prediction of diffusivity and its dependence on temperature, pressure and composition, Boundary conditions, Shell balance approach for mass transfer problems. Problems of diffusion with homogeneous and heterogeneous chemical reaction, Diffusion and chemical reaction in porous catalyst the effectiveness factor, Equation of continuity for multicomponent mixtures

Suggested Text Books

1. Transport Phenomena by R.B. Bird, W.E. Stewart and E. W. Lighfoot, John Wiley & Sons
2. Transport Phenomena by R. S. Brodkey and H. C. Hershey, McGraw-Hill
3. Fundamentals of Momentum Heat and Mass Transfer by J.R. Welty, C.W. Wicks, R.E. Wilson and G. Rorrer, John Wiley & Sons.

Course Outcomes

Upon completion of this course, the students will be able to:

1. analyze heat, mass, and momentum transport in a process;
2. formulate and solve momentum heat and mass transport problems along with appropriate boundary conditions using shell balance approach.;
3. develop model equations and solve steady and transient state problems involving heat, mass, and momentum transport.
4. estimate the friction factor for various flow situations.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1									2	1	1
CO2	3	3	1	1									2	1	1
CO3	3	3	1	1									2	1	1
CO4	3	1	1	1									2	1	1

B.Tech. VII Semester

CH407TPE41 **New Separation Processes** [L:3, T:0, P:0]

Objectives

This is a course further built up on and in continuation with Chemical Engineering operations. It forms the basis Chemical Engineering principles and hence it is required in almost all the courses and throughout the professional career of a Chemical Engineer.

Contents

Unit-I: Overview of Separation Processes: Basic concepts of separation processes; Physico-chemical properties and other factors controlling separation; Limitations of Conventional separation processes and new separation processes; Equilibrium and rate governed separation processes and their characteristics.

Unit-II: Membrane based Separation Processes: Principle of membrane separations process, advantages and disadvantages; classification, membrane materials, general methods of preparation and characterization of membranes; Membrane modules, Concentration polarization.

Unit-III: Porous Membrane Based Processes: Reverse osmosis, Ultrafiltration, Microfiltration, Nano-filtration, Dialysis, Ion-selective membranes and electro-dialysis; Industrial applications of porous membrane-based processes.

Unit-IV: Non-porous Membrane Based Processes: Gas separation, Pervaporation, Liquid Membranes and their Industrial Applications, Medical Applications of Membranes, Miscellaneous Membrane Processes, Membrane Distillation, Membrane Reactors.

Unit-V: Other Non-conventional Separation Processes: Foam and Bubble Fractionation, Pressure and Temperature Swing Adsorption, Cloud Point Extraction, Centrifugal Separation Processes, Super Critical Fluid Extraction.

Suggested Text Books

1. Separation Process Principles by J.D. Seader and E.J. Henley, John Wiley & Sons, Inc
2. Separation Processes by C. J. King, McGraw-Hill, Inc.
3. Membrane Separation Processes by K. Nath, PHI, New Delhi
4. Membrane Technology and Applications by R.W. Baker, , John Wiley and Sons UK
5. Handbook of Industrial Membrane Technology by M.C. Porter, Crest Publishing House.

Course Outcomes

Explain membrane processes in terms of the membrane, feed, sweep, retentate, permeate, and solute membrane interactions. Distinguish among microfiltration, ultrafiltration, Nano filtration, virus filtration, sterile filtration, filter-aid filtration, and reverse osmosis in terms of average pore size. Explain common idealized flow patterns in membrane modules.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1				1						2	2	
CO2	1	1	1				1						2	2	
CO3	1	1	1				1						2	2	

B.Tech. VII Semester

CH407TPE42 **Water Conservation & Management** [L:3, T:0, P:0]

Objectives

1. To understand the importance of water resources and their role in sustainable development. 2. To identify and analyse various water conservation techniques and strategies. 3. To evaluate the environmental, social, and economic impacts of water management practices. 4. To apply mathematical and statistical methods to analyse water-related data and make informed decisions. 5. To demonstrate effective communication skills in presenting water conservation plans and projects.

Contents

Introduction: water cycle, water storage, water quality; water conservation in homes; water conservation in the work place; water management-water quality, controlling use and quality of water, water flow measurement, water quality control, testing water salinity, preserving water quality, minimising evaporation, water sanitation, water audits; water conservation in agriculture; water conservation in process industry; water conservation in construction industry; water conservation in service industry.

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 & Sons Inc.
3. Water Resources, Conservation and Management by S.N. Chatterjee, Atlantic Publishers & Dist.

Course Outcomes

Upon completion of this course, the students will be able to:

1. Apply scientific knowledge and principles to solve real-world problems. 2. Demonstrate understanding of environmental, social, and ethical responsibilities in professional practice. 3. Analyze and evaluate the impacts of engineering solutions in a global and societal context. 4. Apply research methods and tools to investigate complex problems. 5. Communicate effectively with diverse audiences.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				2	2						3		
CO2	3	2	2			2	2						3		
CO3		2	2	2		2	2						3		
CO4	3		2	2		2	2						3		
CO5		2			2	2	2						3		

28/12/23

B.Tech. VII Semester

CH407TPE43 **Process Modelling & Simulation** [L:3, T:0, P:0]

Objectives

Graduates shall be able to (a) understand chemical engineering system in term of modelling principle; (b) distinguish simulation from design of equipment; (c) apply software tools such as UNISIM to model chemical processes; (d) develop algorithm for modelling & solve the model.

Contents

Unit-I: Introduction: Uses of Mathematical Models, Scope of Coverage, Principles of Formulations. Mathematical Modeling in Chemical Reaction Engineering: CSTR, PFR, Batch Reactor, Semi batch Reactor, Series of Isothermal CSTR, Constant Hold-Up CSTR's, CSTR's with Variable Hold Ups, Gas Phase Pressurized CSTR, Non-Isothermal CSTR, Bioreactor, Trickle Bed Reactor.

Unit-II: Mathematical Modeling in Mass Transfer: Ideal Binary Distillation Column, Multi- Component Non-ideal Distillation Column, Batch Distillation with Hold Up, Steam Distillation, Multi-Solute Batch Liquid- Liquid Extraction, Continuous Extraction, Multistage Countercurrent Extraction, Plug Flow Type Liquid- Liquid Extraction, Reactor with Mass Transfer, Absorption, Adsorption.

Unit-III: Mathematical Modeling in Heat Transfer: Two Heated Tanks, Single Component Vaporizer, Double Pipe Heat Exchanger, Shell and Tube Heat Exchanger, Multicomponent Flash Drum, Cooling Towers.

Unit-IV: Mathematical Modeling of Other Chemical Processes: Interacting and Non-Interacting Systems with and without Heaters, Isothermal Hydraulic System, Forward and Backward Feed Triple Effect Evaporator.

Unit-V: Introduction of MATLAB and Use of Language, Simulation, Program Development and Numerical Solutions of Above Processes.

Suggested Text Books

1. Process Modeling, Simulation and Control for Chemical Engineers by W. L. Luyben, McGraw Hill, 1990.
2. Process Plant Simulation by B. V. Babu, Oxford University Press, 2004.
3. Optimisation Techniques for Chemical Engineers by A. Hussain and K. Gangaiah, Macmillan, 2001.
4. Process Control: Modeling, Design and Simulation by B. W. Bequette. Prentice-Hail India, 2006.
5. Elements of Chemical Reaction Engineering by Fogler, Prentice Hall of India.

Course Outcomes

Students would be able to

1. explain detail importance of ODE and PDE;
2. develop model equations for the given system;
3. solve structural, thermal, fluid flow problems;
4. demonstrate the model solving ability for various processes/unit operations;
5. demonstrate the ability to use a process simulation.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO2	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO3	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO4	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO5	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--

B.Tech. VII Semester

CH407TPE51 **Petroleum Refinery Engineering** [L:3, T:0, P:0]

Objectives

To impart knowledge of petroleum refining, hydrocarbon processing, and derived petrochemicals.

Contents

Unit-I: Petroleum Crude and Refining: Formation of petroleum crude, Origin & occurrence composition, Classification & physical properties of petroleum crude, Conversion of organic matter into petroleum crude, Different sources of petroleum oil, refining of petroleum crude, Type of refineries, Planning for operation of oil refinery.

Unit-II: Physical Properties and Testing Methods of Petroleum Products: Physico-chemical properties of various petroleum products as per API / ASTM / BIS specifications.

Unit-III: Crude Processing: Treatment of crude, atmospheric and vacuum distillation crude, Distillation & equilibrium, Degree of separation, Type of trays of distillation column & its efficiencies, Types of distillation in petroleum industries.

Unit-IV: Cracking & Reforming Operation: Cracking, Type of cracking, Thermal cracking reaction, Dubbs process & tube still process of thermal cracking, Vis breaking, Delayed coking & fluidized coking, Catalytic cracking, Fixed & moving bed catalytic cracking, Thermal reforming, Catalytic reforming processes.

Unit-V: Chemical Treatment & Refining Operation: Chemical treatment of petroleum products, Caustic soda treatment, Treatment with H_2SO_4 & H_2, Mercaptan removal & oxidation process, Sulphur removal from petroleum products-Doctor's treatment, hydro de-sulphurization, dewaxing and refining of lubricating oils.

Suggested Text Books

1. Petroleum Refinery Engineering by W.L. Nelson
2. Petroleum Refining by Gary and Handwarke, Marcel Dekker
3. Petroleum Refining & Petrochemicals by N.K. Sinha, Umesh Publications New Delhi.
4. Petroleum Refining Technology by I.D. Mall, CBS Publishers & Distributors Pvt. Ltd. New Delhi.

Course Outcomes

Students would be able to

1. Explain the origin, formation, classification, and physical properties of petroleum crude.
2. Gain knowledge of physical properties of various petroleum products and their testing methods.
3. Understand crude oil refining and conversion processes such as thermal, catalytic cracking and catalytic reforming.
4. Apply knowledge of LPG, gasoline, diesel, kerosene, jet fuel, lubricating oil production from petroleum crude and their storage and transportation.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	1	3						3		3
CO2	3	1	2	3	3	1							3		3
CO3	3	3	3	3	3	3							3		3
CO4	3	1	1	2	3	3							3		3

28/02/23

B.Tech. VII Semester

CH407TPE52 **Process Utilities and Safety** [L:3, T:0, P:0]

Objectives

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

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2		3	1	1	1	1	2	1	3		3
CO2	1	1	1	1		1			1			1	3		3
CO3	1	2	1	1		1		1	1	1	1	1	3		3

B.Tech. VIII Semester

CH407TPE53 **Design and Development of Catalyst** [L:3, T:0, P:0]

Objectives

To gain the knowledge of catalyst preparation methods, characteristics, mechanism of catalytic reactions, and design of catalytic reactors.

Contents

Structure of Solid Surfaces, Chemisorption and Physisorption, Thermodynamics and Kinetics of Surface Processes, Principles of Heterogeneous Catalysis, Preparation, Characterization and Classification, Kinetics of Heterogeneous Reactions, Physical, Chemical and Mathematical Description of Catalyst Deactivation, Deactivation by Fouling, Poisoning and Sintering, Deactivation and Regeneration of Catalyst Pellets, Deactivation and Regeneration of Fixed Beds, Electro catalysis and Photocatalysis, Mechanism and Kinetics of Some Typical Heterogeneous Catalytic Reactions, Applications in Fertilizer, Petroleum, Petrochemical Industries and Pollution Control. Modern characterization techniques such XRD, SEM FTIR etc.

Suggested Text Books

1. Preparation of Catalyst VI: Scientific bases for the preparation of Haterogeneous Catalysts by G. Poncelet,J. Martens, B. Delmon, Elseveir
2. Catalyst Preparation: Science and Engineering by John Regalbuto, CRC Press

Course Outcomes

Upon completion of this course, the students will be able to understand the:

1. Application of catalyst in various industries
2. Development of various type of catalyst and catalytic reaction mechanisms.
3. Effects of external heat and mass transfer in heterogeneous catalysis
4. Design of different types of reactors for catalytic reactions
5. Understand the various characterization techniques.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	2	2						3	2	
CO2	3	3	3	3	2	2	1						3	2	
CO3	3	2	3	2	1	2	1						3	2	
CO4	3	3	3	2	1	2	1						3	2	
CO5	3	3	3	2	3	3	1						3	2	

28/5/22

B.Tech. VIII Semester

CH408TPC16 **Process Equipment Design- III** **[L:3, T:1, P:0]**

Objectives

Chemical Engineers should have knowledge about Design of mass transfer Equipments such as absorption, Distillation Columns, dryer etc. This will also be useful for using Design software which is widely used in chemical industries.

Contents

Mass Transfer Equipment design of: Absorption tower, Distillation tower, Tunnel and rotary dryers.

Suggested Text Books

1. Hand Book of Chemical Engineering J. H. Perry
2. Coulson & Richardson Vol.- VI
3. Mass Transfer by R. E. Treybal
4. ISI Codes

Candidates have to bring their own copies of ISI Code book and they will be not be supplied by the university or the examination centres.

Course Outcomes

Upon completion of this course, the students will be able to:

1. Design mass transfer equipment's for chemical process.
2. Analyze working of various mass transfer equipments.
3. Prepare drawing for chemical process equipment's.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3				1	1			1	3		
CO2	1	3	1	3		1			2		1	1	3		3
CO3	1	1	1	2		1			2		1		1		

28/12/22

B.Tech. VIII Semester

CH408TPE61 **Environmental Engineering** [L:3, T:0, P:0]

Objectives

To understand the significant issues of environmental pollution and their control principals.

Contents

Unit I: Environmental Pollution and Its Effect: Environment and its components, Sources and type of pollutants, General effects on man, animal, vegetation and property.

Unit II: Air Pollution: Air quality criteria and standards, Ambient air sampling and analysis, Stack emission standards, Stack sampling and analysis, Meteorology and dispersion of air pollutants, Atmospheric lapse rate and stability, Plume behavior, Control of gaseous and particulate pollutants from mobile and stationery sources, air pollution acts.

Unit III: Water Pollution: Water quality criteria and effluent discharge standards, Domestic and industrial sources of waste water, Waste water sampling and analysis methods as per BIS specifications, Physico-chemical and biological methods of waste water treatment, Recovery of material from process effluents, water pollution acts.

Unit IV: **Pollution Due to Hazardous Industrial Waste**: Nature of hazardous waste materials from various chemical and allied Industries, Methods of disposal, destruction and reuse, nuclear wastes and their management. Solid waste from commercial, domestic and industrial sectors-composition and characterization, recycle, resource recovery and disposal.

Unit V: **Environmental Pollution Management**: Case studies of air and water pollution control in chemical industries.

Suggested Text Books:

1. Environmental Pollution Control Engineering by C. S. Rao, New Age International Ltd.
2. Environmental Engineering by N. N. Basak, Tata McGraw-Hill Pub. Co. Ltd.
3. Essentials of Environmental Studies by K. Joseph and R. Nagendran, Pearson Education (Singapore) Pvt. Ltd.

Course Outcome:

The students will be able

1. To explain environmental pollution and its effect.
2. To develop the understanding of air pollution and to describe methods of controlling of air pollution.
3. To analyze water quality, evaluate water pollution, and describe the control methods.
4. To analyze the characteristics of hazardous industrial waste and understand its handling and management.
5. To understand the application part through case studies.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1										3		
CO2	3	2	1	2		2							3		
CO3	3	2	1	2		2							3		
CO4	3	2	1	2		2							3		
CO5	3	2	2	1		2							3		

28/03/23

CH408TPE62

B.Tech. VIII Semester
Optimization Techniques

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

Course Objectives

(1) Understanding the concept of optimization methods
(2) Formulate the optimization problem with and without constraint
(3) Introduction to software tools of optimization
(4) Identify and apply the optimization techniques to optimize the process.

Contents

Unit-I: Introduction: Introduction to systems analysis and modelling with reference to chemical engineering problems, Process optimization, Formulation of various process optimization problems and their classification, Basic concepts of optimization-convex and concave functions, Necessary and sufficient conditions for stationary points Differential method for solving one and two variable problems with and without constraints. Lagrangian multiplier method, Karush-Kuhn-Tucker (KKT) conditions,

Unit-II: Optimization of One-Dimensional Functions: Sequential search methods - Golden section method, dichotomous search method, Interval halving method, Fibonacci method; Newton-Raphson method, Quasi-newton's method, Secant method, root finding using optimization techniques.

Unit-III: Multi-Variable Optimization: Multivariable optimization methods without constraints, such as steepest descent, Newton's method and unidirectional search method. Solving two-variable optimization problems using above methods.

Unit-IV: Linear Programming: Modelling, graphical method, single phase simplex method, two phase simplex method, duality.

Unit-V: Special Optimization Techniques: Introduction to dynamic programming as applied to discrete multistage problems like cascade of CSTR, Train of heat exchanger etc. Non-Traditional Optimization Techniques: Genetic Algorithm, Simulated Annealing
Soft tools MS Excel Solver and MATLAB applied to optimization.

Course Outcomes: Upon Completion of the course the students will be able to

(1) Formulate the optimization problems.
(2) Solve single and multivariable optimization problem
(3) Use different optimization techniques for problem solving.
(4) Use non-traditional optimization Techniques for problem solving
(5) Solve optimization problem using software tools

Suggested Text Books:

1. Edgar, T. F., Himmelblau, D. M. and Lasdon, L.S. Optimization of Chemical Processes, McGraw-Hill (2001).
2. S. S. Rao, Engineering Optimization Theory & Practice, Foruth Edition, John Wiley & Sons Inc (2009).
3. Prem Kumar Gupta and D.S.Hira, Problems in Operations Research (Principles and Solutions), S.Chand and company Ltd. New Delhi, India

Reference Books:

1. Kalyanmoy Deb "Optimization for Engineering Design", Prentice Hall, India,2005.
2. Ravindran. A., and Ragsdell, K.M., Reklaitis, G.V., "Engineering Optimization-Methods and Applications", 2nd Edition, Wiley, New York, 2006
3. Babu, B.V., Process Plant Simulation, Oxford University Press (2004).

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO2	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO3	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO4	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO5	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2

B.Tech. VIII Semester

CH408TPE63 **Petrochemical Technology** **[L:3, T:0, P:0]**

Objectives

To impart knowledge of petroleum refining, hydrocarbon processing, and derived petrochemicals.

Contents

Unit-I: Survey of Petrochemical Industries: Petrochemical industries in India, Plastic and synthetic fiber industries, Product of petroleum industries, Feed stocks for petrochemical production, Purification and separation of feed stocks.

Unit-II: C1 and C2 Hydrocarbons: Chemicals from methane, ethane, ethylene and acetylene, Synthesis gas as a feed stock for chemical industries, Naphtha cracking and reforming, Hydrogen from reforming of hydrocarbons.

Unit-III: Chemicals from C3, C4 and Higher Fractions: Carbon compound, Dehydrogenation of hydrocarbon and higher paraffins, Greases and lubricants, Polymers and their properties, Polymers from olefins-polyethylene (HDPE, LDPE), Polypropylene, Vinyl polymers.

Unit-IV: Aromatic Hydrocarbons: Production of BTX, Benzene derivatives, Products from toluene, Oxidation products of toluene, Synthetic fibers and their production, Synthetic rubber and its production.

Unit-V: Plastics: Classifications of plastics, Different types of resin and their production, ABS plastics, Poly carbonates (PC), Poly urethanes, Polyimides, Polystyrene, Synthetic detergents and their production.

Suggested Text Books

1. Modern Petroleum Technology by G.D. Hobson and W Pow.
2. A Textbook on Petrochemical Technology by Bhaskara Rao.

Course Outcomes

Upon completion of this course, the students will be able to:

1. select the appropriate characterization parameters;
2. specify the properties of petroleum products;
3. attain knowledge of various separation & conversion processes involved in petroleum refining;
4. attain knowledge of manufacturing of various petrochemical products.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	1	3						3		3
CO2	3	1	2	3	3	1							3		3
CO3	3	3	3	3	3	3							3		3
CO4	3	1	1	2	3	3							3		3

Open Elective (Offered for other departments)

B.Tech. VIII Semester

CH207TOE02 **Waste to Energy** [L:3, T:0, P:0]

Contents

Unit I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit II: Biomass Pyrolysis: Pyrolysis – Types, slow, fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

- Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
- Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
- Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
- Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course outcomes:

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

1. Classify the waste for fuel and identify the devices for conversion of waste to energy.
2. Implement the Biomass Pyrolysis
3. Evaluate the methods of Biomass Gasification and implement their applications.
4. To design, construct and operation the Biomass Combustion devices.
5. Classify biomass, apply the bio energy systems design and construction.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	0	-	1	1	-	-	-	-	-	1	-	-
CO2	3	2	2	1	-	1	1	-	-	-	-	-	3	-	-
CO3	3	2	2	1	-	1	1	-	-	-	-	-	3	-	-
CO4	3	2	2	1	-	1	1	-		-	-	-	3	-	-

Open Elective (Offered for other departments)

B.Tech. VIII Semester

CH208TOE03 **Project Engineering Economics & Management** [L:3, T:0, P:0]

Objectives

This course is required for the future professional career for engineering related industrial economics and management.

Contents

Unit I: Nature and Importance of Project and Project Engineering: Concept of Project and Project Management, Characteristics of Project, Introduction to Project Engineering, Role of a Project Leader, General Design Considerations, Plant Layout and Site Selection, Flow Diagram, Concept of Scale Up, Concepts of Techno-Economic Feasibility Report.

Unit II: Technical and Financial Analysis: Technical Analysis, Financial Analysis, Significance of Financial Analysis, Elementary knowledge of book of accounts- Journal, Ledger, Balance sheet, Profit and Loss Account. Cost Estimation, Cash Flow Investment, Production Cost, Capital Investment, Cost Indices, Production and Overhead Cost, Interest and Taxes.

Unit III: Project Financing and Value Engineering: Meaning and Importance of Project Finance, Means of Finance and Sources of Project in India, Financial Institution Structure and Financial Assistance, Norms of Finance and Term Loan Procedure, Value Engineering – Function, Aims and Procedure.

Unit IV: Capital Expenditure, Profitability & Alternative Investments: Importance and Kinds of Capital Expenditure Decision, Capital Budgeting Process, Criteria of Capital Budgeting, Depreciation and its Calculation Methods, Methods of calculating profitability, Alternative investments, Break Even Analysis.

Unit V: Network Techniques For Project Management: Introduction, Development of Project Network, Network Scheduling, Critical Path Method, Program Evaluation & Review Technique, Planning and Scheduling of Activity Networks, Time Analysis, Gantt Chart.

Suggested Text Books

1. Plant Design & Economics for chemical Engineers by M.S. Peters & K. D. Timmerhaus.
2. Projects: Planning, Analysis, Selection, Financing, Implementation and Review by Prasanna Chandra.
3. Project Engineering of Process Plants by H. F. Rase
4. Pilot Plants and Models and Scale up Methods in Chemical Engineering by R. E. Johnston.

Course Outcomes

Upon completion of this course, the students will be able to: (a) select a site for the project from given alternatives, (b) calculate working capital requirement for a given project, (c) calculate cost of equipment used in a plant total project cost, (d) calculate cash flow from a given project, (e) understand the break-even analysis; (f) calculate depreciation; (g) list out various milestones related to project concept to commissioning.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1	1	1	1						2		2	1	
CO2	2	1	1	1	1						2		2	1	
CO3	2	1	1	1	1						2		2	1	
CO4	2	1	1	1	1						2		2	1	