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

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)

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					
1	AMUBTB4	Engineering Mathematics-B	3	1	-	03	40	60	100	4
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**

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, 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-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.

NSS

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

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 2021-22)

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

SECOND YEAR, THIRD SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
	THEORY					Sessional			
			L	T	P	IA	ESE	TOTAL	
01.	CH203TBS05	Biology	3	0	0	30	70	100	3
02.	CH203TBS06	Mathematics-III	3	1	0	30	70	100	4
03.	CH203TPC01	Material and Energy Balance Calculations	3	1	0	30	70	100	4
04.	CH203TPC02	Fluid Mechanics	3	1	0	30	70	100	4
05.	CH203TPC03	Thermodynamics-I	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH203PPC01	Chemical Engineering Lab-I	0	0	3	30	20	50	1.5
02.	CH203PPC02	Fluid Mechanics Lab	0	0	3	30	20	50	1.5
		Total	15	3	6			600	21

IA – Internal Assessment | ESE - End Semester Examination | Total Credits: 21

Total Marks – 600 | Total Periods / week - 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)

SCHEME FOR EXAMINATION (Effective from Session 2021-22)
B.TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING
SECOND YEAR, FOURTH SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH204THS02	Business Communication and Presentation Skill	3	0	0	30	70	100	3
02.	CH204TBS07	Numerical Methods in Chemical Engineering	3	1	0	30	70	100	4
03.	CH204TPC04	Thermodynamics-II	3	0	0	30	70	100	3
04.	CH204TPC05	Particle and Fluid Particle Processing	3	1	0	30	70	100	4
05.	CH204TPC06	Process Instrumentation	3	1	0	30	70	100	4
PRACTICAL									
01.	CH204PBS03	Numerical Methods in Chemical Engineering lab	0	0	2	30	20	50	1
02.	CH204PPC03	Particle and Fluid Particle Processing lab	0	0	3	30	20	50	1.5
03.	CH204PPC04	Process Instrumentation Lab	0	0	3	30	20	50	1.5
		Total	15	3	8			650	22

IA – Internal Assessment

ESE - End Semester Examination

Total Credits : 22

Total Marks – 650

Total Periods / week - 26

CH203TBS05 **Biology** **[L:3, T:0, P:0]**

Objectives :

Students will be introduced to the basics of biology such as cell structure and functions, inheritance & evolution, basic concepts of genetics, and an introduction to microbiology.

Unit I : Basics: Diversity of life, prokaryotes and eukaryotes, basic cell constituents and macromolecules.

Unit II : Biochemistry: Metabolism (Catabolism and Anabolism) and bioenergetics.

Unit III : Genetics: Basic principles of Mendel, molecular genetics, structure and function of genes and chromosomes, Transcription and Translation, gene expression and regulation.

Unit IV : Cell Biology: Macromolecules, membranes, organelles, cytoskeleton, signalling, cell division, differentiation, and motility.

Unit V : Microbiology: host-microbe interactions, physiology, ecology, diversity, and virology.

Suggested Text Books :

1. Gardner, Simmons & Snustad, "Principles of Genetics" Student Edition, Wiley Publication.
2. P.K. Gupta, "Principles of Genetics", Rastogi Publication.
3. Prescott's, "Microbiology" Joanne Willey Publication.
4. David L. Nelson & Michael M. Cox, "Principles of Biochemistry", W.H. Freeman & Company.
5. Gerald Karp, Janet Iwasa & Wallace Marshall, "Karp's Cell Biology" Global Edition.

Outcomes :

Students will get insight into biology as a science, outlining the diversity, organization and fundamental principles of living systems.

CH203TBS06 **Mathematics-III** **[L:3, T:1, P:0]**

Objectives :

Basic concepts of statistics, curve fittings, correlation coefficient, probability, distribution and sampling methods.

Unit I : Introduction to statistics, mathematical statistics, variable, frequency distribution, exclusive and inclusive class intervals, type of series, graphical representation: histogram, frequency polygon, ogive measure of central tendency various types of averages, mean median mode for grouped and ungrouped data, geometric mean, harmonic mean, measure of dispersion Skegness 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: Theory of probability- mathematical and statistical definition of probability, sample space, finite sample space sample point, events theorem of total probability, sample and compound event, conditional probability, theorem of compound probability, Baye's theorem, use of binomial theorem.

Unit IV: Theoretical distribution- binominal distribution mean, standard deviation and Pearson's β and γ coefficient, Poisson distribution, mean, variance normal distribution.

Unit V: Random and simple sampling-mean, and standard deviation in simple sampling of attribute, test of significant for large sample test of significance based on Chi square, T, F and Z distribution degree of freedom, condition for applying.

Suggested Text Books:

1. M. Ray, H. S. Sharma & C. C. Chaudhary, "Mathematical Statistics", Ram Prasad Publications.
2. P. C. Biswal, "Probability and Statistics", PHI.
3. A.A.AFTI, "Statistics analysis"

Outcome :

Students should be able to solve statistics problems, problem based on correlation, regression and curve fittings, probability problems, problems relating to mean, standard deviation.

CH203TPC01 Material and Energy Balance Calculations [L:3, T:1, P:0]

Objectives:

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

Unit I : Introductory concepts of units, physical quantities in chemical engineering, Dimensionless groups, "basis" of calculations Gases, Vapours and Liquids: Equations of state, Vapour pressure, Clausius Clapeyron equation, Cox chart, Duhring's plot, Raoult's law.

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

Unit III : Material Balance: Introduction, solving material balance problems without chemical reaction, material balances with recycle, bypass and purge, material balance with chemical reaction, concept of stoichiometry and mole balances, examples, including combustion.

Unit IV : Energy Balance: open and closed system, heat capacity, calculation of enthalpy changes.

Unit V : Energy balances with chemical reaction, heat of reaction, heat of combustion.

Suggested Text Books:

1. S. N. Saha, "Chemical Process Engineering Calculation", Dhanpat Rai Publication Co. (Pvt.) Ltd., New Delhi
2. B. I. Bhatt & S. M. Vora, "Stoichiometry", Tata McGraw Hill Publishing Co. Ltd.

Suggested References Books:

1. R. M. Felder & R. W. Rousseau, "Elementary Principles of Chemical Processes", John Wiley & Sons.
2. O. A. Hougen, K. M. Watson & R. A. Ragatz, "Chemical Process Principles, Part I Material & Energy Balances", CBS Publishers & Distributors.
3. D. M. Himmelblau & J. B. Riggs, "Basic Principles and Calculations in Chemical Engineering", Pearson India Education Services.
4. V. Venkataramani, N. Anantharaman, K. M. Begum & S. Meera, "Process Calculations", Prentice Hall of India.
5. D. C. Sikdar, "Chemical Process Calculations", Prentice Hall of India.

Outcomes:

Students completing the course will

- Develop mastery over process calculations relevant to Chemical Engineering Processes
- Be able to handle elementary flow-sheeting, material and energy balance calculations
- Be able to solve problems based on without and with chemical reactions, and involving concepts like recycle, bypass and purge.
- Be familiar with equations of state and properties of gases and liquids, including phase transition.

CH203TPC02 **Fluid Mechanics** **[L:3, T:1, P:0]**

Objectives:

The objective of this 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 visualization, flow measurement, flow transportation and types of flow.

Unit I : Fluid Static & Applications: Hydrostatic equilibrium, hydrostatic equilibrium in centrifugal field and its applications in chemical engineering like manometers decanters. Fluid Flow 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 Poiseuille 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 – pitot 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. M. White, Fluid Mechanics, Tata-McGraw Hill.
2. V. Gupta & S. K. Gupta, Fundamentals of Fluid Mechanics, New Age International.
3. W. L. McCabe, J. C. Smith & P. Harriot, Unit Operations of Chemical Engineering, McGraw-Hill International Edition.

4. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall of India.
5. R. W. Fox, P. J. Pritchard & A. T. McDonald, Introduction to Fluid Mechanics, Wiley-India.
6. R. Welty, C. E. Wicks, R. E. Wilson, G. Rorrer, Fundamentals of Momentum, Heat and Mass Transfer, Wiley.

Suggested References Books :

1. B. R. Munson, D. F. Young, T. H. Okiishi & W. W. Huebsch, Wiley-India.
2. R. L. Panton, Incompressible Flow, Wiley-India.
3. R. B. Bird, W. E. Stewart & E. N. Light foot, Transport Phenomena, Wiley India.

Outcomes :

- Velocity profiles by simplification of equations of motion in simple 1-D flows
- Boundary layer thicknesses, friction factor, pressure drop, power requirements in single phase flow in pipes
- Two phase gas/liquid pressure drop
- Power requirements, NPSH requirements of pumps

CH203TPC03 Thermodynamics –I [L:3, T:0, P:0]

Objectives:

Principles and application of first and second law of thermodynamics, and phase equilibria.

UNIT I : Basic Concepts, Definitions & P-V-T Relations: Approaches of thermodynamics, system & its types, types of processes, work, heat, energy. 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 : First Law of Thermodynamics: First law, calculation of internal energy, enthalpy, heat capacities, application of first law for open and closed systems, Throttling process, Joule – Thompson effect.

UNIT III : Second law of thermodynamics, heat engine, heat pump, refrigerator, Kelvin and Clausious statement, criteria of irreversibility, Carnot theorem, Carnot cycle, Clausious inequality, entropy and its principle, third law of thermodynamics : definition and applications.

UNIT IV : Thermochemistry: Enthalpy, heat of reaction at constant pressure and volume, Hess's law of constant heat summation, effect of temperature on heat of reaction at constant pressure (Kirchoff's equation), heat of dilution, heat of hydrogenation, heat of formation, heat of neutralization and heat of combustion, adiabatic flame temperature.

UNIT V : Equation of state, VLE/LLE equilibrium: Le Chatlier's principle, kinetic theory, vapour-liquid equilibrium in ideal solution, liquid-liquid equilibrium diagrams, equation of state of real gas, principles of corresponding states.

Suggested Text Books :

1. J. M. Smith, H. C. Van Ness & M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, McGraw-Hill International Edition.
2. Y. V. C. Rao, Chemical Engineering Thermodynamics, University Press.
3. K. V. Narayanan, A Textbook of Chemical Engineering Thermodynamics, Prentice Hall of India.

Suggested References Books :

1. R.C. Srivastava, Thermodynamics a core course, PHI publication, India.

Outcomes :

Course outcomes students would be able to :

- Apply mass and energy balances to closed and open systems.
- Evaluate the properties of non-ideal gases.
- Solve problems involving liquefaction, refrigeration and different power cycles.
- Evaluate the enthalpy of reactions of chemical processes.
- Analyse the system of VLE and LLE.

CH203PPC01 Chemical Engineering Lab-I [L: 0; T:0; P:3]

Objectives:

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

Content:

1. Determine the viscosity of Given Sample using Ostwald Viscometer.
2. Determine the adsorption coefficient of coal and sawdust samples.
3. Determine the Bulk density and angle of repose at different moisture of given sample.
4. To determine the bed void fraction of given sample.
5. Determine the relative humidity using wet and dry bulb temperature.
6. Determine the percentage of heavy and light particle of given sample.
7. Determine the drag coefficient of given sample.
8. Prepare the soap using start.

* Any other experiments may be added further, if needed.

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.

CH203PPC02 Fluid Mechanics Lab [L:0, T:0, P:3]

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 orifice meter 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.

* Any other experiments may be added further, if needed.

Outcomes :

- 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.

CH204THS02 Business Communication and Presentation Skill [L:3, T:0, P:0]

Objectives:

To develop the communication skills like writing technical letters, reports and presentation skills.

Contents:

Unit I : Business communication covering, role of communication in information age; concept and meaning of communication; skills necessary for technical communication; communications in a technical organization; barriers to the process of communication.

Unit II : Style and organization in technical communication covering, listening, speaking, reading and writing as skills; objectivity, clarity, precision as defining features of technical communication; various types of business writing: letters, reports, notes, memos; language and format of various types of business letters; language and style of reports; report writing strategies; analysis of a sample report.

Unit III : Communication and personality development covering, psychological aspects of communication, cognition as a part of communication; emotional intelligence; politeness and etiquette in communication; cultural factors that influence communication; mannerisms to be avoided in communication; language and persuasion; language and conflict resolution.

Unit IV : Language laboratory emphasizing listening and comprehension skills; reading skills; sound structure of English and intonation patterns;

Unit V : Oral presentation and professional speaking covering, basics of English pronunciation; elements of effective presentation; body language and use of voice during presentation; connecting with the audience during presentation; projecting a positive image while speaking; planning and preparing a model presentation; organizing the presentation to suit the audience and context; basics of public speaking; preparing for a speech

Suggested Text Books :

1. Fred Luthans, Organizational Behaviour, McGraw Hill
2. Lesikar & petit, Report writing for Business
3. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill
4. Wallace & masters, Personal Development for Life and Work, Thomson Learning

Suggested Reference Books :

1. T. M. Farhathullah, Communication skills for Technical Students
2. Michael Muckian, John Woods, The Business letters Handbook
3. Herta A. Murphy, Effective Business Communication
4. MLA Handbook for Writers of Research Papers

Outcomes :

Students should be able to :
- Communicate properly, write technical letters and reports.
- Present reports and seminars in an attractive way.

CH204TBS07 Numerical Methods in Chemical Engineering [L:3, T:1, 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.

Unit I : 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 : The 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's $1/3^{rd}$ 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 Range's method Runge-Kutta method.

Books Recommended:

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

Outcomes:

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

CH204TPC04 **Thermodynamics –II** **[L:3, T:0, P:0]**

Objectives:

To introduce the concepts of fugacity, activity coefficient, vapour-liquid equilibrium and reaction equilibrium.

Unit I : 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.

Unit II : Thermodynamic Properties of Gases and Liquids : Joule-Thomson coefficient, Clausisus – Clapeyron equations and some important correlations for estimation of vapour pressures, estimation of thermodynamic properties by using equations, graphs and tables.

Unit III : 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 IV : Properties of Solutions : Ideal solutions (Lewis Randall Rule) phase equilibrium in ideal solutions, phase equilibrium problems, 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.

Unit V : Chemical 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 & M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, McGraw-Hill International Edition.
2. Y. V. C. Rao, Chemical Engineering Thermodynamics, University Press.
3. K. V. Narayanan, A Textbook of Chemical Engineering Thermodynamics, PHI.

Suggested References Books

1. R.C. Srivastava, "Thermodynamics a core course", PHI.
2. P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill.

Outcomes:

Students should be able to understand

- Understand and calculate the various thermodynamics potentials.
- Analyse the thermodynamic properties of gases and liquids.
- Estimate the partial molar properties of gases and liquid.
- Application of various equation of state.
- Evaluate the equilibrium constant for chemical reactions.

CH204TPC05 Particle and Fluid Particle Processing [L:3, T:1, 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. The course addresses fundamentals of fluid-particle mechanics, such as the notion of drag, and builds on those fundamentals to develop design concepts for various industrial processes like packed bed operation, fluidized operations, sedimentation, filtration, separation of solids and fluids, etc. Industrial applications are discussed. The course is concluded with an introduction to colloidal systems, soft materials and nanoparticles. Applications of these novel systems are discussed.

Unit I: Solids Properties, Handling, Mixing : Introduction: Relevance of fluid and particle mechanics, and mechanical operations, in chemical engineering processes. 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. Mixing and storage of Solids: Types of important mixers like kneaders, dispersers, masticaters, roll mills, muller mixer, pug mixer, blender, screw mixer etc., mixing index.

Unit II: Storage and Transportation, Size Reduction : Types of storage equipments, 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 hydro cyclones, filter bags, venturi 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: Fluidization : Fluidization: Fluidized bed, minimum fluidization velocity, pressure drop etc. Types of fluidization: Particulate fluidization, Bubbling fluidization, Applications of fluidization. Packed bed: Void fraction, superficial velocity, channelling, Ergun equation and its derivation, Kozeny Carman equation, Darcy's law and permeability, Blaine's apparatus.

Suggested Text Books :

1. W. McCabe, J. Smith, J. & P. Harriott, Unit Operations of Chemical Engineering,

McGraw Hill.

2. Coulson and Richardson's Chemical Engineering, Vol. 2, Butterworth-Heinemann.

Suggested References Books

1. M. J. Rhodes, Introduction to Particle Technology, John Wiley, Chichester; New York.
2. T. Allen, Powder Sampling and Particle Size Determination, Elsevier.
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, Wiley.

Outcomes:

Students will be able to

- Calculate pressure drop in fixed and fluidized beds.
- Know the significance and usage of different particulate characterization parameters, and equipment to estimate them.
- Describe Size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment.
- Analyse filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage.

CH204TPC06 Process Instrumentation [L:3, T:1, P:0]

Objectives:

This course is to introduce students to learn the basics of instrumentation and handling the process variables, course address fundamentals & amp; operation of different measuring devices such as temperature, level, pressure, flow, pH, humidity and compositions. Course introduced to impart basic knowledge of transmitters, transducers, control valves, digital and analog components related to PLC, DCS.

Unit I : Instruments Characteristics: Introduction to process variables, static and dynamic characteristics of instruments, and their general classification, elements of measuring system and their functions.

Unit II: Transmitters & amp; Transducers: Signal transmission, transmitters, electronic, pneumatic, 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 & amp; Regulators : Principles and construction of electro- pneumatic controllers, multiplexers, final control elements such as pneumatic control vale, stepper motor.

Unit V: Data Acquisition & amp; Analysis : Introduction to data acquisition system and intelligent instruments, instrumentation of process equipment such as distillation column, heat exchanger etc.

Text Books:

1. S. K. Singh, Industrial Instrumentation and Control, McGraw-Hill.
2. William C. Dunn, Fundamentals of Industrial Instrumentation and Process Control, McGrawHill.

References Books:

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

Outcomes :

Students will be well-familiar with instrumentation and automation as relevant to modern chemical plant operation.

CH204PBS03 Numerical Methods in Chemical Engineering Lab [L:0, T:0, P:2]

Objectives :

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.

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.

CH204PPC03 Particle and Fluid Particle Processing 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 laws of crushing for crushing solid particles in Jaw crusher.
2. To verify laws of crushing for crushing solid particles in roll crusher.
3. To verify laws of crushing for crushing solid particles in Ball mill.
4. To find out the Effectiveness of Triple deck Vibrating Screen.
5. To determine the average diameter of a mixture of solid particles of different size using sieve analysis.
6. To determine the collection efficiency at different flow rate for separating dust particles from air.
7. To study the working of continuous Rotary Vaccum Drum Filter.
8. To determine the filter medium resistance and specific cake resistance of plate and frame filter press.

* Any other experiments may be added further, if needed.

Outcomes:

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

1. Apply the principles of unit operations through experimentation and
2. Demonstrate the ability to understand the various mechanical operation equipment used in chemical and allied process industry.

CH204PPC04 Process Instrumentation Lab [L:0, T:0, P:3]

Objectives:

To help the student to enhance their knowledge of different process measuring instruments that used in industry

Content:

1. Study of Mercury in glass thermometer with different temperature range.
2. Study the characteristics of various flow measuring instruments
3. Study the characteristics LVDT, Strain gauge
4. Study the characteristics of Level meter, pH meter, Density meter
5. Study the characteristics of different thermocouples & RTD sensors.
6. Determination of transient response of bimetallic thermocouple.
7. Determination of dissolved oxygen using DO meter.
8. Concentration analysis of gas-liquid chromatograph.
9. Concentration analysis using U-V-visible Photo-spectrometer & to study its principle of operation.
10. Measurement of Humidity using hair hygrometer & to study its principle.
11. Pressure measurement using different pressure gauges, U-tube manometer, pressure transducer and study of their characteristics.

* Any other experiments may be added further, if needed.

Outcomes:

Practical experiences and soft skills associated with this course, the student able to demonstrate the following industry oriented COs associated with course.

1. Able to understand the characteristics of instrument for various chemical processes.
2. Able to understand the temperature measuring instruments in chemical industry.
3. Able to understand the pressure, Level, pH etc. various measuring instruments in chemical industry.
4. Measure the flow and level using various measuring instruments in chemical industry.

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
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 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:

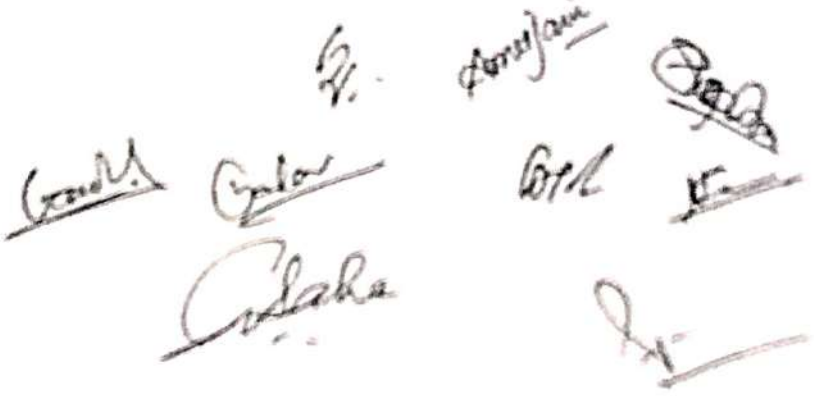
1. Fluidization by J. F. Davidson and D. Harrison, Academic Press.
2. Fluidization and Fluid Particles Systems by F.A. Zenz and D. F. Othmer, Reinhold Publishing.

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.

ꕥꕥꕥꕥꕥꕥ

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.

ꕥꕥꕥꕥꕥꕥ

27 X 4 = 108

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

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 2021-22)

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

FINAL YEAR, SEVENTH SEMESTER (AICTE)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH07TPC14	Process Equipment Design - II	3	1	0	30	70	100	4
02.	CH07TPC15	Chemical Reaction Engineering - II	3	1	0	30	70	100	4
03.	CH07TPC16	Transport Phenomena	3	1	0	30	70	100	4
04.	CH07TPE4X		3	0	0	30	70	100	3
05.	CH07TOE3X		3	0	0	30	70	100	3
	PRACTICAL								
01.	CH07PPC11	Minor Project	0	0	3	30	20	50	1.5
02.	CH07PPC12	Seminar	0	0	3	30	20	50	1.5
		Total	15	3	6			600	21

IA – Internal Assessment

Total Marks – 600

ESE - End Semester Examination

Total Periods / week - 24

Total Credits : 21

B. Tech. Chemical Engineering Final Year

w.e.f : Session 2021-22

BoS held on 23.07.2021

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 2021-22)

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

FINAL YEAR, EIGHTH SEMESTER (AICTE)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH08TPC17	Process Equipment Design - III	3	1	0	30	70	100	4
02.	CH08TPE5X		3	0	0	30	70	100	3
03.	CH08TOE4X		3	0	0	30	70	100	3
	PRACTICAL								
01.	CH08PPC13	Project	0	0	8	70	30	100	4
		Total	9	1	8			400	14

IA – Internal Assessment

Total Marks – 400

ESE - End Semester Examination

Total Periods / week - 18

Total Credits : 14

B. Tech. Chemical Engineering Final Year

w.e.f : Session 2021-22

BoS held on 23.07.2021

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 (Seventh and Eighth semester) (AICTE)

S. No.	Semester	Course No.	Subject
01.	VII	CH07TPE41	Petroleum Refinery Engineering
02.		CH07TPE42	Polymer Technology-I
03.		CH07TPE43	New Separation Processes
04.	VIII	CH08TPE51	Petrochemical Technology
05.		CH08TPE52	Polymer Technology-II
06.		CH08TPE53	Design and Development of Catalyst

List of Open Elective Courses (Seventh and Eighth semester) (AICTE)

S. No.	Semester	Course No.	Subject
01.	VII	CH07TOE31	Process Modelling & Simulation
02.		CH07TOE32	Water Conservation & Management
03.	VIII	CH08TOE41	Optimization Techniques
04.		CH08TOE42	Project Engineering Economics & Management

B.Tech. VII Semester

CH07TPC14 Process Equipment Design - II [L:3, T:1, P:0]

Objectives

This course enables students to integrate all the subjects that they have learnt and design plant/processes from Chemical Engineering Principles. Graduates shall be able to: (a) Understand the Chemical Engineering Principles applicable to design Chemical Engineering equipment's; (b) apply standard codes for design of chemical plant equipment; (c) analyse the specifications for process equipment; (d) design process equipment's and its accessories.

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 should be able to design, calculate size/power/internals, etc required for all the process equipment in the PFD together with necessary instrumentation, safety aspects. Students should be able to calculate costs of equipment. Students should be able to perform a techno economic feasibility of the selected process.

Mandalaar 23/07/2021

B.Tech. VII Semester

CH07TPC15 Chemical Reaction Engineering – II [L:3, T:1, P:0]

Objectives

Graduates shall be able to (a) understand fundamental principles and experimental techniques of heterogeneous reaction systems; (b) apply principles of transfer operation in kinetics studies of heterogeneous reaction systems; (c) analyze the rate controlling step in heterogeneous reaction systems; (d) evaluate the catalytic activity and selectivity influenced by the physical and surface properties of the 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, General characteristics, 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 J.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 Outcomes

Students would be able to (a) explain the concepts of reactor design and reaction kinetics; (b) interpret reactor data; (c) identify ideal reactors and explain various aspects of design for single reactions; (d) explain various aspects of design for multiple reactions, (e) analyze effects of temperature and pressure on conversion.

23/07/2021

B.Tech. VII Semester

CH07TPC16 **Transport Phenomena** **[L:3, T:1, 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 & 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: (a) analyze heat, mass, and momentum transport in a process; (b) formulate problems along with appropriate boundary conditions; (C) develop steady and transient solution for problems involving heat, mass, and momentum transport.

w.e.f : Session 2021-22 **BoS held on 23.07.2021**

23/07/2021

B.Tech. VII Semester

CH07TPE41 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 (a) explain petroleum refining and thermal cracking processes; (b) detail catalytic cracking and catalytic reforming processes; (c) produce fuels such as aviation gasoline, motor fuel, kerosene, jet fuel; (d) manufacture lubricating oil; (e) store and transport petroleum products.

w.e.f : Session 2021-22 **BoS held on 23.07.2021**

23/07/2021

B.Tech. VII Semester

CH07TPE42 **Polymer Technology - I** **[L:3, T:0, P:0]**

Objectives

To deal with identification and characterization of raw material for ensuring the quality of polymer product along with different techniques of processing. 2. To develop the skills required for working in production, processing, testing, marketing and sales department of plastics, rubbers and fibres manufacturing Industries.

Contents

Unit-I: Introduction to Polymer Science: Classification of polymer and functionality, Polymerization, Polymer structure, Molecular weight distribution, Number average, Weight average, z-average Molecular weight, Chemical structure and thermal transition types, Mechanism of polymerization.

Unit-II: Polymer Synthesis: Step growth polymerization and its kinetics, Molecular weight of step growth polymerization, Chain growth polymerization and its kinetics, Copolymerization and its kinetics, Polymerization techniques, Reaction of synthetic Polymer, Chemical structure determination.

Unit-III: Conformation, Solution and Molecular Weight: Thermodynamics of polymer solution, Flory Huggins theory, Polymer conformation and chain dimensions, Process of polymer dissolution, Nature of polymer molecules in solution, Measurement of molecular weight, Osmometry, Light scattering, GPC, 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, Mechanical properties and methods of its testing.

Unit-V: Polymer Degradation & the Environmental Effect: Polymer degradation and stability, Types of degradation, Thermal degradation, Mechanical degradation, Photo degradation, Degradation by high energy radiation, Hydraulic degradation, The management of plastic in environment, biodegradation.

Suggested Text Books

1. Polymer Science and Technology by Fried
2. Outlines of Polymer Technology by Sinha, PHI
3. Polymer Science by V.R. Gowariker, New age International Ltd

Course Outcomes

Students would be able to (a) select appropriate techniques of polymerization; (b) produce plastics using appropriate reactions and unit operations steps; (c) produce rubbers using appropriate reactions and unit operations steps; (d) produce fibres using appropriate reactions and unit operations steps; (e) apply different polymer processing techniques.

w.e.f : Session 2021-22 **BoS held on 23.07.2021**

23/07/2021

B.Tech. VII Semester

CH07TPE43 **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.

w.e.f : Session 2021-22 **BoS held on 23.07.2021**

B.Tech. VII Semester

CH07TOE31 Process Modeling & Simulation [L:3, T:0, P:0]

Objectives

Graduates shall be able to (a) understand chemical engineering system in term of modeling principle; (b) distinguish simulation from design of equipment; (c) apply software tools such as UNISIM to model chemical processes; (d) develop algorithm for modeling & 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-Hall India, 2006.
5. Elements of Chemical Reaction Engineering by Fogler, Prentice Hall of India.

Course Outcomes

Students would be able to (a) explain detail importance of ODE and PDE; (b) develop model equations for the given system; (c) solve structural, thermal, fluid flow problems; (d) demonstrate the model solving ability for various processes/unit operations; (e) demonstrate the ability to use a process simulation.

w.e.f : Session 2021-22 **BoS held on 23.07.2021**

23/07/2021

B.Tech. VII Semester

CH07TOE32 Water Conservation & Management [L:3, T:0, P:0]

Objectives

To introduce the water management principles related to process plants.

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: (a) evaluate the performance of industrial boilers and furnaces; (b) identify the scope for recycle and reuse of water; (c) choose methods for waste minimization and water conservation.

B.Tech. VIII Semester

CH08TPC17 **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: (a) design mass transfer equipment's for chemical process.; (b) prepare drawing for chemical process equipment's.

B.Tech. VIII Semester

CH08TPE51 **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: (a) select the appropriate characterization parameters; (b) specify the properties of petroleum products; (c) attain knowledge of various separation & conversion processes involved in petroleum refining; (d) attain knowledge of manufacturing of various petrochemical products.

B.Tech. VIII Semester

CH08TPE52 **Polymer Technology - II** **[L:3, T:0, P:0]**

Objectives

(a) To deal with identification and characterization of raw material for ensuring the quality of polymer product along with different techniques of processing; (b) To develop the skills required for working in production, processing, testing, marketing and sales department of plastics, rubbers and fibres manufacturing Industries.

Contents

Unit-I: Additives, Blends & Composites: Additives, Plasticizers, Fillers & reinforcements, Stabilizers, Flame retardants, Biocides, Processing additives, Colorants, Polymer blends, Interpenetrating network, Introduction to polymer composites, Composite fabrication.

Unit-II: Polymer Reaction: Hydrolysis, Acidolysis, Aminolysis, Hydrogenation, Addition and substitution reaction, Reaction of various specific groups, Cross linking reaction, Reaction leading of graft & block copolymers, Miscellaneous reactions.

Unit-III: Experimental Methods: Polymer synthesis, Isolation and purification of polymers, Polymer fractionation, Molecular weight determination, Molecular weight distribution curve, Determination of glass transition temperature.

Unit-IV: Engineering and Specialty Polymers: Engineering thermoplastics, Polyolefins, Vinyl polymers, Polyamides, Polycarbonates, Polysulphone, Fluoropolymers, Inorganic polymers, Thermoplastic polyesters, Natural and synthetic rubber, Cellulose and its derivatives.

Unit-V : Polymer Processing & its Manufacturing: Basic processing operations, Extrusion, Modeling, Calendering, Coating, Injection moulding, Compression moulding, Transfer moulding, Blow moulding, Die casting, Rotation casting, Film casting.

Suggested Text Books

1. Polymer Science and Technology by Fried
2. Outlines of Polymer Technology by Sinha PHI
3. Polymer Science by V.R. Gowariker New age International Ltd.

Course Outcomes

Upon completion of this course, the students will be able to: (a) select appropriate techniques of polymerization; (b) produce plastics using appropriate reactions and unit operations steps; (c) produce rubbers using appropriate reactions and unit operations steps; (d) produce fibres using appropriate reactions and unit operations steps; (e) apply different polymer processing techniques.

w.e.f : Session 2021-22 **BoS held on 23.07.2021**

23/07/2021

B.Tech. VIII Semester

CH08TPE53 Design and Development of Catalyst [L:3, T:0, P:0]

Objectives

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

Contents

Structure of Solid Surfaces, Chemisorption and Physiosorption, 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, Dynamics of Polyfunctional Catalysts, Electro catalysis and Photocatalysis, Mechanism and Kinetics of Some Typical Heterogeneous Catalytic Reactions, Applications in Fertilizer, Petroleum, Petrochemical Industries and Pollution Control.

Suggested Text Books

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

Course Outcomes

Differentiate between chemisorption and physical adsorption, List steps involved in adsorption of a solute, and which steps may control the rate of adsorption, Explain the concept of breakthrough in fixed-bed adsorption. Upon completion of this course, the students will be able to: (a) develop various catalytic reaction mechanisms; (b) characterize a catalyst; (c) assess the effects of external heat and mass transfer effects in heterogeneous catalysis; (d) calculate the effectiveness of a porous catalyst; (e) design different types of reactors for catalytic reactions.

B.Tech. VIII Semester

CH08TOE41 **Optimization Techniques** **[L:3, T:0, P:0]**

Objectives

To study and apply optimization techniques in the chemical process industry.

Contents

Unit-I: System Analysis and Modeling: Introduction to systems analysis and modeling with reference to chemical engineering problems, Differential method for solving one and two variable problems with and without constraints, Case studies, Application of langrangian multiplier method.

Unit-II: Linear Programming: Modeling, graphical method, single phase simplex method, two phase simplex method, duality, sensitivity analysis.

Unit-III: Geometric Programming: As applied to chemical engineering problems with degree of difficulty equal to zero and one, with and without constraints.

Unit-IV: Non-linear Programming: One dimensional search methods- Golden section method, dichotomous search method, Interval halving method, Fibonacci method, Newton method, Quasi-Newton method, Finite difference method, Polynomial approximation methods.

Unit-V: Dynamic Programming: Introduction to dynamic programming as applied to discrete multistage problems like cascade of CSTR, Train of heat exchanger etc., Computer programming techniques applied to optimization.

Suggested Text Books

1. Optimization Theory and Practice by Beveridge and Schecheter
2. Optimization Techniques for chemical Engineers by Asghar Hussain
3. Optimization by S.S. Rao
4. Linear Programming by Hadley

Course Outcomes

Upon completion of this course, the students will be able to: (a) formulate the objective functions for constrained and unconstrained optimization problems; (b) use different optimization strategies; (c) Solve problems using non-traditional optimization techniques; (d) use of different optimization techniques for problem solving.

w.e.f : Session 2021-22

BoS held on 23.07.2021

23/07/2021

B.Tech. VIII Semester

CH08TOE42 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.

Chandrakar 23/07/2021