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
	THEORY					Sessional			
			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

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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
	THEORY					Sessional			
			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

ESE - End Semester Examination

Total Credits : 14

Total Marks – 400

Total Periods / week - 18

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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

Program Outcomes	
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering comm Modules and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes	
PSO1	The students of the programme will have a strong foundation in mathematics, basic sciences and chemical engineering to meet the current demands in professional world with cutting-edge research in chemical and allied engineering disciplines.
PSO2	Graduates would be equipped with a working knowledge in professional courses such as process economics, project engineering, industrial safety and sustainable development to work in the conventional as well as frontier area of Chemical Engineering which enables them suitable for chemical industries.
PSO3	Graduates of chemical engineering will be able to communicate in a professional setting, including soft skills, technical writing, presentation, and management skills making them employable to industries.

B.Tech. VII Semester

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

1. Design, calculate size/power/internals, etc required for all the process equipment in the PFD together with necessary instrumentation, safety aspects.
2. Calculate costs of equipment.
3. Perform a techno economic feasibility of the selected process.

CO-PO Mapping

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

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

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

1. Explain the concepts of reactor design and reaction kinetics.
2. Interpret reactor data.
3. Identify ideal reactors and explain various aspects of design for single reactions.
4. Explain various aspects of design for multiple reactions.
5. Analyze effects of temperature and pressure on conversion.

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2	2	3	2							3	2	
CO2	3	3	2	2	2	2							3	2	
CO3	3	2	3	2	3	2							3	2	
CO4	2	1	2	2	2	1							3	2	
CO5	3	2	1	2	2	1							3	2	

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

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

Course Outcomes

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

1. analyze heat, mass, and momentum transport in a process;
2. formulate problems along with appropriate boundary conditions;
3. develop steady and transient solution for problems involving heat, mass, and momentum transport.

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2	2	3	2							3	2	
CO2	3	3	2	2	2	2							3	2	
CO3	3	2	3	2	3	2							3	2	

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

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

1. explain petroleum refining and thermal cracking processes;
2. detail catalytic cracking and catalytic reforming processes;
3. produce fuels such as aviation gasoline, motor fuel, kerosene, jet fuel;
4. manufacture lubricating oil;
5. store and transport petroleum products.

CO-PO Mapping															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1				1						2	2	
CO2	1	1	1				1						2	2	
CO3	1	1	1				1						2	2	
CO4	1	1	1				1						2	2	
CO5	1	1	1				1						2	2	
Weightage: 1-Slightly; 2-Moderate; 3-Strongly															

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

1. select appropriate techniques of polymerization;
2. produce plastics using appropriate reactions and unit operations steps;
3. produce rubbers using appropriate reactions and unit operations steps;
4. produce fibres using appropriate reactions and unit operations steps;
5. apply different polymer processing techniques.

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1				1						2	2	
CO2	1	1	1				1						2	2	
CO3	1	1	1				1						2	2	
CO4	1	1	1				1						2	2	
CO5	1	1	1				1						2	2	

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

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

Students would be able to

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

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1				1						2	2	
CO2	1	1	1				1						2	2	
CO3	1	1	1				1						2	2	

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

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

Objectives

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

Contents

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

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

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

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

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

Suggested Text Books

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

Course Outcomes

Students would be able to

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

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO2	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO3	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO4	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--
CO5	3	3	3	3	3	--	--	--	--	--	--	3	3	3	--

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

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:

1. evaluate the performance of industrial boilers and furnaces;
2. identify the scope for recycle and reuse of water;
3. choose methods for waste minimization and water conservation.

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

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 Equipment such as absorption, Distillation Columns, dryer etc. This will also be useful for using Design software which is widely used in chemical industries.

Contents

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

Suggested Text Books

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

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

Course Outcomes

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

1. design mass transfer equipment's for chemical process.;
2. prepare drawing for chemical process equipment's.

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

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:

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

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1				1						2	2	
CO2	1	1	1				1						2	2	
CO3	1	1	1				1						2	2	
CO4	1	1	1				1						2	2	

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

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:

1. select appropriate techniques of polymerization;
2. produce plastics using appropriate reactions and unit operations steps;
3. produce rubbers using appropriate reactions and unit operations steps;
4. produce fibres using appropriate reactions and unit operations steps;
5. apply different polymer processing techniques.

CO-PO Mapping															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1				1						2	2	
CO2	1	1	1				1						2	2	
CO3	1	1	1				1						2	2	
CO4	1	1	1				1						2	2	
CO5	1	1	1				1						2	2	
Weightage: 1-Slightly; 2-Moderate; 3-Strongly															

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 Photocatalyis, 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 Haterogeneous Catalysts by G. Poncelet,J. Martens, B. Delmon, Elseveir
2. Catalyst Preparation: Science and Engineering by John Regalbuto, CRC Press

Course Outcomes

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

1. (a) develop various catalytic reaction mechanisms;
2. characterize a catalyst;
3. assess the effects of external heat and mass transfer effects in heterogeneous catalysis;
4. calculate the effectiveness of a porous catalyst;
5. design different types of reactors for catalytic reactions.

CO-PO Mapping															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1				1						2	2	
CO2	1	2	1				1						2	2	
CO3	1	1	1				1						2	2	
CO4	2	1	1				1						2	2	
CO5	1	1	1				1						2	2	
Weightage: 1-Slightly; 2-Moderate; 3-Strongly															

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 Modelling: Introduction to systems analysis and modelling 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: Modelling, 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: Search Methods: Sequential search methods - Golden section method, dichotomous search method, Interval halving method, Fibonacci method.

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.

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	2	1								2	2	2
CO2	1	2	1	2	2								1	2	2
CO3	2	2	3	2	2								2	2	1
CO4	2	2	2	2	2								2	2	2

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

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:

1. select a site for the project from given alternatives,
2. calculate working capital requirement for a given project,
3. calculate cost of equipment used in a plant total project cost,
4. calculate cash flow from a given project and understand the break-even analysis;
5. calculate depreciation and list out various milestones related to project concept to commissioning.

CO-PO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		1	1	1	1						2		2	1	
CO2	2	1	1	1	1						2		2	1	
CO3	2	1	1	1	1						2		2	1	
CO4	2	1	1	1	1						2		2	1	
CO5	2	1	1	1	1						2		2	1	

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