CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Kokapet(Village), Gandipet, Hyderabad, Telangana-500075. www.cbit.ac.in

COMMITTED TO RESEARCH, INNOVATION AND EDUCATION

44 years

CHEMICAL ENGINEERING DEPARTMENT

Program Outcomes (PO's)

Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution ofcomplex engineering problems

Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineeringproblems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation ofdata, and synthesis of the information to provide valid conclusions.
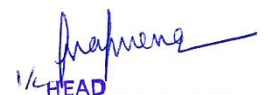
Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledgeto assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate theknowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a memberor leader in diverse teams, and in multidisciplinary settings.

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Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effectivepresentations, and give and receive clear instructions.

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 multidisciplinaryenvironments.

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 technologicalchange.

R20:

Department Vision

To become the most sought center of excellence engaged in training and shaping students as professionals for higher education and process industries both in India and abroad and allow the students to do R & D projects and publish same in the reputed journals.

Department Mission

Imparting contemporary technical education and training manpower to create a skilled human resource talent pool to serve, manage the process industries globally with a sense of responsibility towards society and the environment.

Program Education Objectives (PEOs):

- To train the students for identifying problems relevant to design and general practice of chemical engineering field.
- To provide experience in the three significant design areas of equipment, process and plant operation of chemical industries.
- To educate the students in understanding the multifaceted aspects of chemical engineering and in applying the various computational methods studied, for problem analysis and solution.
- To prepare the students to pursue post graduate studies or to succeed in industry / technical profession through global technical education.

Program Specific Outcomes (PSOs)

PSO-1: Undertake research activities in the area of heat & mass transfer, separation processes,

Reaction engineering, related to Green Chemical Engineering.

PSO-2: Undertake real life projects in process industries and allied fields.

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Chemical Engineering Department
Course Outcome Statements for B. Tech (Chemical)-R20

SNo	Course Code	Course Name	Course Outcomes Statements
1.	20MT C05	Calculus	Apply the Matrix Methods to solve system of linear equations Apply the Matrix Methods to solve the system of linear equations
			Analyse the geometrical interpretation of Mean value theorems.
			Determine the extreme values of functions of two variables.
			Examine the convergence and divergence of infinite Series.
			Calculate the Euler's coefficients for Fourier series of a function
2.	20CE C01	Engineering Mechanics - I	Calculate the components and resultant of coplanar forces system.
			Understand free body diagram and apply equilibrium equations to solve for unknown forces.
			Apply concepts of friction for solving engineering problems.
			Analyse simple trusses for forces in various members of a truss
			Determine centroid for elementary, composite figures and bodies.
3.	20PY C01	Chemistry	Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
			Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells
			Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
			Classify the various methods used in treatment of water for domestic and industrial use.
			Outline the synthesis of various Engineering materials & Drugs.
4.	20CS C01	Programming for Problem Solving	Identify and understand the computing environments for scientific and mathematical problems.
			Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
			Choose data types and control structures to solve mathematical and scientific problem.
			Decompose a problem into modules and use functions to implement the modules.
			Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
			Develop applications using file I/O.

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SNo	Course Code	Course Name	Course Outcomes Statements
5	20CY C02	Chemistry Lab	Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
			Estimate the amount of chemical substances by volumetric analysis.
			Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
			Calculate the concentration and amount of various substances using instrumental techniques.
			Develop the basic drug molecules and polymeric compounds.
6	20CS C02	Programming For Problem Solving Lab	Identify and setup program development environment.
			Design and test programs to solve mathematical and scientific problems.
			Identify and rectify the syntax errors and debug program for semantic errors
			Implement modular programs using functions.
			Represent data in arrays, pointers, structures and manipulate them through a program
			Create, read, and write to and from simple text files.
7	20ME C02	Workshop / Manufacturing Practice	Understand safety measures to be followed in workshop to avoid accidents.
			Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
			Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
			Perform various operations in welding, machining and casting processes.
			Conceptualize and produce simple device/mechanism of their choice.
8	20ME C03	Engineering Exploration	Understand the role of an engineer as a problem solver.
			Identify multi-disciplinary approaches in solving an engineering problem.
			Build simple systems using engineering design process.
			Analyze engineering solutions from ethical and sustainability perspectives.
			Use basics of engineering project management skills in doing projects.
9	20MT C06	Vector Calculus And Differential Equations	Calculate the areas and volumes.
			Apply the vector differential operators to Scalars and Vector functions
			Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
			Calculate the solutions of first order linear differential equations.
			Solve higher order linear differential equations.

SNo	Course		Course Outcomes Statements
	Code	Name	
10	20 EG C01	English	Illustrate the nature, process and types of communication and communicate effectively without barriers.
			Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
			Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
			Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
			Critique passages by applying effective reading techniques
11.	20PY C07	Physics	Demonstrate the physical properties of the light.
			Find the applications of lasers and optical fibers in engineering and technology.
			Identify different types of magnetic and dielectric materials.
			Recall the fundamentals of nanomaterials.
			Apply the ideas of quantum mechanics for related problems
12.	20EEC01	Basic Electricalengineering	Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits 2. 3. 4. 5. 6.
			Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
			Understand the principle of operation, the emf and torque equations and classification of AC and DC machines
			Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
			Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
			Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations
13	20EG C02	English Lab	Define the speech sounds in English and understand the nuances of pronunciation in English.
			Apply stress correctly and speak with the proper tone, intonation and rhythm.
			Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
			Determine the context and speak appropriately in various situations.
			Design and present effective posters while working in teams, and discuss and participate in Group discussions.
14	20PY C10	Physics Lab	Interpret the errors in the results of an experiment.
			Demonstrate the wave nature of light experimentally
			Utilize physical properties of magnetic and dielectric materials for various applications
			Make use of lasers and optical fibers for engineering applications
			Explain light induced phenomenon and motion of electrons in electric and magnetic fields

SNo	Course Code	Course Name	Course Outcomes Statements
15.	20EEC02	BASIC ELECTRICAL ENGINEERING LAB	Get an exposure to common electrical components, their ratings and basic electrical measuring equipment. 2. 3. 4. 5. 6.
			Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
			Comprehend the circuit analysis techniques using various circuital laws and theorems.
			Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
			Recognize the basic characteristics of transformer and components of switchgear.
			Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.
16.	20ME C01	CAD AND DRAFTING	Become conversant with appropriate use of CAD software for drafting.
			Recognize BIS, ISO Standards and conventions in Engineering Drafting.
			Construct the projections of points, lines, planes, solids
			Analyse the internal details of solids through sectional views
			Create an isometric projections and views
17.	20MBC02	COMMUNITY ENGAGEMENT	Gain an understanding of Rural life, Culture and Social realities.
			Develop a sense of empathy and bonds of mutuality with Local Communities
			Appreciate significant contributions of Local communities to Indian Society and Economy.
			Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
			Utilise the opportunities provided by Rural Development Programmes
18.	20MTC08	PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS	Find solution of initial value problems of ODE by Numerical Method.
			Solve Linear and Non-Linear PDE‟s.
			Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation
			Use the basic probability for fitting the Random phenomenon.
			Analyze the random fluctuations of probability distribution and Principles of Least Squares approximations for the given data.
19	20CSC06	BASICS OF DATA STRUCTURES	Identify various data structures, searching & sorting techniques and their applications.
			Describe the linear and non-linear data structures, searching and sorting techniques.
			Apply suitable data structures to solve problems.
			Analyze various searching and sorting techniques.
			Evaluate the linear and non-linear data structures.

SNo	Course Code	Course Name	Course Outcomes Statements
20.	20CHC01	CHEMICAL ENGINEERING THERMODYNAMICS-I	Understand the fundamental concepts of thermodynamics to engineering applications.
			Understand the relation between the measurable nature of P, V, T and the un-measurable nature of H,U,A, G
			Calculate the thermodynamic properties of real gases by using EOS.
			Understand and analyze the various thermodynamic processes involving ideal gases.
			Analyze the power cycles; refrigeration cycles, and liquefaction processes.
			Apply the energy balance equations to Open and Closed systems and also to evaluate the thermodynamic efficiency of nozzles, turbines and compressors.
21.	20CHC02	FLUID MECHANICS	Distinguish different types of fluids, manometers
			Apply Shell balances to illustrate fluid flow phenomena
			Identify the concepts of incompressible flow in pipes, channels and associated frictional losses
			Explain the concept of fluidization and flow through packed beds.
			Choose the types of pumps for different fluids under different conditions such as toxic, acidic, slurry type.
			Identify equipment to be used to measure fluid flow based on their properties
22.	20CHC03	MATERIAL ENERGY BALANCE CALCULATIONS	Convert physico-chemical quantities from one system of units to another and identify basis of calculation
			Solve material balance problems without chemical reactions.
			Solve material balance problems with chemical reactions
			Solve material balance problems with recycle, purge and bypass
			Analyze the ideal and real behavior of gases, vapors and liquids
			Solve energy balance problems with and without chemical reaction
23.	20CHC04	MECHANICAL UNIT OPERATIONS	Decide the transport of solids based on their properties.
			Select equipment for industrial application with respect to size reduction.
			Design equipment for industrial application with respect to separation of solids.
			Decide the necessary equipment to screen different particles based on their properties
			Apply different filtration techniques for industrial application
			Identify the suitable technique for blending and mixing of liquids and solids.
24	20CSC07	Basics of Data Structures Lab	Implement the abstract data type.
			Demonstrate the operations on stacks, queues using arrays and linked lists
			Apply the suitable data structures including stacks, queues to solve problems
			Analyze various searching and sorting techniques.
			Choose proper data structures, sorting and searching techniques to solve real world problems
25	20CHC05	FLUID MECHANICS LAB	Identify variable area flow meters and variable head flow meters
			Explain the fluid flow characteristics.
			Demonstrate the Bernoulli principle
			Analyze the flow of fluids through closed conduits, open channels
			Interpret the characteristics of pumps 6. Analyze the flow in packed beds.

SNo	Course Code	Course Name	Course Outcomes Statements
26.	20CHC06	MECHANICAL UNIT OPERATIONS LAB	Understand mechanical unit operations and their role in process industries.
			Understand the nature of solids, their characterization, handling and the processes involving solids.
			Analyze the performance of size reduction equipment and calculate the power and efficiency requirements.
			Understand the principle, construction and operation of various classification equipment.
			Analyze Solid liquid separation in industrial equipment based on settling, density and centrifugal force.
			Design and operate filtration equipment.
27.	20CHC07	CHEMICAL REACTION ENGINEERING-I	Classify reactions, rate and forms of rate expressions.
			Summarize fundamentals of kinetics and interpret the data including relationships between moles, Concentration, extent of reaction and conversion.
			Explain Batch, CSTR, and PFR performance equations from general material balances for homogeneous and heterogeneous reactions.
			Identify the right reactor among single, multiple, recycle reactors etc
			Determine the effect of temperature on reactor performance for adiabatic and non adiabatic operation.
			Analyze the non ideality of reactors.
28.	20CHC08	CHEMICAL TECHNOLOGY	Estimate the chemical industry growth and opportunities.
			Differentiate between unit operation and unit processes.
			Develop flow diagrams of different processes.
			Classify between Inorganic and Organic processes.
			Design processes based on conditions space time, yield, conversion, recycle methods, temperature and pressure.
			Predict the process limitations and propose a model to overcome the limitations.
29.	20CHC09	HEAT TRANSFER	Distinguish between different types of heat transfer
			Calculate heat transfer coefficients for forced and natural convection
			Analyze and understand the concepts of Heat exchangers
			Analyze the heat transfer phenomena in fluids involving phase changes
			Identify the type of evaporator required for a specific purpose and design it
			Explain the impact of radiation shields and laws of radiation.
30	20CHC10	MASS TRASFER OPERATIONS - I	Apply the concepts of diffusion mass transfer to fluids and solids
			Write the rate equations for mass transfer operations
			Estimate the mass transfer coefficients of mixtures
			Design Absorber/Stripper by equilibrium methods
			Design the cooling tower with the concept of humidification.
			Interpret the drying mechanism by estimating total drying period

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31.	20EGM01	INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES	Understand the making of the Indian Constitution and its features.
			Identify the difference among Right To equality, Right To freedom and Right to Liberty.
			Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
			Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
			Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.
32.	20EEM01	INDIAN TRADITIONAL KNOWELDGE	Understand philosophy of Indian culture
			Distinguish the Indian languages and literature
			Learn the philosophy of ancient, medieval and modern India
			Acquire the information about the fine arts in India
			Know the contribution of scientists of different eras.
33.	20CEM01	ENVIRONMENTAL SCIENCE	Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and affects of over utilisation.
			Understand the concept of ecosystems and realise the importance of interlinking of food chains.
			Contribute for the conservation of bio-diversity.
			Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
			Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
34.	20CHE01	ENERGY ENGINEERING	Classify and explain energy sources
			Summarize the basic principles and fundamentals of non-conventional energy sources
			Summarize the basic principles and fundamentals of conventional energy sources
			Outline the production and future perspectives of bio fuels
			Relate the importance of future energy resources
			Demonstrate the need for energy auditing and conservation
35	20CHE02	FOOD PROCESSING TECHNOLOGY	Understand food demand scenario with respect to world and India 2. 3. 4. 5. 6.
			Explain techniques in food processing
			Design process equipment to achieve the desired quality of food.
			Develop novel food processes that have a minimal effect on food quality
			Select control strategies to maintain food quality
			Apply the scientific method to food science problems

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SNo	Course		Course Outcomes Statements
	Code	Name	
36.	20CHE03	MATERIAL SCIENCE FOR CHEMICAL ENGINEERS	Classify different engineering materials as ferrous and non-ferrous alloys.
			Select materials for design and fabrication of process equipment.
			Understand the significance of mechanical, thermal and optical properties of engineering materials
			Select materials for high and low temperature applications.
			Identify new or alternate materials for development and operation of process industry.
			Characterize material using different experimental techniques.
37.	20CHE04	PULP AND PAPER TECHNOLOGY	Design the operation, maintenance and safety aspects for paper making
			Identify the factors that drive industry trends
			Evaluate different grades of paper and boards based on testing methods
			Select appropriate bleaching technique for required paper quality
			Distinguish the important wood and fiber properties that affect paper quality
			Identify, formulate and solve design problems pertaining to pulp digester
38.	20CHC11	CHEMICAL REACTION ENGINEERIN G LAB	Compare the performance of ideal reactors.
			Develop rate law for use in reactor design based on reaction data from a reactor.
			Find the conversion of reactants for a particular reaction in different reactors.
			Interpret the kinetics of an exothermic reaction.
			Analyze laboratory reactors through residence time distributions.
			Determine mass transfer coefficient of Solid-Liquid and Liquid-Liquid systems.
39.	20CHC12	HEAT TRANSFER LAB	Demonstrate and evaluate heat transfer by conduction in solids for steady state conditions
			Determine thermal conductivity of different materials of varying geometries
			Estimate heat transfer coefficents and determine effectiveness of pin fin for free and forced convection
			Determine surface emissivity of a test plane and Stefan-Boltzmann's constant and compare with theoretical values
			Determine critical heat flux in pool boiling
			Estimate heat transfer coefficents and determine effectiveness of heat exchangers to analyze their performance

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Chemical Engineering Department
Course Outcome Statements for B. Tech (Chemical)-R18

SNo	Course		Course Outcomes Statements
	Code	**Name**	
1.	18MT CO1	MATHEMATICS– I	Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
			Check the series convergence.
			Find the evolutes of the given curves.
			Expand and find extreme values of functions of two variables.
			Understanding the significance of gradient, divergence and curl.
			An ability to solve the problems and interpret in geometrical approach.
2.	18PY C05	PHYSICS	Demonstrate the wave nature of the light and describe the types of lasers and optical fibres and their applications
			Develop the concepts related to electromagnetic behavior
			Demonstrate the important concepts of Quantum Mechanics
3.	18CS C01	Programming for Problem Solving	Identify the computing environments.
			Formulate solutions to problems and represent them using algorithms/ Flowcharts.
			Choose proper control statements and data structures to implement the algorithms.
			Trace the Decompose a problem into modules and use functions to implement the modules programs with test the program solution.
			Develop applications using file I/O.
4.	18EG C01	ENGLISH	The students will understand the nature, process and types of communication and will communicate effectively without barriers.
			The students will write correct sentences and coherent paragraphs.
			The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
			The students will demonstrate advanced writing skills by drafting formal reports.
			The students will apply their reading techniques and analyze reading comprehension passages.
			The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

SNo	Course Code	Course Name	Course Outcomes Statements
5	18PY C08	PHYSICS LABORATORY	Understand the concept of errors and find the ways to minimize the errors.
			Demonstrate interference and diffraction phenomena experimentally.
			Understand the applications of magnetic and dielectric materials.
			Know the working of lasers and optical fibres.
			Distinguish between polarized and unpolarized light.
6	18CS C02	Programming for Problem Solving	Identify and setup program development environment.
			Implement the algorithms using C programming language constructs.
			Identify and rectify the syntax errors and debug program for semantic errors.
			Analyze the results to evaluate the solutionsof the problems.
			Solve problems in amodular approach using functions.
			Implement file operations with simple text data.
7	18ME C02	WORKSHOP/ MANUFACT URING PRACTICE	Fabricate components with their own hands.
			Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
			Assembling different components, student will be able to produce small mechanisms/devices of their interest.
			Gain practical skills of carpentry, tinsmithy, fitting, house wiring
			Gain knowledge of different Engineering Materials and Manufacturing Methods.
			Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application
8	18EG C02	ENGLISH LAB	The students will differentiate the speech sounds in English.
			The students will interact with the software and understand the nuances of pronunciation in English.
			The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
			The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
			The students will speak with clarity and confidence.
			The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.
9	18MT CO3	MATHEMATICS– II	Find the areas, volumes and surface of solids revolution.
			Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
			Able to solve solutions of differential equations with initial and boundary value problems.
			Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
			Real and complex integrals by using Cauchy's theorems.
			Solve physical and engineering problems.

SNo	Course		Course Outcomes Statements
	Code	Name	
10	18CY C01	CHEMISTRY	Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
			Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
			List major chemical reactions that are used in the synthesis of molecules.
			Apply the various methods used in treatment of water for domestic and industrial use.
			Discuss the various Engineering materials & Drug synthesis & their applications.
11.	18CE C01	ENGINEERING MECHANICS	Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
			Determine centroid and moment of inertia for elementary, composite areas and bodies.
			Analyze simple trusses for forces in various members of a truss.
			Solve problem in kinematics and kinetics of particles and rigid bodies.
			Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.
12.	18ME C01	ENGINEERING GRAPHICS AND DESIGN	Introduction to engineering design and its place in society.
			Exposure to the visual aspects of engineering design.
			To become familiar with engineering graphics standards.
			Exposure to solid modelling.
			Exposure to computer-aided geometric design.
			Exposure to creating working drawings.
			Exposure to engineering communication.
13	18EE C01	BASIC ELECTRICAL ENGINEERING	Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
			Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
			Acquire the concepts of principle of operation of Transformers and DC machines.
			Acquire the concepts of principle of operation of DC machines and AC machines.
			Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
			Recognize importance of earthing and methods of earthing and electrical installations.
14	18EE C02	BASIC ELECTRICAL ENGINEERING LAB	Get an exposure to common electrical components and their ratings.
			Make electrical connections by wires of appropriate ratings.
			Understand the circuit analysis techniques.
			Determine the parameters of the given coil.
			Understand the basic characteristics of transformer.
			Understand the basic characteristics of dc and ac machines

SNo	Course Code	Course Name	Course Outcomes Statements
15	18CY C02	CHEMISTRY LAB	Estimate rate constants of reactions from concentration of reactants/ products as a function of time
			Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
			Synthesize a small drug molecule and Identify the organic compounds.
			understand importance of analytical instrumentation for different chemical analysis.
			Perform interdisciplinary research such that the findings benefit the common man.
16.	20MTC08	PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS	Find solution of initial value problems of ODE by Numerical Method.
			Solve Linear and Non-Linear PDE‟s.
			Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
			Use the basic probability for fitting the Random phenomenon.
			Analyze the random fluctuations of probability distribution and Principles of Least Squares approximations for the given data.
17.	20CSC06	BASICS OF DATA STRUCTURES	Identify various data structures, searching & sorting techniques and their applications.
			Describe the linear and non-linear data structures, searching and sorting techniques.
			Apply suitable data structures
			Analyze various searching and sorting techniques.to solve problems.
			Evaluate the linear and non-linear data structures.
18	20CHC01	CHEMICAL ENGINEERING THERMODYN AMICS-I	Understand the fundamental concepts of thermodynamics to engineering applications.
			Understand the relation between the measurable nature of P, V, T and the un-measurable nature of H,U,A, G
			Calculate the thermodynamic properties of real gases by using EOS.
			Understand and analyze the various thermodynamic processes involving ideal gases.
			Analyze the power cycles; refrigeration cycles, and liquefaction processes.
			Apply the energy balance equations to Open and Closed systems and also to evaluate the thermodynamic efficiency of nozzles, turbines and compressors.
19	20CHC02	FLUID MECHANICS	Distinguish different types of fluids, manometers
			Apply Shell balances to illustrate fluid flow phenomena
			Identify the concepts of incompressible flow in pipes, channels and associated frictional losses
			Explain the concept of fluidization and flow through packed beds.
			Choose the types of pumps for different fluids under different conditions such as toxic, acidic, slurry type.
			Identify equipment to be used to measure fluid flow based on their properties

SNo	Course Code	Course Name	Course Outcomes Statements
20	20CHC03	MATERIAL ENERGY BALANCE CALCULATIONS	Convert physico-chemical quantities from one system of units to another and identify basis of calculation
			Solve material balance problems without chemical reactions.
			Solve material balance problems with chemical reactions
			Solve material balance problems with recycle, purge and bypass
			Analyze the ideal and real behavior of gases, vapors and liquids
			Solve energy balance problems with and without chemical reaction
21.	20CHC04	MECHANICAL UNIT OPERATIONS	Decide the transport of solids based on their properties.
			Select equipment for industrial application with respect to size reduction.
			Design equipment for industrial application with respect to separation of solids.
			Decide the necessary equipment to screen different particles based on their properties
			Apply different filtration techniques for industrial application
			Identify the suitable technique for blending and mixing of liquids and solids.
22.	20CSC07	Basics of Data Structures Lab	Implement the abstract data type.
			Demonstrate the operations on stacks, queues using arrays and linked lists
			Apply the suitable data structures including stacks, queues to solve problems
			Analyze various searching and sorting techniques.
			Choose proper data structures, sorting and searching techniques to solve real world problems
23	20CHC05	FLUID MECHANICS LAB	Identify variable area flow meters and variable head flow meters
			Explain the fluid flow characteristics.
			Demonstrate the Bernoulli principle
			Analyze the flow of fluids through closed conduits, open channels
			Interpret the characteristics of pumps 6. Analyze the flow in packed beds.
24	20CHC06	MECHANICAL UNIT OPERATIONS LAB	Understand mechanical unit operations and their role in process industries.
			Understand the nature of solids, their characterization, handling and the processes involving solids.
			Analyze the performance of size reduction equipment and calculate the power and efficiency requirements.
			Understand the principle, construction and operation of various classification equipment.
			Analyze Solid liquid separation in industrial equipment based on settling, density and centrifugal force.
			Design and operate filtration equipment.

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SNo	Course Code	Course Name	Course Outcomes Statements
25	20CHC07	CHEMICAL REACTION ENGINEERING-I	Classify reactions, rate and forms of rate expressions.
			Summarize fundamentals of kinetics and interpret the data including relationships between moles, Concentration, extent of reaction and conversion.
			Explain Batch, CSTR, and PFR performance equations from general material balances for homogeneous and heterogeneous reactions.
			Identify the right reactor among single, multiple, recycle reactors etc
			Determine the effect of temperature on reactor performance for adiabatic and non adiabatic operation.
			Analyze the non ideality of reactors.
26	20CHC08	CHEMICAL TECHNOLOGY	Estimate the chemical industry growth and opportunities.
			Differentiate between unit operation and unit processes.
			Develop flow diagrams of different processes.
			Classify between Inorganic and Organic processes.
			Design processes based on conditions space time, yield, conversion, recycle methods, temperature and pressure.
			Predict the process limitations and propose a model to overcome the limitations
27.	20CHC09	HEAT TRANSFER	Distinguish between different types of heat transfer
			Analyze and understand the concepts of Heat exchangers
			Analyze the heat transfer phenomena in fluids involving phase changes
			Identify the type of evaporator required for a specific purpose and design it
			Explain the impact of radiation shields and laws of radiation Calculate heat transfer coefficients for forced and natural convection.
28	20CHC10	MASS TRASFER OPERATIONS - I	Apply the concepts of diffusion mass transfer to fluids and solids
			Write the rate equations for mass transfer operations
			Estimate the mass transfer coefficients of mixtures
			Design Absorber/Stripper by equilibrium methods
			Design the cooling tower with the concept of humidification.
			Interpret the drying mechanism by estimating total drying period
29	20EGM01	INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES	Understand the making of the Indian Constitution and its features.
			Identify the difference among Right To equality, Right To freedom and Right to Liberty.
			Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
			Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
			Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.

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SNo	Course Code	Course Name	Course Outcomes Statements
30	20EEM01	INDIAN TRADITIONAL KNOWELDGE	Understand philosophy of Indian culture 2. 3. 4. 5.
			Distinguish the Indian languages and literature
			Learn the philosophy of ancient, medieval and modern India
			Acquire the information about the fine arts in India
			Know the contribution of scientists of different eras
31	20CEM01	ENVIRONMENTAL SCIENCE	Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and affects of over utilisation.
			Understand the concept of ecosystems and realise the importance of interlinking of food chains.
			Contribute for the conservation of bio-diversity.
			Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
			Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
32	20CHE01	ENERGY ENGINEERING	Classify and explain energy sources 2. 3. 4. 5. 6.
			Summarize the basic principles and fundamentals of non-conventional energy sources
			Summarize the basic principles and fundamentals of conventional energy sources
			Outline the production and future perspectives of bio fuels
			Relate the importance of future energy resources
			Demonstrate the need for energy auditing and conservation
33	20CHE02	FOOD PROCESSING TECHNOLOGY	Understand food demand scenario with respect to world and India
			Explain techniques in food processing
			Design process equipment to achieve the desired quality of food.
			Develop novel food processes that have a minimal effect on food quality
			Select control strategies to maintain food quality
			Apply the scientific method to food science problems.
34	20CHE03	MATERIAL SCIENCE FOR CHEMICAL ENGINEERS	Classify different engineering materials as ferrous and non-ferrous alloys.
			Select materials for design and fabrication of process equipment.
			Understand the significance of mechanical, thermal and optical properties of engineering materials
			Select materials for high and low temperature applications.
			Identify new or alternate materials for development and operation of process industry.
			Characterize material using different experimental techniques.

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SNo	Course Code	Course Name	Course Outcomes Statements
35	20CHE04	PULP AND PAPER TECHNOLOGY	Design the operation, maintenance and safety aspects for paper making
			Evaluate different grades of paper and boards based on testing methods
			Select appropriate bleaching technique for required paper quality
			Distinguish the important wood and fiber properties that affect paper quality
			Identify, formulate and solve design problems Identify the factors that drive industry trends pertaining to pulp digester
36	20CHC11	CHEMICAL REACTION ENGINEERING LAB	Compare the performance of ideal reactors.
			Develop rate law for use in reactor design based on reaction data from a reactor.
			Find the conversion of reactants for a particular reaction in different reactors.
			Interpret the kinetics of an exothermic reaction.
			Analyze laboratory reactors through residence time distributions.
			Determine mass transfer coefficient of Solid-Liquid and Liquid-Liquid systems.
37	20CHC12	HEAT TRANSFER LAB	Demonstrate and evaluate heat transfer by conduction in solids for steady state conditions
			Determine thermal conductivity of different materials of varying geometries
			Estimate heat transfer coefficents and determine effectiveness of pin fin for free and forced convection
			Determine surface emissivity of a test plane and Stefan-Boltzmann's constant and compare with theoretical values
			Determine critical heat flux in pool boiling
			Estimate heat transfer coefficents and determine effectiveness of heat exchangers to analyze their performance
38	18CH C10	CHEMICAL REACTION ENGINEERING I	Classify reactions, rate and forms of rate expressions.
			Summarize fundamentals of kinetics and interpret the data including relationships between moles, Concentration, extent of reaction and conversion.
			Explain Batch, CSTR, and PFR performance equations from general material balances for homogeneous and heterogeneous reactions.
			Identify the right reactor among single, multiple, recycle reactors etc.
			Apply the concepts of heat effects on reactions.
			Analyze the non ideality of reactors.
39	18CH C11	MASS TRANSFER I	Apply the concepts of diffusion mass transfer to liquids and solids.
			Estimate the mass transfer coefficients.
			Design gas absorber by equilibrium method to find the number of theoretical stages.
			Estimate the number of theoretical stages of distillation column using McCabe- Thiele and PonchanSavarit methods.
			Explain extractive distillation and azeotropic distillation.

SNo	Course Code	Course Name	Course Outcomes Statements
40	18CH C 12	HEAT TRANSFER	Distinguish between different types of heat transfer
			Analyze and understand the concepts of Heat exchangers
			Calculate the rate of heat transfer with and without change of phase
			Identify the type of evaporator required for a specific purpose and design it
			Explain the impact of radiation shields and design aspects of furnaces.
41	18CH C 13	PARTICLE AND FLUID-PARTICLE PROCESSING	Identify and describe fluid-particle systems in terms of their basic physical properties
			Explain size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment.
			Find drag force and terminal settling velocity for single particles.
			Determine pressure drop in fixed and fluidized beds.
			Apply separation techniques sedimentation, flocculation to separate a solid fluid mixtures
			Analyze filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage
42	18CH E 01	WATER CONSERVAT ION AND MANAGEME NT (Core Elective I)	Identify the water storage methods in practice based on available sources and supply.
			Understand the water quality parameters and analysis methods.
			Classify the basic characteristics of water and their testing methods.
			Explain the objectives of water harvesting and recycling methods.
			Make use of water conservation methods at work place, agriculture, service and process industry.
43	18CH E 02	RENEWABLE ENERGY (Core Elective I)	Describe the environmental aspects of non-conventional energy resources compared with various conventional energy systems, their prospects and limitations.
			Explain the use of solar energy and the various components used in the energy production with respect to applications.
			Find out the need of Wind Energy and the various components used in energy generation and know the classifications.
			Understand the concept of Biomass energy resources and their classification, types of biogas Plants applications
			Summarize the knowledge of Ocean energy, tidal energy, Geothermal energy.
			Understand the Fuel cells principles and applications.
44	18CH E 03	EXPERIMENTAL AND ANALYTICAL TECHNIQUES (Core Elective I)	Build basic knowledge of analytical techniques
			Distinguish the applicability of Microscopy techniques
			Identify the suitable spectroscopy methods
			Select the electro-analytical techniques
			Infer the role of different separation techniques

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45	18CH E 04	POLYMER SCIENCE AND TECHNOLOGY (Core Elective II)	Explain the basic concepts of polymers, polymerization techniques and behaviour in polymers
			Distinguish different types of polymerization.
			Determine the molecular weight of polymers by different techniques
			Familiarize with various processing techniques for polymers, rubbers and fibers
			Summarize the manufacturing and characterization of various industrially important polymers
46	18CH E 05	GREEN TECHNOLOGY (Core Elective II)	Describe the principles of green chemistry 2. 3. 4. 5.
			Identify manufacturing processes for waste minimization
			Identify technologies to reduce the level of emissions
			Understand the importance of eco-friendly solvents
			Apply principles of green chemistry to design greener processes
47	18CH E 06	CATALYSIS (Core Elective II)	Explain the basic concepts of catalysis
			Summarize the methods of preparation and characterization of catalysts
			Analyze the role of heat and mass transfer in the catalytic reactor design
			Distinguish the performance of catalytic reactors
			Identify the role of catalysts in the environmental protection
			Explain the commercial aspects of catalytic reactors
48	18CH C16	CHEMICAL REACTION ENGINEERING – II	Indentify and characterize solid catalysts
			Explain the kinetics for solid catalyzed reactions
			Interpret the kinetics of fluid and particle reactions
			Identify regions of mass transfer control and reaction rate control in fluid-fluid reactions
			Apply the concepts to Gas fluid and catalytic reactors
49	18CH C17	MASS TRANSFERS- II	Understand the concept of different mass-transfer operations and their concerned equipment used in the chemical industries.
			Interpret the importance and the role of liquid–liquid extraction and leaching in Separation Process
			Articulate the process of adsorption and the equipment used in chemical industry
			Calculate the enthalpies and interpret psychometric charts and design of cooling towers and drying equipment.
			Distinguish among micro-filtration, ultra-filtration, nano-filtration, and reverse osmosis
50	18CH C 18	PROCESS CONTROL	Characterize and analyze the dynamic behavior of linear systems (First and Second order)
			Build block diagrams for simple chemical processes
			Analyze stability, speed of response, frequency response, of simple feedback control systems
			Analyze and tune process controllers
			Empirically identify process dynamics

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SNo	Course Code	Course Name	Course Outcomes Statements
51	18CH E07	FLUIDIZATION ENGINEERING (Core Elective III)	Determine the minimum fluidization velocity and optimum operating fluidization velocity.
			Design the fluidized bed in terms of pressure drop across the bed
			Construct the distributors, TDH, height, diameter, power consumption of compressor for air.
			Distinguish between boiler and furnaces, methods of starting up.
			Estimate the amount of chemicals required to control the emission like SO_2.
52	18CH E 08	PETROCHEMICAL TECHNOLOGIES (Core Elective III)	Explain the composition, applications and formation theories of crude
			Summarize the refining process of crude oil.
			Classify Ethylene derivatives and summarize their manufacturing processes.
			Outline Propylene and C4 derivatives and explain their manufacture processes.
			Classify higher paraffin derivatives and outline manufacturing processes.
			Identify Aromatic derivatives sources and separation methods for aromatics.
53	18CH E 09	BIOCHEMICAL ENGINEERING (Core Elective III)	Describe the basic structure and function of cells & relate cell function to products and processes useful to man
			Explain classification, growth concepts and various types of interactions in microbes
			Illustrate the significance of enzymes as biocatalysts and immobilized enzymes.
			Identify and explain the basic features of bioreactors
			Describe the principles of the various separation procedures involved in the downstream processing of products
			Summarize the principles of Fermentation technology and products from Industrial biotechnology
54	18CH E10	SUGAR TECHNOLOGY (Core Elective IV)	Apply Principles and skills of work in sugar cane milling, processing and refining in practical settings.
			Determine the composition of different types of sugars by volumetric and gravimetric methods.
			Explain the unit operations for effective processing of cane juice, Batch and continuous methods
			Identify the concepts of quality assurance and control in industry as per Indian regulations and practices.
			Summarize the methods to reclaim by-products.
55	18CH E11	PULP AND PAPER TECHNOLOGY (Core Elective IV)	Design the operation, maintenance and safety aspects for paper making.
			Identify grade paper and boards based on different testing methods.
			Select appropriate bleaching technique for required paper quality.
			Differentiate the important wood and fibre properties that affect paper quality.
			Identify, formulate and solve design problems pertaining to pulp digesters.

SNo	Course		Course Outcomes Statements
	Code	Name	
56	18CH E 12	FOOD TECHNOLOGY (Core Elective IV)	Explain techniques in food processing
			Design process equipment to achieve the desired quality of food.
			Develop novel food processes that have a minimal effect on food quality
			Select control strategies to maintain food quality.
			Apply the scientific method to food science problems
57	18EEO 05	WASTE MANAGEMENT (Open Elective I)	Understand the various processes involved in allied disciplines of engineering
			Infer the regulations of governance in managing the waste
			Distinguish the nature of waste materials concerned to the particular branch of engineering
			Explore the ways and means of disposal of waste material
			Identify the remedies for the disposal of a selected hazardous waste material
58	18ME O04	ENTREPREN EURSHIP (Open Elective I)	Understand the concept and essence of entrepreneurship.
			Identify business opportunities and nature of enterprise.
			Analyze the feasibility of new business plan.
			Apply project management techniques like PERT and CPM for effective planning and execution of Projects
			Use behavioral, leadership and time management aspects in entrepreneurial journey
59	18ME O06	NANO MATERIALS AND TECHNOLOGY (Open Elective I)	Understand the basic concepts, developments and challenges in nanotechnology.
			Describe the methods of evaluating magnetic and electronic properties, microstructure by SPM and atomic force microscopy
			Apply heterogeneous methods and characterization techniques of zero & one dimensional nanostructure
			Evaluate various nano material fabrication techniques.
			Analyze nano materials and nano biomaterials for obtaining solutions to societal problems.
60	18ME O07	INTELLECTUAL PROPERTY RIGHTS (Open Elective I)	Understand the evolution of IP, working of organization's at global level to protect and promote IP
			Familiarize with the patent filing process at national and international level.
			Draw the logical conclusion of research, innovation and patent filing.
			Compare different kinds of IP and their patenting system.
			Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms for protection.
61	18CSO 09	BASICS OF ARTIFICIAL INTELLIGENCE (Open Elective I)	Identify various search strategies to solve problems
			Compare and contrast knowledge representation schemes
			Apply Bayesian Networks and Dempster Shafer theory for reasoning.
			Explain the role of agents and interaction with the environment.
			Determine different learning paradigms
			Explain robotic architectures and expert systems.

SNo	Course		Course Outcomes Statements
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62	18CH C 21	TRANSPORT PHENOMENA	Develop expressions for velocity, temperature and concentration profiles using shell balances
			Identify analogy between momentum, mass and energy transport
			Formulate and solve one-dimensional transport problems by using the conservation equations
			Apply equations of change to solve flow problems
			Understand transport phenomena in turbulent flows
63	18CH C 22	PROCESS TECHNOLOGY AND ECONOMICS	Explain various sources and processes of manufacture of various industrially important chemicals
			Apply unit operations to draw block diagrams/ process flow diagrams of the processes used for manufacture of industrially important chemicals
			Find out energy sources, requirement of raw materials and operating conditions of petrochemicals
			Outline the application of industry relevant fuels
			Apply various economic equations to evaluate project viability
64	18CH C 23	PROCESS INSTRUMEN TATION	Identify instruments required in process industry based on their purpose and function
			Compare the range of operation and working of different temperature measuring instruments
			Interpret the different pressure measuring instruments based on their application
			Select the required flow and level measuring instruments for process industry
			Apply the different methods of composition analysis for industrial analysis
65	18CH E 13	MINERAL PROCESSING TECHNOLOGY (Core Elective V)	Explain the principles governing a range of processes applied in the mineral industry
			Identify typical unit processes and flow-sheets for production of a number of metals
			Apply basic engineering principles to the design of mineral processes
			Develop conceptual designs for simple extraction processes Summarize the operation of beneficiation units for coal and mineral
66	18CH E 14	CORROSION ENGINEERING (Core Elective V)	Explain and predict various corrosion mechanism based on the corrosion theories.
			Distinguish and identify various types of corrosion
			Explain and apply corrosion testing methods
			Identify and apply various corrosion prevention techniques
			Apply modern theories and techniques to predict and prevent corrosion
67	18CH E 15	SCALE-UP METHODS (Core Elective V)	Explain principles of scale-up 2. 3. 4. 5.
			Apply dimensional analysis technique for scale up problems
			Deduce the scale up of mixers and heat exchangers
			Outline the scale up of chemical reactors
			Design the distillation columns and packed towers scale up process

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SNo	Course Code	Course Name	Course Outcomes Statements
68	18ME O 11	MODERN MANUFACTUR ING PROCESSES (Open Elective II)	Understand the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits.
			Apply the concept, architecture and process of digital manufacturing.
			Evaluate real-life scenarios and recommend the appropriate use of 3Dprintingtechnoloy
			Compare various non-traditional machining processes.
			Demonstrate the procedure for the fabrication of micro-Electronic devices.
69	18EE O 02	ENERGY MANAGEMENT SYSTEMS (Open Elective II)	Know the current energy scenario and importance of energy conservation.
			Understand the concepts of energy management.
			Evaluate the performance of existing engineering systems
			Explore the methods of improving energy efficiency in different engineering systems
			Design different energy efficient devices.
70	18ME O 03	RESEARCH METHODOL OGIES (Open Elective II)	Define research problem.
			Review and assess the quality of literature from various sources.
			Understand and develop various research designs.
			Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
			Improve the style and format of writing a report for technical paper/Journal report.
71	18CE O 02	DISASTER MITIGATION AND MANAGEMEN T (Open Elective-II)	Identify and understand the fundamental terminologies in disaster management.
			Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and nonstructural mitigation measures.
			Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.
			Analyze various mechanisms and consequences of human induced disasters.
			Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.
72	18CS O 10	MACHINE LEARNING USING PYTHON (Open Elective II)	Define the basic concepts related to Python and Machine Learning.
			Apply Python packages for data visualization.
			Text and time series data analysis using NLP toolkit.
			Evaluate and interpret the results of the various machine learning techniques.
			Solve real world problems using deep learning Describe the feature engineering methods, regression techniques and classification methods. framework
73	18CH C 24	PROCESS INSTRUMENTATION AND CONTROL LAB	Evaluate the performance of a U-tube manometer
			Assess the discharge efficiency of an orifice meter
			Analyze step response of simple feedback control systems
			Determine frequency response of control systems
			Analyze the behavior of a control system using different modes of control when subjected to a permanent disturbance
			Apply closed loop and open loop techniques to tune process controllers

SNo	Course		Course Outcomes Statements
	Code	Name	
74	18CH C 25	PROCESS MODELING AND SIMULATION LAB	Develop chemical engineering process models based on fundamental laws of mass and energy transfer
			Dynamically simulate and interpret two heated tanks, using MATLAB
			Dynamically simulate and analyze continuous reactors in Series
			Apply ASPEN software for simulation of batch Distillation using MATLAB
			Adapt ASPEN software to perform steady state simulation of valves
			Utilize ASPEN software to design Plug flow reactor
75	18CH C 26	PROJECT: PART I	Summarize the literature review to identify and formulate engineering problems
			Design the experiments/ process /mathematical model by selecting the engineering tools/components for solving the identified problem
			Develop skills of problem solving, interpreting analysis and evaluation
			Illustrate written and oral communication skills through project report and presentation
			Demonstrate the knowledge, skills, attitude and ethics of a professional engineering graduate
			Adapt to the working environment of Industry/Institute by working as a team
76	18CH E 16	CHEMICAL PROCESS SAFETY (Core Elective VI)	Evaluate effect of chemical hazards and risks of toxicants.
			Analyze chemical incidents and possible consequences to plant facilities, workers, and the general public.
			Integrate safety concepts into chemical plant design.
			Analyze fire and explosion hazards.
			Apply ethics during process plant operation
77	18CH E 17	FERTILIZER TECHNOLOGY (Core Elective VI)	Identify the different nutrients and significance of feed stocks for the production of various nitrogenous fertilizers.
			Apply different manufacture methods for various phosphorous fertilizers.
			Explain production methods for potassium and mixed complex fertilizers
			Explain the need, application techniques and uses of new variety of fertilizers.
			Summarize effluent treatment methods and impact of fertilizers on environment.
78	18CH E 18	CHEMICAL PROCESS SYNTHESIS (Core Elective VI)	Analyze alternative processes and equipment
			Synthesize a chemical process flow sheet that would approximate the real process
			Design best process flow sheet for a given product
			Perform economic analysis related to process design
			Evaluate project profitability
79	18 PY O 01	HISTORIES OF SCIENCE AND TECHNOLOGY (Open Elective III)	Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
			Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
			Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
			Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.

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			Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

| S No | Course | | Course Outcomes Statements |
	Code	Name	
80	18ME O 11	MODERN MANUFACTUR ING PROCESSES (Open Elective II)	Understand the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits.
			Apply the concept, architecture and process of digital manufacturing.
			Evaluate real-life scenarios and recommend the appropriate use of 3Dprintingtechnoloy
			Compare various non-traditional machining processes.
			Demonstrate the procedure for the fabrication of micro-Electronic devices.
81	18EE O 02	ENERGY MANAGEMENT SYSTEMS (Open Elective II)	Know the current energy scenario and importance of energy conservation.
			Understand the concepts of energy management.
			Evaluate the performance of existing engineering systems
			Explore the methods of improving energy efficiency in different engineering systems
			Design different energy efficient devices.
82	18ME O 03	RESEARCH METHODOL OGIES (Open Elective II)	Define research problem.
			Review and assess the quality of literature from various sources.
			Understand and develop various research designs.
			Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
			Improve the style and format of writing a report for technical paper/Journal report.
83	18CE O 02	DISASTER MITIGATION AND MANAGEMEN T (Open Elective-II)	Identify and understand the fundamental terminologies in disaster management.
			Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and nonstructural mitigation measures.
			Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.
			Analyze various mechanisms and consequences of human induced disasters.
			Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.
84	18CS O 10	MACHINE LEARNING USING PYTHON (Open Elective II)	Define the basic concepts related to Python and Machine Learning.
			Apply Python packages for data visualization.
			Text and time series data analysis using NLP toolkit.
			Evaluate and interpret the results of the various machine learning techniques.
			Solve real world problems using deep learning Describe the feature engineering methods, regression techniques and classification methods. framework
85	18CH C 24	PROCESS INSTRUMENTATION	Evaluate the performance of a U-tube manometer
			Assess the discharge efficiency of an orifice meter

		AND CONTROL LAB	Analyze step response of simple feedback control systems
			Determine frequency response of control systems
			Analyze the behavior of a control system using different modes of control when subjected to a permanent disturbance
			Apply closed loop and open loop techniques to tune process controllers

SNo	Course		Course Outcomes Statements
	Code	Name	
86	18EG O 02	GENDER SENSITIZATION (Open Elective III)	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
			Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
			Appreciate women's contributions to society historically, culturally and politically.
			Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
			Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.
87	18EG O 01	TECHNICAL WRITING SKILLS (Open Elective III)	Understand the channels of communication and define nature and aspects of Technical communication
			Compare and contrast technical communication to that of general communication while constructing error free sentences applying features of technical writing.
			Analyze data, draw inferences to write Journal articles and conference papers and to compose business letters.
			Evaluate data to draft technical reports and technical proposals
			Design a technical presentation by understanding the nuances of presentation skills and also transfer data from verbal to graphic and vice versa.
88	18CSO 03	IoT AND APPLICATIONS (Open Elective III)	Understand Internet of Things and its hardware and software components.
			Interface I/O devices, sensors & communication module.
			Hypothesizing real time IoT based projects.
			Remotely monitor data and control devices.
			Advance towards research based IoT in the field of biotechnology
89	18CSO 04	BASICS OF DATA SCIENCE USING R (Open Elective III)	Summarize the basics of R and in-built data visualization packages. 2. 3. 4. 5. 6.
			Describe the data analysis using Bayesian and stochastic modeling.
			Relate Gibbs, Z- sampling distributions and compare the binomial, chi-square, wilcoxon and Fisher's exact tests in hypothesis testing.
			Explore the ANOVA in Regression analysis and classify the multivariate data.
			Experiment with the biological data using R tool and apply clustering algorithms to biological data.
			Identify R commands for data manipulation and database technologies for datasets of bioinformatics

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SNo	Code	Name	Course Outcomes Statements
90	18CH C 27	TECHNICAL SEMINAR	Summarize the literature review in order to identify and formulate the engineering problem
			Show preparedness to study independently and apply acquired technical skills to variety of real time problem scenarios
			Develop the required critical thinking ability and analytical skills for evaluation of the selected problem
			Illustrate the written and oral communication skills through a seminar report and presentation
			Demonstrate the required knowledge, skills, attitude and ethics as a professional engineering graduate
			Work in a team by adapting to the working environment

SNo	Course		Course Outcomes Statements
	Code	Name	
91	18CH C 28	PROJECT: PART II	Summarize the literature review to identify and formulate engineering problems
			Design the experiments/ process /mathematical model by selecting the engineering tools/components for solving the identified problem
			Develop skills of problem solving, interpreting analysis and Illustrate written and oral communication skills through project report and presentation evaluation
			Demonstrate the knowledge, skills, attitude and ethics of a professional engineering graduate
			Adapt to the working environment of Industry/Institute by working as a team
92	18CH O 01	NUCLEAR ENGINEERING	Identify the radioactive elements as nuclear fuel.
			Illustrate techniques for enrichment of fuel materials.
			Outline properties and irradiation effects on materials for design of cladding and other incore structures.
			Understand concepts of heat removal, control and safety needs
			Summarize safe handling, storage and reprocessing of spent fuel for operation of nuclear reactors.
93	18CH O 02	PAINT TECHNOLOGY	Identify the suitable paints for domestic and industry purpose
			Study more about specific paint manufactures.
			Outline main ingredients of paints, their manufacture and properties.
			Explain the usage of different types of solvents for both industrial paints and domestic paints and also about paint solid structures (Resins).
			Identify the suitable application methods for powder and liquid paints.
94	18CH O 03	PHARMACEUTICAL TECHNOLOGY	Outline the grades of chemicals, identify the Impurities & limit tests.
			Summarize the preparation, tests, properties of Pharmaceuticals & fine Chemicals.
			Develop flow sheets for Manufacturing Pharmaceuticals.
			Develop flow sheets for Manufacturing Chemicals.
			Demonstrate theoretical knowledge about tablet & Capsule making.
			Know various sterilization methods.

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SNo	Course		Course Outcomes Statements
	Code	**Name**	
1	16MT C01	ENGINEERING MATHEMATICS – I	Solve system of linear equations and identify the Eigen values and Eigen vector in engineering problems
			Expand and find extreme values of functions of two variables
			Trace and interpret curve behavior in physical systems
			Find the areas, volumes and surface of solids revolution
			Use-differential equations to model engineering phenomena such as circuit theory, networks
			An ability to solve the problems and interpret it in geometrical approach
2	16CY C01	ENGINEERING CHEMISTRY	This syllabus gives necessary theoretical aspects required for understanding intricacies of the subject and also gives sufficient exposure to the chemistry aspects in different disciplines of engineering
			The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
			This syllabus imparts a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
3	16PY C02	APPLIED PHYSICS	Understand the advances in laser physics, holography, optical fibers and apply them in engineering & technology
			Explain the importance of wave mechanics and band theory of solids
			Analyze and apply distributions of statistical mechanics for problem solving
			Identify the materials with semiconducting and superconducting
			Understand the role of novel materials and their characterization techniques in engineering and technology properties for engineering applications
4	16CS C01	PROGRAMMING AND PROBLEM SOLVING	Develop algorithms for scientific problems. 2. 3. 4. 5. 6.
			Explore algorithmic approaches to problem solving.
			Understand the components of computing systems.
			Choose data types and structure to solve mathematical problem.
			Develop modular programs using control structure, arrays and structures.
			Write programs to solve real world problems using structured features.
6	16ME C01	ELEMENTS OF MECHANICAL ENGINEERING	Select the material depending upon requirement.
			Evaluate performance of Petrol & Diesel engines.
			Demonstrate his/her knowledge in preparing process chart for various machining operations
			Estimate the power required for various power transmitting devices like belt and gear trains.
			Become a successful entrepreneur after studying principles of management.
			Apply various quality control techniques after studying principles of industrial engineering.

SNo	Course		Course Outcomes Statements
	Code	Name	
7	16EC C01	ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING	Familiar with the basic electronic devices and simple circuits
			Work with Boolean algebra principles, build the simple combinational and sequential circuits
			Appreciate the need for modulation, filtering and multiplexing
			Understand the working principles of a few communication systems
			Familiar to the selected applications
8	16CE C03	PROFESSIONAL ETHICS AND HUMAN VALUES	Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
			Students turn themselves into champions of their lives.
			Students take things positively, convert everything into happiness and contribute for the happiness of others.
			Students become potential sources for contributing to the development of the society around them and institutions/ organisations they work in.
			Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas
9	16PY C04	APPLIED PHYSICS LABORATORY	Understand the various applications of semiconductor devices and their suitability in engineering
			Demonstrate the working of lasers and optical fibers and their applications in the field of communication
			Analyze the electrical properties of a given solid based on its energy band gap
			Verify the resistance and thermoelectric power properties with temperature variation
			Demonstrate the concept of electron and its charge experimentally
10	16CY C03	ENGINEERING CHEMISTRY LABORATORY	This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
			The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
11	16 MT C02	ENGINEERING MATHEMATICS – II	Solve the solutions of Differential Equations which arise in electrical circuits, vibrations and other linear systems.
			Able to solve solutions of differential equations with initial and boundary value problems.
			Evaluating definite integrals using Beta, Gamma functions.
			Understating the significance of gradient, divergent and Curl.
			Use Greens, Gauss and Stoke"s theorems to find the surface and volume integrals.
			Able to solve and analyse the Engineering problems.
12	16PY C01	ENGINEERING PHYSICS	Describe the types of oscillations and analyze them
			Demonstrate the wave nature of the light
			Develop the concepts related to electromagnetic behavior
			Identify the various crystal systems and defects
			Explain the origin of magnetism and dielectric polarization and applications of these materials in the field of engineering & technology

SNo	Course		Course Outcomes Statements
	Code	Name	
13	16CY C02	APPLIED CHEMISTRY	At the end of the course, the students will be familiar with the fundamentals of water technology; corrosion and its control; applications of polymers in domestic and engineering areas; nano materials and their applications.
			The engineer who has the above background can effectively manage the materials in his designing applications and for discovering & improving the systems for various uses in industry, agriculture, health care, technology, telecommunications and electronics.
			The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the Study of nano related materials helps to update the knowledge necessary to launch into the demands of the world.common man.
14	16EE C01	ELEMENTS OF ELECTRICAL ENGINEERING	Acquire the knowledge of basic concepts of electrical circuits such as Ohm‟s law, Kirchhorff‟s laws etc.
			Acquire the knowledge of basic Faraday‟s laws of electromagnetic induction.
			Acquire the knowledge to solve the problem of AC circuits.
			Acquire the knowledge of specifications of batteries, types of cells and sources of renewable energy.
			Acquire the knowledge of electrical wiring and cables and their types and electrical equipment and their specification.
			Acquire the knowledge of safety precautions in handling electrical appliances, importance of grounding and methods of earthing.
15	16CE C01	ENGINEERING MECHANICS	Solve problems dealing with forces in planar force systems
			Draw free body diagrams to analyze the forces in the given structure
			Understand the concept of moments and couples in plane systems.
			Understand the mechanism of friction and can solve friction problems
			Determine the centroid of plane areas and centers of gravity of bodies using integration methods
			Determine moments of inertia, product of inertia for all areas and mass moments of inertia for bodies
16	16EG C01	PROFESSIONAL COMMUNICATION IN ENGLISH	Understand the nature, process and types of communication and will communicate effectively without barriers.
			Understand the nuances of listening and will learn to make notes
			Read different texts, comprehend and draw inferences and conclusions.
			Write effective paragraphs, letters and reports
			Critically analyze texts and write book reviews
17	16CE C02	ENVIRONMENTAL STUDIES	To understand the scope and importance of environmental studies, identify the natural resources and ecosystems and contribute for their conservation.
			To understand the ecological services of biodiversity and contribute for their conservation.
			To develop skills to solve the problems of environmental pollution and contribute for the framing of legislation for protection To relate the social issues and the environment and contribute for the sustainable development. of environment.
			To understand the essence of the ethical values of the environment for conserving depletable resources and pollution control.

SNo	Course Code	Course Name	Course Outcomes Statements
18	16ME C02	ENGINEERING GRAPHICS	To understand theory of projections
			Ability to improve visualization skills
			Ability to sketch Engineering Objects
19	16PY C03	ENGINEERING PHYSICS LABORATORY	Understand the concept of errors and find the ways to minimize the errors
			Demonstrate interference and diffraction phenomena experimentally
			Distinguish between polarized and unpolarized light
			Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering
			Understand the suitability of dielectric materials in engineering applications
20	16CY C04	APPLIED CHEMISTRY LABORATORY	This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
			The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
21	16EG C02	PROFESSIONAL COMMUNICATION LABORATORY	The students will understand the speech sounds in English and the nuances of pronunciation.
			The students will understand tone, intonation and rhythm and apply stress correctly.
			The students will be able to participate in group discussions with clarity and confidence.
			The students will speak confidently on stage with appropriate body language.
			The students will debate on various issues and learn to work in teams.
22	16MT C05	ENGINEERING MATHEMATICS-III	Expand functions in the given intervals.
			Solve linear and non linear PDEs.
			Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
			Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
			Expand functions by using Taylor's and Laurent's series.
			Solve Real and Complex integrals by using Cauchy Theorems.
23	16CH C01	CHEMICAL TECHNOLOGY	Estimate the chemical industry growth and opportunities.
			Differentiate between unit operation and unit processes.
			Develop flowdiagrams of different processes.
			Classify between inorganic and organic processes.
			Design processes based on conditions, space time, yield, conversion, recycle methods, temperature, pressure.
			Predict the process limitations and propose a model to overcome the limitations.
24	16CH C02	FLUID MECHANICS	Differentiate different types of fluids.
			Identify equipments to be used to measure fluid flow based on their properties.
			Design the piping for flow of fluids under different conditions useful for industry.
			Apply the phenomena of fluidization applications in petroleum, chemical and allied industries.
			Calculate the energy losses during the transport of fluids through pipes.
			Deicide the types of pumps for different fluids under different conditions such as toxic, acidic, slurry type.

SNo	Course Code	Course Name	Course Outcomes Statements
25	16CH C03	MATERIAL AND ENERGY BALANCES	Differentiate between mass and volume relations.
			Develop material balance equations for the processes involving unit operations.
			Write material balance equations for the process involving chemical reactions.
			Develop material balance equations for recycle and bypass operations.
			write energy balance equations for chemical processes.
			Apply this knowledge to solve advanced chemical engineering problems.
26	16 CY CO7	PHYSICAL CHEMISTRY	Describe the operation of electrochemical system for the production of electric energy.
			Apply fundamental concepts of dilute solutions to engineering problems.
			Identify the kinetics of a reaction and offer reaction mechanisms.
			Design a new catalytic material.
			Operate instruments for studying the structure of chemical compounds.
27	16MB C01	ENGINEERING ECONOMICS AND ACCOUNTANCY	apply fundamental knowledge of Managerial economics concepts and tools.
			understand various aspects of demand analysis and forecasting.
			understand price determination for different markets.
			study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
			analyze different opportunities and come out with best feasible capital investment decisions.
			apply accountancy concepts and conventions, Final accounts and financial analysis.
28	16CY C08	PHYSICAL CHEMISTRY LAB	Analyze the efficient management of any industrial processes.
			Ability to understand, explain and select instrumental techniques for analysis.
			Demonstrate chemical and analytical methods.
			Apply chemical principles in science and technology as well as on multidisciplinary design teams.
			Ability to analyze and interpret the experimental data.
			Gain ability in handling experiments and design new experiments.
29	16ME C13	MECHANICAL ENGINEERING LAB	Evaluate the properties of material by tensile testing and performance of diesel engine.
			Produce the parts by simple turning process.
			Understand the concepts of welding, casting (moulding) process.
30	16EE C05	ELECTRICAL ENGINEERING LAB	Find out the resistance of the given resistor.
			Understand the voltage division and current division rules.
			Determine the parameters of the given coil.
			Measure the power factor of a coil using different methods.
31	16CH C05	CHEMICAL ENGINEERING THERMODYNAMICS – I	use the fundamentals and differentiate between relations of measurable nature of P, V, T and the un-measurable nature of H, U, A, G.
			estimate thermodynamic properties of real gases using equations of state, correlations and tables.
			analyze processes involving ideal gases, such as isothermal, isobaric, isentropic, cyclic.

			reiterate the first and second laws of thermodynamics and apply their practical implications in engineering design.
			apply energy balances to open and closed systems and to evaluate the thermodynamic efficiency of nozzles, compressors, turbines.
			analyze steam power cycles; refrigeration cycles and liquefaction and calculate relevant system efficiencies for the processes.

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32	16CH C06	CHEMICAL REACTION ENGINEERING – I	Derive performance equations of batch, and continuous reactors from general material balances.
			Analyse reactor performance for homogeneous and heterogeneous reactions.
			Apply the concepts of heat effects on reactions.
			analyse multiple Design different types of chemical reactors for batch and continuous operation like CSTR and Tubular.
			Determine reactor behavior for non-ideal flow.
33	16CH C07	MATERIAL SCIENCE FOR CHEMICAL ENGINEERS	Apply the basic fundamentals of engineering for material selection.
			developTime–Temperature–Transformation (T-T-T) relations of materials.
			apply phase equilibrium diagrams for heat treatment of steels.
			select the right materials for design and fabrication of process equipment.
			select materials for high and low temperature applications.
			identify new or alternate materials for development and operation of process industry.
34	16CH C08	MECHANICAL UNIT OPERATIONS	decide the transport of solids based on their properties.
			select equipment for industrial application with respect to size reduction.
			design equipment for industrial application with respect to separation of solids.
			decide the necessary equipment to screen different particles based on their properties.
			Apply the different filtration techniques for industrial application.
			identify the suitable technique for blends and mixing of liquids and solids.
35	16CH C09	PROCESS HEAT TRANSFER	Distinguish between different types of heat transfer
			Analyze the concepts of heat exchanger
			Calculate the rate of heat transfer with and without change of phase.
			Decide the type of evaporator required for a specific purpose.
			Identify the effect of combined heat transfer by conduction, convection and radiation.
36	16CY E01	ADVANCED ORGANIC CHEMISTRY	identify organic functional groups using chemical processes.
			classify the types of isomerism in various organic molecules.
			illustrate the mechanism of a reaction using oxidizing and reducing agents.
			design separation techniques commonly used in research industries.
			analyze the molecules using data from spectroscopic techniques.
37	16MT E01	NUMERICAL TECHNIQUES AND STATISTICAL	Solve the non-linear equations for generating the roots.
			Solve the first order ordinary differential equations using numerical techniques.

		METHODS	Analyse the probability function with the help of statistical averages.
			Fit the probability distribution (discrete and continuous) for the random phenomenon.
			Formulate the statistical hypothesis for the statistical data.
			Interpret the random behaviour of physical data.

SNo	Course		Course Outcomes Statements
	Code	Name	
38	16CH E01	FERTILIZER TECHNOLOGY	Identify the different nutrients and significance of feed stocks for the production of fertilizers.
			Identify methods for the production of various nitrogenous fertilizers.
			Apply different manufacture methods for various phosphorous fertilizers.
			Production methods for potassium and mixed complex fertilizers
			Differentiate the need, application techniques and uses of new variety of fertilizers.
			Design effluent treatment methods and impact of fertilizers on environment.
39	16EG CO3	SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT LAB	Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
			Write resumes, prepare and face interviews confidently.
			Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
			Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
			To do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.
40	16CH C 12	CHEMICAL REACTION ENGINEERING - II	Predict conversions in non-ideal reactors using various models.
			Understand phenomena for catalytic activity and determine various properties of catalysts.
			Describe the steps in a catalytic mechanism, derive a rate law theoretically and the effects of pore diffusion.
			Derive rate equations and other kinetics parameters of catalytic reactions from experimental data.
			Analyze performance of catalysts when deactivating.
			Understand the concepts of fluid-fluid and fluid particle reaction kinetics.
41	16CH C 12	MASS TRANSFER OPERATIONS – I	Write rate equations for any mass transfer operations.
			Calculate the mass transfer coefficients using different corelations.
			Calculate the resistances offered by gas-phase and liquid phase.
			Design Absorber/Stripper by equilibrium method to find the number of theoretical Stages.
			Design Cooling towers(able to find the height of packed bed required).
			To find the total time required in in-direct heating tray dryers.
42	16CH C 13	PROCESS INSTRUMENTATION	Identify and select instruments based on their purpose and function as required in process industry.
			Select temperature measuring instrument based on the range of operation.
			Select pressure measuring instrument based on their application.

			Identify and apply different methods of composition analysis in process industry.
			Select flow measuring instrument based on type of fluids.
			Select level measuring instrument based on their need in process industry.

SNo	Course		Course Outcomes Statements
	Code	Name	
43	16 CH E 02	SURFACE COATING TECHNOLOGY (ELECTIVE –II)	To identify the suitable paints for domestic and Industries.
			To study more about specific paint manufactures.
			To know main ingredients of paints,their manufacturers and properties.
			To come across the usage of different types of solvents for both industrial paints and domestic paints and also about paint solid structures (Resins).
			To identify the suitable application methods for powder and liquid paints and also to develop paint testing Lab.
			The student can differentiate between normal paints and special paints and their applications and uses.
44	16CH E 03	TECHNOLOGY OF VEGETABLE OILS AND FATS (ELECTIVE –II)	Analyze the various properties of fats and oils to determine their use in food, soap and other industries
			Identify unit operations involved in extraction of oils
			Know the methods of purification of oils and fats
			Know about the degradation occurring during storage of oils and fats and prevention methods
			Understand the mechanism Hydrogenations of oils
			Know the techniques involved in the preparation of soaps
45	16CH E 04	CORROSION ENGINEERING (ELECTIVE III)	Identity the type of corrosion.
			Correlate the damage with the cause of corrosion.
			Identify the correct method of testing any corrosion.
			Select the appropriate preventive method to avoid corrosion.
			Select the significant coating for corrosion prevention.
			Apply modern method of corrosion measurement.
46	16CH E 05	MINERAL PROCESSING TECHNOLOGY ELECTIVE - III	Understand the principles governing a range of processes applied in the mineral industry.
			Describe typical unit processes and flow-sheets for production of a number of metals.
			Apply basic engineering principles to the design of mineral processes.
			Produce conceptual designs for simple extraction processes.
			Understand the operation of beneficiation units for coal and mineral.
47	16CH C 14	MECHANICAL UNIT OPERATIONS LAB	Understand mechanical unit operations and their role in chemical engineering industries.
			Understand the nature of solids, their characterization, handling and the processes involving solids.
			Analyze the performance of size reduction equipment and calculate the power and efficiency requirements.
			Understand the solid-fluid separation process and operation.

SNo	Course Code	Course Name	Course Outcomes Statements
48	16CH C 15	PROCESS HEAT TRANSFER LABORATORY	At the end of the semester the students will be in a position to know the principles involved in different modes of heat transfer.
			They will be in a position to design and analyze heat exchangers such as shell and tube, extended surface exchangers etc.
			Thermal conductivity of insulating materials can be found by them involving conduction mode. Emissivity of given surfaces will be found based on radiation phenomenon.
49	16CH E 06	SURFACE COATING TECHNOLOGY LAB (ELECTIVE – II LAB)	Students are able to understand the importance of Organic surface coatings.
			Students are able to perform different paint tests and analyze the quality of paints.
			Student can differentiate between lacquers, varnishes and paints.
50	16CH E 07	TECHNOLOGY OF VEGETABLE OILS AND FATS LABORATORY (ELECTIVE -II)	to analyze the different oil samples
			to carry out various techniques used to determine quality oils and fats.
51	16CH C 16	BIO CHEMICAL ENGINEERING	Describe the basic structure and function of cells & Relate cell function to products and processes useful to man
			Understand classification, growth concepts and various types of interactions in microbes
			Significance of enzymes as biocatalysts.
			Identify and explain the basic features of bioreactors
			Describe the principles of the various separation procedures involved in the downstream processing of products
			Understand various other aspects of bioprocess technology viz, fermentation types, media formulation, environmental biotechnology and commercial aspects.
52	16CH C 17	CHEMICAL ENGINEERING THERMODYNAMICS – II	Calculate the Partial Properties and Fugacity coefficients using various equations.
			Calculate Fugacity and Fugacity Coefficients for miscible binary Mixtures.
			Calculate and determine the activity coefficients by various models.
			Calculate the Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-XY for miscible binary mixtures using various models.
			Generate the Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-XY for miscible binary mixtures using various models. Calculate and determine equilibrium constant and composition of product mixture at given temperature and pressure.
53	16CH C 18	CHEMICAL PROCESS SAFETY	Evaluate effect of chemical hazards and risks of toxicants.
			Analyze chemical incidents and possible consequences to plant facilities, workers, and the general public.
			Apply the technique of safe process design.
			Analyze fire and explosion hazards
			Integrate safety concepts into chemical plant design.
			Follow the ethics during process plant operation.

SNo	Course Code	Course Name	Course Outcomes Statements
54	16CH C 19	PROCESS DYNAMICS AND CONTROL	Characterize and analyze the dynamic behavior of linear systems (1st and 2nd order)
			Understand the importance of various modes of control
			Construct block diagrams for simple chemical processes
			Analyze stability of simple feedback control systems
			Analyze and tune process controllers to achieve desired performance
			Empirically identify process dynamics
55	16CH C 20	PROCESS MODELING SIMULATION AND OPTIMIZATION	formulate a process model by applying fundamental laws of mass and energy balance.
			formulate linear and non-linear process models for chemical processes and apply numerical methods and MATLAB codes to solve them.
			formulate ODE process models and solve by numerical methods and MATLAB coding.
			fit polynomial functions as process models and solve by regression analysis and MATLAB coding.
			optimize using different elimination methods of non-linear programming.
			design and simulate chemical processes.
57	16CH E 08	ENERGY ENGINEERING (ELECTIVE IV)	The significance and classification of energy sources.
			The basic principles and fundamentals of conventional energy sources
			The basics and applications of various non-conventional energy sources.
			The production and future perspectives of bio fuels
			The significance of future energy resources
			The importance of energy auditing and conservation
58	16CH E 09	FLUIDIZATION ENGINEERING (ELECTIVE IV)	Calculate the minimum fluidization velocity and optimum operating fluidization velocity.
			Design the cooling tube length for required heat transfer area.
			Design the fluidized bed in terms of pressure drop across the bed.
			Design the distributors, TDH, height, diameter, power consumption of compressor for air.
			Distinguish between boiler and furnaces, methods of starting up.
			Calculate the amount of chemicals required to control the emission like SO2.
59	16CH E 10	PHARMACEUTICAL TECHNOLOGY (ELECTIVE IV)	Get a know how about the grades, Identify the Impurities & limit tests.
			Prepare & test the Properties of Pharmaceuticals & fine Chemicals.
			Draw flow sheets for Manufacturing Pharmaceuticals.
			Draw flow sheets for Manufacturing Chemicals.
			Have a theoretical knowledge about tablet & Capsule making.
			Know various sterilization methods.
60	16CH C 21	CHEMICAL REACTION ENGINEERING LABORATORY	Find rate equations in batch reactor, mixed flow reactor, PFR, packed bed Reactor.
			understand the concept of reaction and mass transfer in a liquid – liquid and solid-liquid system.
			Predict conversion in adiabatic reactor.
			Determine the extent of non –ideality in tubular reactor.

SNo	Course		Course Outcomes Statements
	Code	Name	
61	16CH C 22	PROCESS DYNAMICS AND CONTROL LABORATORY	Evaluate the step response and frequency response of first order systems
			Identify the difference between closed loop and open loop operations
			Choose the controller mode for a particular requirement in the system
			Determine the characteristics of a second order under damped system
			Determine the controller parameters using tuning rules
			Analyze the stability of a system using Frequency response (Bode Plots)
62	16CH C 23	PROCESS MODELING SIMULATION LABORATORY	Develop and solve ODE for chemical processes and apply numerical methods to solve them using MATLAB.
			Develop and solve linear equations and apply numerical methods to solve them using MATLAB.
			develop and solve non-linear equations and apply numerical methods to solve them using MATLAB.
			Fit polynomial functions to given data and solve by regression analysis using MATLAB.
			Solve the process models developed for open-loop simulation of selected unit operations in chemical engineering using MATLAB.
63	16CH C 24	MASS TRANSFER OPERATIONS – II	Differentiate the application of various types of distillation processes.
			Design and estimate the number of theoretical stages of distillation column using McCabe- Thiele method and Ponchan-Savarit method.
			Design and estimate the number of theoretical stages for Liquid-Liquid extraction.
			Design and estimate the number of theoretical stages for Solid-Liquid extraction.
			Design and estimate the number of theoretical stages for Adsorber.
64	16CH C 25	PETRO CHEMICAL ENGINEERING	Grade the crude oil, its composition and applications based on formation theories.
			Know refining process of crude oil.
			Apply the techniques of catalytic and non-catalytic cracking methods.
			Design the manufacture of derivative products.
			Design the safety and pollution control techniques in petroleum refining industries
65	16CH C 26	PROCESS EQUIPMENT DESIGN	Identify the design needs for process equipment based on operating conditions of chemical plant operation.
			Design flanges and nozzles and to select the right component parts for any process vessel
			Design process equipments like storage vessels, reactors.
			Design continuous distillation for multi component system
			Design shell and tube heat exchanger (1-2)
66	16CH C 27	TRANSPORT PHENOMENA	Apply the first principles to solve various chemical engineering problems.
			Compare various flow phenomena
			Develop expressions for steady state velocity, temperature and concentration profiles using shell balance method
			Apply equations of change to solve flow problems.
			Develop expressions for unsteady state isothermal and nonisothermal flows

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SNo	Code	Name	Course Outcomes Statements
67	16CH E 11	POLYMER TECHNOLOGY (CORE ELECTIVE V)	Familiarize the polymers, polymerization techniques and behavior in polymers
			Understand the different types of polymerization.
			Illustrate the different techniques used to determine the molecular weight of polymers
			Impart knowledge on various testing methods and characterization of polymers
			Familiarize the various polymer processing techniques for polymers, rubbers and fibers
68	16CH E 12	PULP AND PAPER TECHNOLOGY (CORE ELECTIVE V)	Design the operation, maintenance and safety aspects for paper making.
			Identify the factors that drive industry trends.
			Grade paper and boards based on different testing methods.
			Select appropriate bleaching technique for required paper quality.
			Differentiate the important wood and fiber properties that affect paper quality.
69	16CH E 13	POLLUTION CONTROL IN PROCESS INDUSTRIES (CORE ELECTIVE V)	Differentiate the types of wastes generated in an industry, their effects on living and non-living things
			Understand the effect of climate changes, atmospheric dispersion of air pollutants, and operating principles.
			Working principles of particulate control devices.
			Quantify industrial wastewater and its treatment.
			Analyze the hazardous and nonhazardous solid wastes and select the treatment and disposal methods.
70	16CE O 02	DISASTER MITIGATION AND MANAGEMENT (OPEN ELECTIVE I)	Ability to analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
			Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
			Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
			To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
			Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management
71	16ME O 01	ENTREPRENEURSHIP (OPEN ELECTIVE I)	Identify opportunities and deciding nature of industry
			Brainstorm ideas for new and innovative products or services
			Analyze the feasibility of a new business plan and preparation of Business plan
			Use project management techniques like PERT and CPM
			Analyze behavioural aspects and use time management matrix

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SNo	Course Code	Course Name	Course Outcomes Statements
72	16ME O 04	INTELLECTUAL PROPERTY RIGHTS (OPEN ELECTIVE I)	Will respect intellectual property of others
			Learn the art of understanding IPR
			Develop the capability of searching the stage of innovations.
			Will be capable of filing a patent document independently.
			Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.
73	16EG O 01	TECHNICAL WRITING SKILLS (OPEN ELECTIVE I)	Communicate effectively, without barriers and understand aspects of technical communication.
			Differentiate between general writing and technical writing and write error free sentences using technology specific words
			Apply techniques of writing in business correspondence and in writing articles.
			Draft technical reports and technical proposals.
			Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.
74	16CH C 31	PLANT DESIGN AND ECONOMICS	Calculate the time value of money and depreciation.
			Estimate fixed and working capitals and operating costs for process plants.
			Evaluate the profitability of process industry projects using measures such as ROI, NPV and DCF
			Identity and apply the selection criteria for design of flow sheets, equipment and material.
			Design the piping specifications as per standards.
75	16CH E 14	MEMBRANE SEPARATION TECHNOLOGY (CORE ELECTIVE VI)	Understand different types of membrane processes
			Identify a membrane process for a specific application
			Understand the types and preparation of membranes
			Calculate performance factors for various membrane processes
			Write design equations for simple membrane modules
76	16CH E 15	SUGAR TECHNOLOGY (CORE ELECTIVE VI)	Principles and skills of work in sugar cane milling, processing and refining in practical settings.
			Analyze the composition of different types of sugars by volumetric and gravimetric determination.
			Different unit operations for effective processing of cane juice.
			Batch and continuous methods for an efficient operation of sugar industry.
			Concepts of quality assurance and control in industry as per Indian regulations and practices.
77	16CH E 16	FOOD TECHNOLOGY (CORE ELECTIVE VI)	Explain techniques in food processing
			Design process equipment to achieve the desired quality of food.
			Develop novel food processes that have a minimal effect on food quality
			Select control strategies to maintain food quality
			Apply the scientific method to food science problems
78	16ME O 05	NANO MATERIALS AND TECHNOLOGY (OPEN ELECTIVE II)	Understand the developments and challenges in nano technology
			Understand magnetic and electronic properties and its microstructure
			Learn synthesis and characterization techniques of Zero and One dimensional Nano structures and their applications
			Study various Nano Material Fabrication Techniques
			Understand the applications of special nano materials and nano bio materials

SNo	Course		Course Outcomes Statements
	Code	Name	
79	16CS O 03	Iot AND APPLICATIO NS (OPEN ELECTIVE II)	Understand Internet of Things and its hardware and software components.
			Interface I/O devices, sensors & communication module.
			Remotely monitor data and control devices.
			Develop real time IOT based projects.
			Advance towards research based IOT
80	16PY O 01	HISTORY OF SCIENCE AND TECHNOLOGY (OPEN ELECTIVE II)	Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
			Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
			Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
			Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
			Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.
81	16EG O 02	GENDER SENSITIZATION (OPEN ELECTIVE II)	Develop a better understanding of important issues related to what gender is in contemporary India.
			Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
			Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
			Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
			Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.