



**Priyadarshini College of Engineering,
Nagpur**
Department of Chemical Engineering
Session 2023-2024
CO-PO-PSO Statements



Third Semester B.Tech. Chemical Engineering (CBCS)

Subject Name:	Material & Energy Balance Computations (Theory)	Subject Code:	CE - PCC -301 T(BCE)
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COs	Statements
CO1	Analyze the fundamental principles, SI units, and conversion techniques relevant to performing calculations in chemical processes.
CO2	Apply knowledge of gas laws, volume alterations, humidity, saturation, solubility, and crystallization in practical scenarios.
CO3	Execute material and energy balances on chemical processes/equipment, both with and without reactions.
CO4	Apply the principles of energy conservation to develop and evaluate energy balances for chemical reactions occurring within processes and equipment.
CO5	Illustrate energy balances on chemical processes/equipment, addressing chemical reactions, heat, and combustion challenges

Subject Name:	Particle & Fluid Particle Processing	Subject Code:	CE - PCC -302T (BCE)
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COs	Statements
CO1	Analyze solid particles and understand how fluid mechanics and mechanical operations impact chemical engineering processes.
CO2	Analyze the principles of size reduction in crushing and screening processes, evaluating the role of different equipment for achieving desired particle size distributions.
CO3	Design efficient systems for handling and transporting solid materials and suspensions, considering factors like flow properties and potential challenges.
CO4	Demonstrate proficiency in the separation of solids from fluids through sedimentation, encompassing fundamental principles, operations, and equipment.
CO5	Apply separation methods for solids and fluids through Filtration, flotation, and classification, demonstrating understanding of fundamental principles, operations, and pertinent equipment.



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Subject Name:	Thermodynamics II	Subject Code:	CE - PCC - 303T (BCE)
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COs	Statements
CO1	Recognize the laws and rules of thermodynamics, equilibrium and phase rule.
CO2	Identify various thermodynamic properties and relationships, and coefficients of species and their properties.
CO3	Recognized liquid phase properties from VLE, models for excess Gibbs energy, heat effects, and property change on mixing.
CO4	Execute different Equilibria, equilibrium criteria, evaluation of equilibrium constant, and equilibrium conversion at different conditions.
CO5	Describe the molecular basis of thermodynamic phenomena, such as phase transitions and chemical reactions.

Subject Name:	Material Science	Subject Code:	CE -GES-304 T (BGE)
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COs	Statements
CO1	Evaluate diverse atomic bonding, thermal expansion, elastic modulus, and material melting points, emphasizing the significance of materials selection in design.
CO2	Analyze the relationship between atomic packing, crystal structures (Miller Indices & close-packed), and material properties (ionic solids, glass, & polymers).
CO3	Analyze various imperfections, impurities, dislocations, defects, and stacking faults in materials.
CO4	Examine the distinct structures and strength characteristics of materials, as well as the strain behavior of metals, ceramics, and polymers.
CO5	Evaluate the influence of material structure (amorphous vs. nano-composite) on environmental degradation processes.



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Subject Name:	Maths –III	Subject Code:	CE-BS-305 T (BGE)
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COs	Statements
CO1	Represent the solution of differential equations in the form of series.
CO2	Solve Laplace transform and inverse Laplace transform of various functions involved in engineering field.
CO3	Apply Laplace transform to solve Ordinary and Partial Differential equations as well as to evaluate the integral equations & solve hyperbolic, Parabolic, elliptical PDE's using various Numerical methods and apply these methods to solve various engineering problems.
CO4	Apply Fourier Transform to Solve Integral Equations.
CO5	Evaluate the integration of function of complex variable. Also, able to transform the function from one plane to another

Subject Name:	Elementary Molecular Approach	Subject Code:	CE -BS -306 T (BGE)
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COs	Statements
CO1	Apply solution chemistry principles to analyze and solve real-world problems.
CO2	Illustrate phase diagrams for diverse solid systems and evaluate their metallurgical implications.
CO3	Design macromolecules with tailored properties for novel engineering applications.
CO4	Apply nuclear spin resonance principles to analyze and determine the structures of unknown compounds.
CO5	Analyze the fundamentals of nuclear spin resonance spectroscopy and apply this understanding in the structure elucidation of chemical compounds.

Subject Name:	Material Science Laboratory	Subject Code:	CE -BS-307 P (BGE)
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Course Outcome

CO1	Analyze the structure and properties of materials
CO2	Characterize the mechanical behavior of materials
CO3	Differentiate between material types and their properties
CO4	Apply material science principles to practical applications



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Subject Name:	Elementary Molecular Approach Laboratory	Subject Code:	CE -BS-308 P (BGE)
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CO1	To acquire practical knowledge on the basic chemistry principles for apply in chemical engineering.
CO2	To acquire training in accurate and precise data collection
CO3	To acquire practical knowledge of the phase diagrams and its application in metallurgy
CO4	To acquire practical knowledge of analytical techniques like conductometric and spectroscopic techniques and solvent extraction process to deal with practical problems.

Subject Name:	Particle & Fluid Processing Lab	Subject Code:	CE - PCC - 310P(BCE)
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Course Outcome

CO1	Acquire the physical properties, property measurement and handling of solid-solid and solid-fluid mixtures.
CO2	Analyze separation processes for solid-solid and solid-fluid mixtures.
CO3	Demonstrate the processes involved in agitation and mixing of liquids
CO4	Comparing the working and applications of solid-storage and conveying, and flow through packed and fluidized beds

Subject Name:	Engineering Workshop	Subject Code:	CE -GES-309 P (BGE)
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Course Outcome

CO1	Demonstrate fundamental manufacturing processes and tools
CO2	Apply safe practices in a manufacturing environment
CO3	Utilize basic metrology tools for part measurement and inspection
CO4	Explain the role of computer-aided manufacturing (CAM) and CNC machines



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Fourth Semester B.Tech. Chemical Engineering (CBCS)

Subject Name:	Process Technology & Economics (Theory)	Subject Code:	CE-PCC-401T (BCE)
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COs	Statements
CO1	Demonstrating the raw materials, operating conditions, basic block diagrams, and simplified process flow diagrams for the manufacturing of inorganic chemicals.
CO2	Analyze the fundamental components of raw materials, operating conditions, basic block diagrams, and simplified process flow diagrams for petroleum refining, cracking operations, syngas, and hydrogen manufacturing.
CO3	Develop an understanding of feedstocks, process conditions, and key unit operations for the production of essential petrochemicals.
CO4	Analyze an understanding of industrially relevant fuels, coal, coal-based chemicals, and common utilities.
CO5	Develop an overview of project introduction, components of the cost of production, and their estimation, along with the analysis of working results in a project.

Subject Name:	Mass Transfer I (Theory)	Subject Code:	CE-PCC-402T (BCE)
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COs	Statements
CO1	Analyze the mechanisms of mass transport through diffusion processes.
CO2	Execute convective mass transfer, interphase mass transfer, and the theories of mass transfer, utilizing them in relevant applications.
CO3	Analyze the gas absorption processes in plate and packed columns, including design considerations for absorption in wetted wall columns, packed towers, and spray towers.
CO4	Apply the knowledge about absorption in tray towers, tray efficiencies, calculations of the number of trays for absorption, and the equipment used in absorption processes.
CO5	Analyze batch distillation, continuous binary fractionation, azeotropic distillation, multicomponent distillation, and various methods employed in the distillation process.



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Subject Name:	Fluid Mechanics	Subject Code:	CE - PCC-403T (BCE)
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COs	Statements
CO1	Apply fluid statics principles to analyze their behavior of basic properties and classification of fluids, along with the principles of fluid statics.
CO2	Analyze fluid energy balance, energy losses, and the characteristics of various pipe fittings.
CO3	Apply knowledge of velocity distribution, fluid friction, and two-phase flow to predict and explain the flow patterns occurring in specific two-phase systems.
CO4	Analyze the operating principles and mathematical relationships used by flow meters to quantify flow rates under diverse flow conditions.
CO5	Analyze the concepts related to the transportation of fluids, the classification of pumps, and their inherent properties

Subject Name:	Numerical Methods in Chemical Engineering	Subject Code:	CE - PCC -404T (BCE)
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COs	Statements
CO1	Apply various linear algebraic equations to solve chemical engineering problems with a comprehensive understanding.
CO2	Analyze root finding methods for solving non-linear algebraic equations in the context of chemical engineering problems.
CO3	Apply interpolation and approximation methods to solve chemical engineering problems effectively.
CO4	Implement various methods of numerical integration and numerical differentiation to address chemical engineering problems.
CO5	Apply a comprehensive understanding of various ordinary differential equations and partial differential equations to solve complex chemical engineering problems.



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Subject Name:	Inorganic Process Technology	Subject Code:	CE- BS-405 T(BGE)
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COs	Statements
CO1	Apply the knowledge of unit operations to effectively produce industrial gases and acids.
CO2	Recall and apply knowledge in the production process of various industrial carbon and pigments.
CO3	Apply nuclear engineering principles to analyze and evaluate processes in the nuclear industry.
CO4	Analyze the techniques employed in the creation of electrolytic and electro-thermal products
CO5	Analyze the various methods employed in fertilizer production to understand their strengths and weaknesses.

Subject Name:	HASS II Functional English	Subject Code:	CE- HSMC-HS-406 T (BGE)
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COs	Statements
CO1	Apply the knowledge of structure of language.
CO2	Develop the skills and knowledge necessary to excel in competitive exams and the interview process, becoming a strong candidate for employment.
CO3	Develop business writing skills.
CO4	Recall with technology enabled communication and can develop technical and scientific writing skills

Subject Name:	Fluid Mechanics Lab	Subject Code:	CE - PCC -407P (BCE)
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Course Outcome

CO1	Execute typical problems in fluid dynamics at the appropriate level
CO2	Estimate the fluid dynamics and also the principles of turbulent flow, calculation of turbulent boundary layers with pressure gradient, transition from laminar to turbulent flow
CO3	Measure volumetric and mass flow rates through the Venturi meter and Orifice meter and efficiency of pumps



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CO4	Analyze and understand the applications to industrial flows
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Subject Name:	Numerical Methods in Chemical Engineering Lab (Practical)	Subject Code:	CE - PCC - 408P (BCE)
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Course Outcome

CO1	Apply computational techniques to solve mathematical problems
CO2	Implement numerical methods for various mathematical tasks
CO3	Analyze and interpret the accuracy of numerical solutions
CO4	Formulate numerical approaches for solving ordinary differential equations (ODEs)

Subject Name:	Inorganic Process Technology Laboratory	Subject Code:	CE- BS-409 P (BGE)
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Course Outcome

CO1	Perform basic laboratory procedures for inorganic compound preparation and purification
CO2	Apply quantitative analysis techniques to evaluate the composition of inorganic materials:
CO3	Utilize laboratory equipment for inorganic chemistry experiments
CO4	Demonstrate safe and responsible laboratory practices



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Fifth Semester B.Tech. Chemical Engineering (CBCS)

Subject Name:	Heat Transfer (Theory)	Subject Code:	CE-PCC-501T (BCE)
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COs	Statements
CO1	Analyze and estimate heat rate, load, transfer area, and temperature distribution for diverse object geometries in both steady and unsteady state conditions.
CO2	Analyze heating and cooling operations, along with natural and forced convection phenomena, while adeptly evaluating heat transfer coefficients.
CO3	Illustrate understanding of boiling and condensation operations, coupled with the ability to evaluate heat transfer coefficients in these processes.
CO4	Estimate design parameters for double pipe and shell & tube heat exchangers based on first principles, aligned with specific situational requirements.
CO5	Apply radiative heat transfer principles to analyze and estimate heat transfer coefficients for diverse equipment

Subject Name:	Chemical Reaction Engineering I (Theory)	Subject Code:	CE-PCC-502T (BCE)
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COs	Statements
CO1	Analyze and determine reaction rate laws by utilizing concentration-time data obtained from batch reactors.
CO2	Calculate the volumes of ideal reactors (batch, mixed flow, and plug flow) for a specified conversion using relevant model equations.
CO3	Optimize the arrangement of ideal reactors (in series or parallel) to maximize conversion efficiency.
CO4	Calculate the volumes of mixed flow reactor, adiabatic plug flow reactor, adiabatic recycle reactor, and plug flow reactor with optimal temperature progression.
CO5	Interpret C, E, and F curves, elucidating residence time distribution concepts, while defining catalysis mechanisms and related principles.



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Subject Name:	Mass Transfer II (Theory)	Subject Code:	CE-PCC-503T (BCE)
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COs	Statements
CO1	Estimate mass transfer coefficients and design parameters for liquid-liquid extraction and leaching processes.
CO2	Analyze the principles of drying, humidification, and estimate design parameters for dryers and cooling towers based on first principles.
CO3	Apply the concepts of adsorption and ion exchange, and estimate design parameters for adsorbers.
CO4	Analyze the principles of crystallization and utilize them in the estimation of design parameters for specific crystallizer applications.
CO5	Analyze the knowledge of the fundamentals and types of membrane separation processes, along with other novel separation techniques.

Subject Name:	Core Elective- I: Non-Newtonian Flow and Rheology (Theory)	Subject Code:	CE-CEE-504T (BCE)
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COs	Statements
CO1	Analyze the properties of fluids, distinguishing between Newtonian and non-Newtonian behaviors
CO2	Analyze flow behavior in pipes leveraging expertise in fluid dynamics.
CO3	Investigate flow behavior in various particulate systems by exploring their unique characteristics.
CO4	Analyze heat transfer characteristics of non-Newtonian fluids within pipes.
CO5	Evaluate the mixing behavior of liquids and select appropriate mixing equipment.



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Subject Name:	Core Elective- I: Chemical Process Synthesis and Design (Theory)	Subject Code:	CE-CEE-504T (BCE)
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COs	Statements
CO1	Compare reaction paths and choose suitable reactors for diverse processes.
CO2	Evaluate separation methods for economic feasibility to choose the optimal option.
CO3	Apply pinch technology in heat integration and analyze heat exchanger networks.
CO4	Analyze distillation configurations (simple & complex) with and without heat integration to identify the optimal sequence.
CO5	Apply the fundamentals of safety and assess hazards in chemical process industries.

Subject Name:	Open Elective- I: Environmental Pollution and Control (Theory)	Subject Code:	CE-OLE-505T (BCE)
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COs	Statements
CO1	Apply the concept of water quality, including the classification of sources, types of environmental pollutants, and fundamentals of pollution parameters.
CO2	Analyze the natural processes of water purification, recognize the significance of air pollution, and estimate design parameters for industrial air pollution control equipment.
CO3	Identify sources of water pollution and estimate design parameters for water treatment processes.
CO4	Develop the ability to identify, classify, and select optimal techniques for solid waste processing.
CO5	Evaluate global and national environmental policies, along with pollution control measures in selected process industries.



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Subject Name:	Open Elective- I: Renewable Energy (Theory)	Subject Code:	CE-OLE-505T (BCE)
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COs	Statements
CO1	Analyze the principles of solar energy conversion and evaluate the function of components in solar energy production systems.
CO2	Analyze the principles of wind energy conversion and evaluate the function of various components in a wind turbine system.
CO3	Analyze the characteristics and classifications of bioenergy resources to evaluate the effectiveness of various biogas plant designs for their utilization.
CO4	Apply the concept of hydrogen generation and storage, along with its application in fuel cells.
CO5	Evaluate the feasibility of geothermal, tidal, and ocean energy as alternative energy sources through techno-economic analysis

Subject Name:	HASS III: Industrial Economics & Project Management (Theory)	Subject Code:	CE -HSMC-HS - 506T (BCE)
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COs	Statements
CO1	Analyze the principles of industrial economics to identify and implement strategies for optimizing industrial efficiency.
CO2	Develop a foundational understanding of standard market structures and gain insight into the conceptual framework for industrial economics.
CO3	Estimate profitability criteria and comprehend various theories of profit, along with financial ratios.
CO4	Analyze the various aspects of project management and identify the essential competencies required for effective project leadership.
CO5	Analyze the purpose and interdependencies of the project management phases to ensure successful project delivery.



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Subject Name:	Chemical Reaction Engineering I Lab (Practical)	Subject Code:	CE-PCC-507P (BCE)
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Course Outcomes

CO1	Investigate the characteristics and performance of ideal batch reactors.
CO2	Analyze the behavior of Continuous Stirred Tank Reactors (CSTRs).
CO3	Develop experimental protocols to study the dynamics of isothermal plug flow reactors.
CO4	Create experimental setups and methodologies to evaluate the combined performance of PFR and CSTR systems, including parameter estimation.

Subject Name:	Mass Transfer Lab (Practical)	Subject Code:	CE-PCC-508P (BCE)
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Course Outcomes

CO1	Determine mass transfer coefficients for vapor-liquid, liquid-liquid, and solid-liquid systems.
CO2	Analyze equilibria in distillation, absorption, extraction and membrane-based processes
CO3	Study of evaporation from free surface, batch & forced draft drying, crystallization and adsorption for estimation of various process parameters
CO4	Apply various approaches and to estimate the desired degree of separation using distillation, absorption, extraction etc. and Apply separation principles in estimation of design parameters of contacting equipment for distillation, absorption, extraction.

Subject Name:	Heat Transfer Lab (Practical)	Subject Code:	CE-PCC-509P (BCE)
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Course Outcomes

CO1	Design experiments to investigate heat conduction and apply Fourier's Law to determine thermal conductivity.
CO2	Conduct experiments to analyze convective heat transfer and calculate heat transfer coefficients.
CO3	Develop experimental setups to study radiative heat transfer and fin performance.
CO4	Create experimental protocols to evaluate the heat transfer characteristics of industrial equipment and optimize performance parameters.



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Sixth Semester B.Tech. Chemical Engineering (CBCS)

Subject Name:	Chemical Reaction Engineering II (Theory)	Subject Code:	CE-PCC-601T (BCE)
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COs	Statements
CO1	Derive rate laws for heterogeneous non-catalytic gas-solid and gas-liquid reactions using appropriate model equations.
CO2	Apply engineering principles to design and optimize towers for gas-liquid reactions and fluidized bed reactors for gas-solid reactions.
CO3	Determine rate laws for heterogeneous catalytic reactions and design the contactor (reactor) for given gas-solid-liquid catalytic reactions.
CO4	Develop kinetic models for step-growth polymerization and free-radical polymerization reactions.
CO5	Analyze non-isothermal and non-adiabatic reactor behavior to troubleshoot operational issues and optimize reactor performance in continuous flow processes.

Subject Name:	Process Equipment Design (Theory)	Subject Code:	CE-PCC-602T (BCE)
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COs	Statements
CO1	Apply the fundamental design considerations and material selection for pressure vessels.
CO2	Estimate different stresses and thickness of pressure vessels under internal and external pressure, and comprehend the design of thick-walled pressure vessels.
CO3	Develop the knowledge and skills necessary to analyze and estimate design parameters for pressure vessel components, including supports, nozzles, flanges, and gaskets.
CO4	Illustrate the critical factors to consider when designing cylindrical and spherical storage tanks.
CO5	Apply the regulations and standards guiding the design of shell and tube heat exchangers and investigate different types of agitators, including techniques for estimating their power usage.



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Subject Name:	Process Dynamics & Control (Theory)	Subject Code:	CE-PCC-603T (BCE)
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COs	Statements
CO1	Apply the concept of control system block diagrams and their elements.
CO2	Analyze knowledge to solve problems related to first-order control systems, servo, and regulatory control.
CO3	Apply knowledge to solve problems related to the dynamics of second-order control systems and estimate various parameters.
CO4	Develop the ability to analyze and select appropriate controllers for various applications in the Chemical Process Industry.
CO5	Evaluate the performance of direct digital feedback control systems and comprehend the working mechanism of various instruments.

Subject Name:	Core Elective- II: Advanced Separation Processes (Theory)	Subject Code:	CE-CEE-604T (BCE)
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COs	Statements
CO1	Develop VLE and estimate process parameters for the separation of multicomponent mixtures.
CO2	Analyze the use of bubble point and dew point calculations in estimating design parameters for multicomponent distillation.
CO3	Estimate process parameters for azeotropic and extractive distillation.
CO4	Analyze the fundamentals and applications of membrane separation processes.
CO5	Analyze the relationship between adsorption isotherms and design parameters in packed bed adsorbers, enabling the estimation of key design values.



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Subject Name:	Core Elective- II: Process Intensification (Theory)	Subject Code:	CE-CEE-604T (BCE)
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COs	Statements
CO1	Recognize opportunities for process intensification within chemical processes.
CO2	Apply methodologies to enhance process intensification.
CO3	Evaluate the impact of process parameters on scale-up in chemical reactions to identify and mitigate potential challenges.
CO4	Demonstrating the process issues through the utilization of intensification technologies.
CO5	Analyze energy-based approaches to process intensification

Subject Name:	Open Elective- II: Polymer Science and Engineering (Theory)	Subject Code:	CE-OLE-605T (BCE)
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COs	Statements
CO1	Apply the appropriate polymerization reaction and technique for polymer synthesis.
CO2	Analyze the polymer properties of interest and select the most suitable characterization and testing methods to achieve a comprehensive understanding.
CO3	Evaluate the material requirements of the application to recommend the polymer with properties best suited for its intended use.
CO4	Design strategies utilizing blending or composite formation to tailor polymer properties and achieve performance improvements.
CO5	Analyze the relationships between process parameters and product quality in plastic product manufacturing to identify the optimal settings for achieving desired final product characteristics.



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Subject Name:	Open Elective- II: Membrane Technology (Theory)	Subject Code:	CE-OLE-605T (BCE)
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COs	Statements
CO1	Apply the appropriate membrane separation process in industrial practice.
CO2	Evaluate membrane preparation techniques to select the most suitable option for specific process requirements.
CO3	Analyze the transport mechanisms governing permeation through different membrane types.
CO4	Explain the principles of electrokinetic phenomena in driving mass transport across membranes for separation processes.
CO5	Apply various membrane modules and configurations in industrial practice.

Subject Name:	Process Equipment Design and Drawing Lab (Practical)	Subject Code:	CE-PCC-608P (BCE)
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Course Outcomes

CO1	Interpret and utilize standard symbols effectively in equipment and process design.
CO2	Apply appropriate vessel connections, including nozzles, flanges, jackets, and supports, for process requirements.
CO3	Analyze control logics, safety interlocks, and instrumentation to develop comprehensive P&IDs.
CO4	Design and model basic equipment using CAD software (AutoCAD/SolidWorks) to meet process specifications.



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Subject Name:	Process Dynamics & Control Lab (Practical)	Subject Code:	CE-PCC-609P (BCE)
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Course Outcomes

CO1	Analyze the underlying physical and chemical principles governing the dynamic behavior of first-order systems.
CO2	Predict the response characteristics of multi-capacity systems based on system parameters.
CO3	Design and implement analog and digital control strategies to regulate process variables.
CO4	Evaluate the performance of PID controllers in achieving desired process responses under servo and regulator conditions.

Subject Name	Chemical Reaction Engineering II Lab (Practical)	Subject Code	Subject: CE-PCC-607P (BCE)
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Course outcome

CO1	Investigate and model the behavior of non-ideal reactors (CSTR and PFR) through experimentation.
CO2	Optimize the design and operation of industrial reactors (trickle bed, packed bed, fluidized bed) based on experimental data.
CO3	Explain the impact of reaction rate constants and catalysts on chemical reaction kinetics.
CO4	Develop experimental methodologies to quantify mass transfer parameters in reactive systems, analyze solid-fluid interactions, and determine optimal operating conditions.



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Seventh Semester B.Tech. Chemical Engineering (CBCS)

Subject Name:	Transport Phenomena (Theory)	Subject Code:	CE-PCC-701T (BCE)
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COs	Statements
CO1	Evaluate overall heat, mass, and momentum balance across a system using different coordinate systems.
CO2	Derive and apply continuity, Navier-Stokes, and motion equations to determine velocity profiles.
CO3	Develop differential heat balance equations for diverse systems to predict temperature distribution.
CO4	Develop differential mass balance equations for various systems.
CO5	Analyze analogies between heat, mass, and momentum transfer, understand drag concepts, and apply transport phenomena principles to biological systems.

Subject Name:	Process Modelling and Simulation (Theory)	Subject Code:	CE-PCC-702T (BCE)
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COs	Statements
CO1	Predict process parameters for various chemical processes using mathematical models built on fundamental laws.
CO2	Develop mathematical models for diverse chemical processes involving heat transfer, mass transfer, and reactions.
CO3	Analyze systems and their behavior.
CO4	Develop empirical models using statistical analysis methods.
CO5	Solve mathematical models for chemical systems using analytical or numerical methods.



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Subject Name:	Core Elective- III: Advanced Catalysis (Theory)	Subject Code:	CE-CEL-703T (BCE)
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COs	Statements
CO1	Explain the fundamentals of catalysis and types of catalysts.
CO2	Develop the methods for catalyst preparation and characterization.
CO3	Analyze the mechanisms and kinetics of homogeneous catalysis for reactor design.
CO4	Analyze the mechanisms and kinetics of heterogeneous catalysis for multiphase reactor design.
CO5	Analyze the mechanisms and kinetics of bio-catalysis for bioreactor design.

Subject Name:	Core Elective- III: Advanced Petroleum Refining (Theory)	Subject Code:	CE-CEL-703T (BCE)
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COs	Statements
CO1	Identify and classify various hydrocarbons and non-hydrocarbons found in crude oil.
CO2	Analyze test methods and properties of petroleum and its products.
CO3	Analyze various primary, secondary, and supporting processes in petroleum refining.
CO4	Differentiate post-processing treatment techniques for crude oil.
CO5	Comprehend finishing treatments used in petroleum processing.



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Subject Name:	Core Elective- IV: Piping Engineering (Theory)	Subject Code:	CE-CEL-704T (BCE)
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COs	Statements
CO1	Explain the piping fundamentals and the key stages of a pipeline's lifecycle (design, construction, installation, maintenance).
CO2	Utilize fundamentals to calculate line sizes and understand piping accessories.
CO3	Apply fundamentals to develop unit plot plans, P&IDs, equipment layouts, utility layouts, and isometrics.
CO4	Select piping accessories in accordance with codes and standards.
CO5	Analyze procedures for designing piping systems for diverse applications.

Subject Name:	Core Elective- IV: Multiphase Flow (Theory)	Subject Code:	CE-CEL-704T (BCE)
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COs	Statements
CO1	Explain the fundamentals of multiphase flow, including principles and applications.
CO2	Analyze and differentiate various flow patterns and regimes.
CO3	Interpret simple analytical models and homogeneous flow models for one-dimensional, steady-state flow.
CO4	Analyze drift flux and separated flow models for multiphase flow.
CO5	Comprehend and analyze diverse measurement techniques for multiphase flow.



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Subject Name:	Open Elective- III: Nanoscience and Nanotechnology (Theory)	Subject Code:	CE-OEL-705T (BCE)
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COs	Statements
CO1	Explain the concept of nanoscale, nanotechnology, and diverse classifications of nanomaterials.
CO2	Analyze the fundamentals and methods for nanomaterial synthesis tailored to specific applications.
CO3	Explore appropriate characterization techniques for analyzing nanomaterials.
CO4	Explore the synthesis and diverse applications of carbon nanomaterials.
CO5	Identify and evaluate the applications of nanotechnology in chemical engineering, considering its environmental and safety implications.

Subject Name:	Open Elective- III: Biochemical Engineering (Theory)	Subject Code:	CE-OEL-705T (BCE)
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COs	Statements
CO1	Recognize the significance and applications of bioprocessing.
CO2	Analyze enzyme function and develop understanding of enzyme kinetics.
CO3	Develop a general understanding of major metabolic pathways.
CO4	Design and analyze the performance of bioreactors.
CO5	Design and develop wastewater treatment units using principles of biochemical engineering.



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Subject Name:	Open Elective- IV: Advanced Materials (Theory)	Subject Code:	CE-OEL-706T (BCE)
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COs	Statements
CO1	Explain the synthesis and properties of nanomaterials.
CO2	Evaluate the usefulness of nanomaterials and composite materials in various applications.
CO3	Explain the fundamentals of optical materials and evaluate the usefulness of optical materials in various applications.
CO4	Compare and contrast superconducting materials.
CO5	Describe the characteristics and uses of smart/functional materials.

Subject Name:	Open Elective- IV: Sustainable Development and Governance (Theory)	Subject Code:	CE-OEL-706T (BCE)
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COs	Statements
CO1	Explain the concept of sustainable development, including its necessity, terminology, and challenges.
CO2	Identify national and international efforts, laws, and treaties related to sustainable development.
CO3	Analyze different sustainability reporting formats.
CO4	Investigate the process of environmental impact assessment, particularly in India, and interpret relevant case studies.
CO5	Explore the framework of corporate social responsibility for India.



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Subject Name:	Seminar and Summer Internship Evaluation (Practical)	Subject Code:	CE-PCC-708P (BCE)
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COs	Statements
CO1	Conduct a literature review on a recent advancement or innovation in chemical engineering and technology.
CO2	Analyze chemical engineering and technology topics regarding environmental and sustainability concerns.
CO3	Integrate ethical principles and social responsibility into individual and team work.
CO4	Utilize knowledge to draft a formatted report and present findings using ICT tools

Subject Name:	Process Modelling and Simulation Lab (Practical)	Subject Code:	CE-PCC-707P (BCE)
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Course Outcomes

CO1	Develop mathematical models to represent complex physical and chemical phenomena in various processes.
CO2	Apply simulation tools (MS-Excel, MATLAB) to optimize design parameters for linear and nonlinear algebraic models.
CO3	Simulate and analyze unsteady-state processes using simulation tools (MS-Excel, MATLAB) to determine optimal operating conditions.
CO4	Employ advanced process simulators (ASPEN PLUS, HYSYS, CHEMCAD) to predict process performance and evaluate design alternatives.



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Eighth Semester B.Tech. Chemical Engineering (CBCS)

Subject Name:	Industry Internship / Project	Subject Code:	CE-PCC-801P (BCE)
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COs	Statements
CO1	Select a relevant topic or problem, conduct a literature review, and define a solution approach.
CO2	Analyze the chosen topic/problem, leveraging core engineering knowledge to solve it.
CO3	Integrate ethical principles and social responsibility into individual and team work during project execution.
CO4	Prepare a formatted report and present findings using ICT tools.