



**ALL INDIA SHRI SHIVAJI MEMORIAL SOCIETY'S
COLLEGE OF ENGINEERING, PUNE - 1
Department of Chemical Engineering
2.6.1 Course Outcomes**



S E CHEMICAL (2015 Pattern)

YEAR	COURSE CODE	COURSE NAME	COURSE OUTCOMES
S E [SEMESTER -III, TERM-I]	207004	Engineering Mathematics-III	1. Solve higher order linear differential equations and apply to modeling and analyzing chemical transformation and heat and mass transfer systems.
			2. Apply Laplace Transform and Fourier Transform techniques to solve differential equations involved in vibration theory, Liquid level systems and related chemical engineering applications.
			3. Perform vector differentiation and integration, analyze the vector fields and apply to fluid mechanics problems.
			4. Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations.
	209341	Chemistry-I	1. Apply the knowledge of bonding and reactivity of organic molecules.
			2. Calculate the order of simple and complex chemical reactions.
			3. Understand the principles of analytical instruments (UV, IR, GC and HPLC).
			4. Calculate the molar mass from colligative properties of solutions.
			5. Predict the mecorganic reaction mechanisms.
			6. Analyze the structure, preparations and reactions of heterocyclic compounds and dyes.
	209342	Fluid Mechanics	1. Apply fluid mechanics concepts to Chemical Engineering.
			2. Solve fluid statics and its applications related to pressure measuring devices in chemical industry.
3. Analyze basic equations of fluid flow and their applications to determine fluid flow rate by different devices.			
4. Formulate mathematical equations for fluid flow through different systems and determine different losses occurring in pipelines.			
5. Develop relationships among process or system variables using dimensional analysis.			
6. Determine head loss through valves and pumps for transportation of fluid through pipelines.			
209343	Engineering Materials	1. Apply core concepts in Materials Science to solve engineering problems.	
		2. Select materials for design and construction.	
		3. Identify the different metals and their alloys.	

		4. Understand the relationship between nano/microstructure, properties and processing and design of materials.	
		5. Characterize and analyze techniques for the nano/micro structures.	
		6. Compare typical engineering materials like glass, ceramics etc.	
209344	Process Calculations	1. Perform basic unit conversions and calculations.	
		2. Perform material and energy balance calculations without chemical reaction.	
		3. Perform material and energy balance calculations with chemical reaction.	
		4. Perform energy balance calculations.	
		5. Apply material and energy balance calculations to unit operations.	
		6. Perform combustion calculations.	
209345	Introduction to Chemical Engineering	1. Understand the scope and history of Chemical Engineering.	
		2. Understand unit operations in Chemical Industry.	
		3. Understand unit processes in Chemical Industry.	
		4. Perform basic chemical calculations.	
		5. Understand the basic concept of chemical processes.	
		6. Understand process instrumentation and safety.	
209346	Soft Skills	1. Communicate, interact and present ideas to other professionals.	
		2. Understand and be aware of importance, role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.	
		3. Develop self -motivation, raise aspirations and belief in one's own abilities, defining and committing to achieving one's goals.	
		4. Assess the requirements of a task, identify the strengths within the team, utilize the diverse skills of the group to achieve the set objectives.	
S E [SEMESTER -IV, TERM-II]	209347	Chemistry - II	
			1. Understand structure and properties of bio-molecules.
			2. Understand properties of transition metals and co ordination chemistry.
			3. Understand theories of adsorption and catalysis.
			4. Understand and conduct volumetric analysis.
			5. Understand stereochemistry.
6. Classify drugs and pesticides and their synthesis.			
209348	Heat Transfer	1. Demonstrate basic concepts of conduction.	
		2. Demonstrate basic concepts of convection.	
		3. Conduct experiments as well as analyze and interpret data.	

			4. Demonstrate basic concepts of radiation.
			5. Design heat exchangers.
			6. Solve problems on evaporation.
209349	Principles of Design		1. Formulate and analyze stresses and strains in machine elements and structures subjected to various loads.
			2. Apply multidimensional static failure criteria in the analysis and design of mechanical components.
			3. Analyze and design power transmission shafts carrying various elements with geometrical features.
			4. Analyze and design structural joints like riveted and welded joints.
			5. Design thin walled pressure vessels.
			6. Design high pressure vessels.
209350	Chemical Engineering Thermodynamics-I		1. Apply the first law of thermodynamics.
			2. Use appropriate equation of state for representing the P-V-T behavior of gases.
			3. Calculate the heat of reaction at any temperature.
			4. Calculate the ideal and actual efficiencies of heat engines and performance of heat pumps.
			5. Calculate changes in U, H, S and G for ideal and non-ideal gases.
			6. Perform refrigerator and heat pump calculations.
209351	Mechanical Operations		1. Select suitable type of screen and size reduction equipment for different particle sizes.
			2. Select suitable type of thickeners and clarifiers for separation of suspended solid particles.
			3. Apply fluidization and beneficiation technique.
			4. Select suitable type of agitator for mixing and agitation and estimate power consumption in mixing and agitation.
			5. Select suitable type of filter for filtration of slurry or suspension.
			6. Select suitable type of conveyor for transportation of different types of solids.
209352	Workshop Practices		1. Perform operations on lathe machine.
			2. Prepare green sand mould.
			3. Understand metal casting process.
			4. Identify type of welding process for a particular metal joining operation.
T E CHEMICAL (2015 Pattern)			
YEAR	COURSE CODE	COURSE NAME	COURSE OUTCOMES
T E [SEMESTER]	309341	Chemical Engineering	1. Solve problems of error and root equations.
			2. Solve problems of linear algebraic equations.

-V, TERM-I]

	Mathematics	<ol style="list-style-type: none"> 3. Perform regression analysis and interpolation. 4. Solve ordinary differential equations. 5. Solve the problems using finite difference method. 6. Solve problems of process optimization.
309342	Mass Transfer-I	<ol style="list-style-type: none"> 1. Estimate mass transfer rate . 2. Estimate mass transfer coefficient. 3. Calculate no. of trays and height of packing for gas mixture separation using absorption. 4. Use psychrometric chart and calculate height of cooling tower. 5. Understand the construcion and working of gas dispersal and liquid dispersal equipments. 6. Select a suitable dryer to dry a given material.
309343	Industrial Organisation and Management	<ol style="list-style-type: none"> 1. Apply knowledge of management science. 2. Apply managerial skills to increase productivity. 3. Apply knowledge of international trade. 4. Apply knowledge of stores management. 5. Apply knowledge of management laws. 6. Apply knowledge of patent laws.
309344	Chemical Process Technology	<ol style="list-style-type: none"> 1. Apply knowledge of unit operations. 2. Apply knowledge of unit processes. 3. Develop flow sheets. 4. Understand basic flow sheet parameters. 5. Compare economy and safety aspects. 6. Analyze engineering problems associated with processes.
309345	Chemical Engineering Thermodynamics -II	<ol style="list-style-type: none"> 1. Calculate fugacity and fugacity coefficients for pure species and solutions. 2. Calculate activity coefficients for solutions using Margules and Van Laar equations. 3. Calculate VLE using modified Raoult's Law and K-Values. 4. Perform liquid-liquid equilibrium calculations. 5. Calculate equilibrium constant, and effect of temperature and pressure on equilibirum constant. 6. Calculate equilibrium constant for reactions in equilibria.
309346	Computer Aided Chemical Engineering -I	<ol style="list-style-type: none"> 1. Perform process calcuations using excel. 2. Perform data fitting using excel and computational tools. 3. Perform numericial integration and interpolations.

			4. Solve ordinary differential equations.
			5. Develop a program for root of equation.
			6. Develop a program for eigen values and eigen vector.
	309347	Industrial Training -I Evaluation	1. Understand actual working environment.
			2. Understand the actual operation of the chemical plants.
			3. Apply theoretical knowledge in actual industrial practice.
			4. Prepare a report based on the experiences gained in Industry.
			5. Develop technical writing and oral presentation skills.
TE [SEMESTER -VI, TERM-II]	309348	Chemical Reaction Engineering-I	1. Perform basic homogeneous kinetics calculations.
			2. Analyze and interpret batch reactor data.
			3. Perform reactor design for batch reactor, ideal PFR and MFR.
			4. Perform reactor design for parallel and series reactions.
			5. Perform calculations for the effect of temperature and pressure on reaction kinetics.
			6. Design reactors for deviations from ideal reactors.
	309349	Transport Phenomena	1. Perform heat, mass and momentum transfer analysis.
			2. Apply shell balances to momentum, energy and mass transport .
			3. Perform macroscopic balance.
			4. Apply equation of macroscopic balance for isothermal momentum transport.
			5. Calculate the inter-phase transport in multi-component systems.
			6. Analyze problems along with appropriate boundary conditions.
	309350	Chemical Engineering Design- I	1. Formulate and design storage vessels and tall vertical vessels.
			2. Formulate and design vessel supports.
			3. Formulate and design heat exchangers.
			4. Formulate and design evaporator, condenser, etc.
			5. Formulate and design process equipment like agitators, reaction vessels.
			6. Design auxiliary process vessels like decanter, cyclone separators and gas-liquid separator.
	309351	Mass Transfer-II	1. Apply mass transfer theories and principles to distillation process problems.
			2. Solve problems related to distillation.
			3. Analyze and solve liquid-liquid extraction problems.
			4. Analyze and solve leaching problems.
			5. Analyze and solve adsorption and ion-exchange problems.

		6. Analyze and solve crystallization problems.
309352	Process Instrumentation and Control	1. Understand fundamentals of process instrumentation.
		2. Understand temperature measuring instruments.
		3. Understand pressure measuring instruments.
		4. Understand level and flow measuring instruments.
		5. Understand instrumental methods of analysis.
		6. Understand process dynamics and control.
309353	Seminar	1. Search for advances in the areas of chemical engineering.
		2. Conduct literature survey and collect technical information.
		3. Analyze data based on literature survey.
		4. Develop technical writing skills.
		5. Develop oral presentation skills.

B E CHEMICAL (2012 Pattern)

YEAR	COURSE CODE	COURSE NAME	COURSE OUTCOMES
B E [SEMESTER -VII, TERM-I]	409341	Process Dynamics and Control	1. Perform mathematical modelling of simple processes.
			2. Design single loop feedback control systems.
			3. Perform stability analysis of feedback systems.
			4. Perform frequency response analysis of linear processes.
			5. Design complex control systems.
			6. Apply control theory to industrial problems.
409342	Chemical Reaction Engineering- II	1. Develop rate equations for heterogenous reactions.	
		2. Design reactors for heterogenous reactions.	
		3. Calculate the physical properties of catalysts like surface area, void volume etc.	
		4. Calculate effectiveness of catalytic reactions.	
		5. Understand the mechanism of catalytic reactions.	
		6. Develop rate equations for bio-chemical reaction (like M-M equation and inhibition).	
409343	Chemical Engineering Design- II	1. Perform process design and mechanical design of distillation column.	
		2. Perform process design and mechanical design of packed absorption column.	
		3. Perform process design and mechanical design of pipelines on fluid dynamics parameters.	
		4. Perform process design and mechanical design of pipelines for transportation of natural gas, crude oil.	

		5. Understand applications of plant utilities and uses of steam generators in chemical industries.
		6. Understand different types of maintenance for pumps, valves, compressors with consideration of plant safety.
409344	Petroleum Refining [Elective-I]	1. Differentiate the petroleum composition and products.
		2. Understand petroleum pre-refining operations and crude oil distillation.
		3. Apply petroleum refining conversion processes.
		4. Perform process design for production of lube oil and bitumen.
		5. Design petroleum based supporting processes such as hydrogen management, sulphur recovery.
		6. Perform modification in finishing processes in petroleum refinery and logistics.
409344	Environmental Engineering [Elective-I]	1. Study environmental laws, standards and climate change.
		2. Understand the sources of air pollution and its effects on human health, plants, animals and materials.
		3. Design particulate matter control devices.
		4. Analyse waste water parameters.
		5. Select suitable waste water treatment processes.
		6. Understand ethical and societal responsibilities.
409345	Piping Design and Engineering [Elective-II]	1. Perform pressure drop calculations for different types of flow patterns.
		2. Select materials of construction for piping systems and gaskets.
		3. Understand different types of safety valves, pressure relieving devices and calculate line size.
		4. Perform line sizing and pump selections.
		5. Perform calculation of critical thickness of insulations.
		6. Understand piping layout, piping isometric and bill of materials.
409345	Industrial Management and Entrepreneurship [Elective-II]	1. Understand the basic concepts of entrepreneurship development.
		2. Understand the concepts of creating entrepreneurial venture and project management.
		3. Understand the role of central government and state government in entrepreneurship development.
		4. Understand the concepts of management theories and managerial work.
		5. Understand project management based on microsoft project.
		6. Understand the concepts of marketing management.
409346	Industrial Training II	1. Understand actual working environment.
		2. Understand the actual operation of the chemical plants.
		3. Apply theoretical knowledge in actual industrial practice.
		4. Prepare a report based on the experiences gained in Industry.
		5. Develop technical writing and oral presentation skills.

	409347	Computer Aided Chemical Engineering- II	1. Solve chemical engineering problems using various tools such as MATLAB, UniSim and ChemCAD.
			2. Develop computer programs for solving linear, non-linear, steady state and unsteady state equations.
			3. Develop computer programs for solving ODE and PDE.
			4. Develop computer programs for plotting P-x-y and T-x-y diagram.
			5. Develop computer programs for reactor design, distillation column, heat exchangers, mass transfer equipment and fluid flow operations problems.
			6. Simulate steady state flow sheeting.
	409348	Project Phase- I	1. Conduct literature survey and collect technical information.
			2. Analyze data based on literature survey.
			3. Design engineering solutions to chemical engineering problems.
			4. Perform thermodynamic feasibility, material and energy balance of processes.
			5. Design major equipments/perform experiments in the selected project.
			6. Develop technical writing and presentation skills.
B E [SEMESTER -VIII, TERM- II]	409349	Process Modeling and Simulation	1. Apply laws of conservation.
			2. Apply laws of conservation, chemical equations & chemical laws.
			3. Develop models of heat transfer equipments.
			4. Develop models of mass transfer equipments.
			5. Develop models of reactors.
			6. Apply modelling and simulation in chemical unsteady operations & processes.
	409350	Process Engineering Costing & Plant Design	1. Develop process selection and equipment specification sheet.
			2. Understand basic principles of process economics, costing and depreciation of process equipment.
			3. Perform cost estimation of process equipment and study types of taxes.
			4. Understand economic optimization techniques and optimum design of batch and cyclic operations.
			5. Perform optimum design of process equipment.
			6. Perform project scheduling of new projects by using CPM and PERT techniques.
	409351	Chemical Process Safety [Elective-III]	1. Understand safety hazard surveys, hazards and operability studies (HAZOP).
			2. Understand safety for storage and handling of flammable and toxic chemicals.
			3. Understand and develop plant layout for safe operations.
			4. Understand the working principles of explosion proof equipment.
			5. Understand the hazard models.
			6. Understand the impact of exposures to noise and toxic vapors.

409352	Petrochemical Engineering [Elective- IV]	1. Understand the main building blocks of petrochemical industry.
		2. Understand first generation raw materials like olefins and aromatics from hydrocarbon stock.
		3. Understand hydrocarbon cracking, separation techniques and purification.
		4. Understand second generation intermediates like glycol, amines, acids, ketones etc.
		5. Understand the types of polymerization with applications.
		6. Understand power generation, pollution control and safety considerations in petrochemical plants.
409353	Project Phase -II	1. Conduct literature survey and collect technical information.
		2. Analyze data based on literature survey.
		3. Design engineering solutions to chemical engineering problems.
		4. Perform thermodynamic feasibility, material and energy balance of processes.
		5. Design major equipments/perform experiments in the selected project.
		6. Develop technical writing and presentation skills.

ME (2017 Patten)

ME [SEMESTER -I TERM-I]	509101	Mathematical and Statistical Methods	1. Solve problems of linear and ordinary differential equations.
			2. Solve partial differential equations such as heat, wave and laplace equations.
			3. Solve complex function using power, Laurent series, residue integration method.
			4. Understand the concept of probability theory and its application to solve statistical problems.
			5. Solve problems of regression analysis and correlation analysis.
			6. Understand design of experiments and the concept of statistical control.
	509102	Process Optimization	1. Apply knowledge of optimization to formulate problems.
			2. Analyze optimization criterion for solving problems.
			3. Apply different methods of optimization and suggest techniques for specific problems.
			4. Apply simplex method for linear optimization problems.
			5. Apply advanced optimization techniques like genetic algorithms.
			6. Apply optimization for solving industrial problems of relevance to chemical industry.
	509103	Advanced Separation Processes	1. Understand advanced separation processes and their selection.
			2. Understand principles and processes of adsorption, membrane separation.
			3. Design an absorber or membrane unit to achieve a specified separation.
			4. Understand the concept of separation by adsorption technique.
			5. Understand the principle of ionic separators.
			6. Understand new techniques in separation technologies.

	509104	Research Methodology	1. Understand research methodology.
			2. Solve problems using quantitative methods.
			3. Apply methods of design of experiment.
			4. Understand research planning and execution.
			5. Understand the structure and components of research report and presentation.
			6. Understand intellectual property rights.
	509105	Computer Aided Design [Elective - I]	1. Apply principles of CAD in the field of chemical engineering.
			2. Apply the basic structure and components of CAD software.
			3. Apply underlying thermodynamic and physical principles.
4. Understand the approaches used in the simulation of flow sheets.			
5. Apply the knowledge of flow charts and computer languages.			
6. Apply the knowledge of numerical methods.			
509106	Lab Practice – I	1. Solve design of experiments problems using MATLAB.	
		2. Solve optimization problems using MATLAB.	
		3. Solve chemical engineering problems using UniSim.	
		4. Perform COD and BOD Analysis.	
		5. Understand analytical instruments.	
ME [SEMESTER -II TERM-II]	509107	Advanced Transport Phenomena	1. Understand the concepts of transport phenomena.
			2. Apply equations of change for isothermal and for non-isothermal flow.
			3. Apply equations of change for multi component systems.
			4. Apply concept of dimensional analysis.
			5. Solve the problems of two dimensional flow.
	509108	Advanced Process Control	1. Establish control-relevant process models using first-principles, and empirical approaches.
			2. Design complex control structures for processes with difficult dynamics.
			3. Analyze and design multi-loop (MIMO) control systems.
			4. Understand discrete-time control systems.
			5. Study the applications of advanced process control systems.
			6. Develop plant-wide control system.
	509109	Advanced Reaction Engineering	1. Understand the heterogeneous catalyzed reactions and the models involved in reactor design.
			2. Study mass and heat transfer mechanisms in different reactors.
			3. Solve problems on external and internal transport effects in gas-solid and liquid-solid systems.

		4. Design isothermal and non-isothermal reactors for heterogeneous catalytic reactions.	
		5. Design multiphase flow reactors.	
		6. Analyse residence time distribution in real reactors.	
509110	Industrial Pollution Control [Elective - II]	1. Differentiate pollution types and apply knowledge for the protection of environment.	
		2. Select and use suitable wastewater treatment techniques.	
		3. Identify suitable equipment for air pollutants.	
		4. Analyse and identify environmental problems.	
		5. Apply environmental management systems (EMS) to industrial activity.	
509111	Lab Practice- II	1. Perform process modeling and simulation of chemical operations and processes.	
		2. Simulate dynamic behavior of processes.	
		3. Simulate closed loop control of processes.	
		4. Perform dynamic simulation of chemical processes.	
		5. Perform controllability analysis of chemical processes.	
		6. Apply advanced tools for numerical computations.	
509112	Seminar - I	1. Search for advances in the areas of chemical engineering.	
		2. Conduct literature survey and collect technical information.	
		3. Analyze data based on literature survey.	
		4. Develop technical writing skills.	
		5. Develop oral presentation skills.	
ME [SEMESTER -III TERM-I]	509113	Process Modeling and Simulation	
			1. Apply laws of conservation.
			2. Apply constitutive equations.
			3. Calculate rate parameters of different models.
			4. Perform optimization of single and multi-variable systems.
			5. Apply optimization techniques.
6. Apply modelling and simulation in chemical unsteady operations & processes.			
509114	Advanced Thermodynamics	1. Perform phase equilibrium calculations.	
		2. Perform chemical reaction equilibrium calculations.	
		3. Perform calculations based on statistical thermodynamics.	
		4. Perform calculations based on the thermodynamics of electrolytic solutions.	
		5. Perform calculations based on the irreversible and non-equilibrium thermodynamics.	
		6. Apply thermodynamics concepts to typical cases.	

	509115	Computational Fluid Dynamics [Elective - III]	1. Derive governing equations for fluid dynamics.
			2. Solve flow system equations using finite difference method.
			3. Solve flow system equations using finite volume method.
			4. Analyse stability of physics of the system.
			5. Analyse turbulent flows using various models.
			6. Analyse multiphase flows using various models.
	509116	Seminar - II	1. Search for advances in the areas of chemical engineering.
			2. Conduct literature survey and collect technical information.
			3. Analyze data based on literature survey.
4. Develop technical writing skills.			
5. Develop oral presentation skills.			
509117	Project Stage - I	1. Conduct literature survey and collect technical information.	
		2. Analyze data based on literature survey.	
		3. Design engineering solutions to chemical engineering problems.	
		4. Perform thermodynamic feasibility, material and energy balance of processes.	
		5. Design major equipments/perform experiments in the selected project.	
		6. Develop technical writing and presentation skills.	
ME [SEMESTER -IVTERM-II]	509118	Seminar - III	1. Search for advances in the areas of chemical engineering.
			2. Conduct literature survey and collect technical information.
			3. Analyze data based on literature survey.
			4. Develop technical writing skills.
			5. Develop oral presentation skills.
	509119	Project Stage - II	1. Conduct literature survey and collect technical information.
			2. Analyze data based on literature survey.
			3. Design engineering solutions to chemical engineering problems.
			4. Perform thermodynamic feasibility, material and energy balance of processes.
			5. Design major equipments/perform experiments in the selected project.
6. Develop technical writing and presentation skills.			