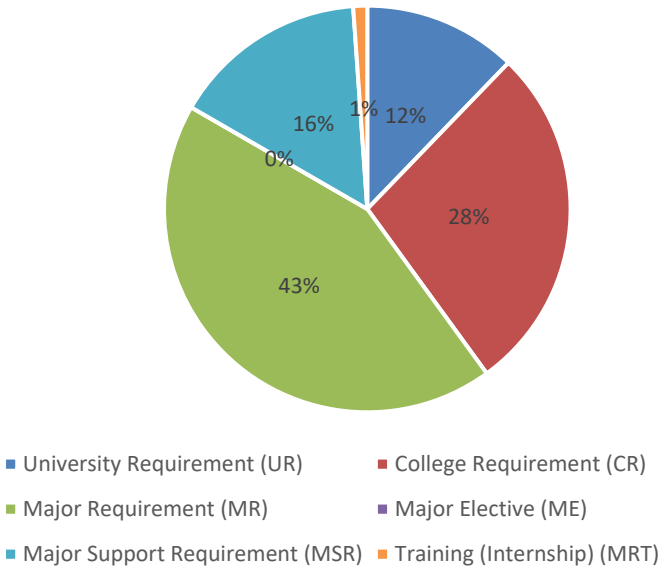
Associate Degree in Chemical Engineering 2025

An Exit Qualification from the 2022 Chemical Engineering Bachelor of Science Program onward

Program Components



Course Type	CRD
University Requirement (UR)	**11**
College Requirement (CR)	**25**
Major Requirement (MR)	**39**
Major Elective (ME)	**------**
Major Support Requirement (MSR)	**14**
Training (Internship) **(MRT)**	**3**
Total Credit (CRD)	**92**

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 101	General Chemistry I	3	2	4	CR	None	No
ENGL 101	Communication Skills I	3	0	3	CR	None	No
MATHS 101	Calculus I	3	0	3	CR	None	No
PHYCS 111	Fundamentals of Physics	3	2	4	MSR	None	No
	TOTAL	12	4	14			

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ARAB 110	Arabic Language Skills	3	0	3	UR	None	No
CHEMY 102	General Chemistry II	3	2	4	MSR	CHEMY 101	No
CHEN 101	Chemical Engineering Principles I	2	2	3	MR	CHEMY 101 MATHS 101	Yes
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	None	No
MATHS 102	Calculus II	3	0	3	CR	MATHS 101	No
	TOTAL	14	4	16			

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 220	Organic Chemistry for Chemical Engineering	2	2	3	MSR	CHEMY 102	No
CHEN 202	Chemical Engineering Principles II	2	2	3	MR	CHEN 101 CHEMY 102	Yes
HRLC 107	Human Rights	2	0	2	UR	None	No
MATHS 203	Calculus III	3	0	3	CR	MATHS 102	No
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	No
	TOTAL	12	4	14			

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEN 203	Computer Programming & Applications for Chemical Engineering	0	6	3	MR	CHEN 202	Yes
CHEN 211	Chemical Engineering Thermodynamics I	2	2	3	MR	CHEN 202	Yes
CHEN 213	Fluid Mechanics	2	2	3	MR	CHEN 202 MATHS 205	Yes
EENG 263	Circuits and Electronics	2	2	3	MSR	MATHS 101 PHYCS 111	No
ENGL 242	Report Writing and Presentation	3	0	3	CR	ENGL 101	No
STAT 276	Statistical Data Analysis for Engineering	3	0	3	CR	MATHS 102	No
	TOTAL	12	12	18			

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEN 304	Linear Algebra and Numerical Methods	2	2	3	MR	CHEN 203 MATHS 205	Yes
CHEN 312	Chemical Engineering Thermodynamics II	2	2	3	MR	CHEN 211	Yes
CHEN 314	Heat Transfer	2	2	3	MR	CHEN 213	Yes
CHEN 315	Mass Transfer	2	2	3	MR	CHEN 213	Yes
CHEN 316	Applied Physical Chemistry	2	2	3	MR	CHEN 202 STAT 276 EENG 263	Yes
	TOTAL	10	10	15			

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEN 317	Chemical Reactor Analysis and Design	2	2	3	MR	CHEN 314 CHEN 316	Yes
CHEN 321	Chemical Engineering Laboratory I	0	6	3	MR	CHEN 312 CHEN 314 ENGL 242	Yes
CHEN 323	Equilibrium Stage Separation Processes	2	2	3	MR	CHEN 312 CHEN 315	Yes
ISLM 101	Islamic Culture	3	0	3	UR	None	No
	TOTAL	7	10	12			

Training Requirement

CHEN 290	Industrial Training	0	3	1	MRT	Completion of 45 credits	YES

Course Description

Major Courses Descriptions

Course Code: CHEN 101 **Course Title:** Chemical Engineering Principles I
Units and dimensions. Introduction to chemical process calculations. Processes and process variables. Process flowcharts. Material balances on single and multiple-unit processes, without and with chemical reactions, including bypass and recycle. Introduction to single-phase systems: solid/liquid densities, ideal gases, introduction to non-ideal gases EOS, the compressibility factor. Tools: spreadsheet software (e.g. Microsoft® Excel).

Course Code: CHEN 202 **Course Title:** Chemical Engineering Principles II
Introduction to multiphase systems: single-component phase equilibrium, Gibbs phase rule, one condensable component, multicomponent gas-liquid systems. Forms of energy and energy conservation law. Energy balance on closed and open systems. Tables and charts of thermodynamic data. Combined material and energy balances on non-reactive and reactive processes. Computer-aided balance calculations. A case study on a chemical process. Tools: spreadsheet software (e.g. Microsoft® Excel).

Course Code: CHEN 203 **Course Title:** Computer Programming & Applications for Chemical Engineering
Introduction to modern programming languages. MATLAB®: creating vector and matrices, if statements, while and for loops, script and function files, matrix operations, MATLAB® built-in functions, plot commands. Solving systems of linear and nonlinear equations. Introduction to chemical process flowsheet package, applications to material and energy balances. Tools: chemical process flowsheet package (e.g. AspenTech products), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 211 **Course Title:** Chemical Engineering Thermodynamics I
First law of thermodynamics. Applications of the first law for closed, open, steady and unsteady systems. Volumetric properties of pure fluids. Heat effects. The second law of thermodynamics, heat engines, heat pumps and refrigerators, reversible and irreversible processes, Carnot cycle and performance indicators. Entropy and entropy relations. Applications of the second law to steady-flow devices. Vapor power cycles and vapor-compression refrigeration cycles. Tools: spreadsheet software (e.g. Microsoft® Excel), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 213 **Course Title:** Fluid Mechanics
Classification of fluids. Fluid statics. Flow of fluids in closed conduits. Friction factor. The mechanical energy balance. Bernoulli's equation and fluid flow measurements. Characteristics of pumps. Compressible flow. Momentum balance. Navier-Stokes equations. Dimensional analysis. Laminar boundary layer. Universal velocity distribution. Flow past regular bodies, flow through packed beds, fluidization. Tools: spreadsheet software (e.g. Microsoft® Excel), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 290 **Course Title:** Industrial Training
All students in the program must participate in an approved training program in a relevant industry. At the completion of 300 hours of supervised training, each student must submit a formal report and conduct an oral presentation.

Course Code: CHEN 304 **Course Title:** Linear Algebra and Numerical Methods
Linear algebraic equations and selected matrix operations (e.g. Reduced row echelon form, Eigenvalues etc.). Numerical Methods and errors. Numerical solution of systems of linear equations: Elimination and iterative methods. Numerical solution of nonlinear equations: bracketed and open methods. Open methods for simultaneous nonlinear equations. Interpolation and curve-fitting. Finite difference methods. Numerical differentiation and integration. Solution of ODE's - Initial Value Problems. Applications related to chemical engineering. Tools: spreadsheet software (e.g. Microsoft® Excel), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 312 **Course Title:** Chemical Engineering Thermodynamics II
Thermodynamic properties of fluids: Maxwell equations, residual properties, enthalpy of vaporization calculations. Vapor/liquid equilibrium calculations. Solution thermodynamics: theory and applications, partial molar properties and fugacity. Topics in phase equilibrium: excess properties, activity coefficient calculation. Chemical reaction equilibria: Gibbs energy change, effect of temperature, composition and pressure on equilibrium constant. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 314 **Course Title:** Heat Transfer
Modes of heat transfer. Mechanism of conduction in gases, liquids and solids. Steady-state heat conduction in one and two dimensions, transient heat conduction. Convection, equations of momentum and heat transport. Dimensionless correlations for free and forced convection. Heat transfer with phase change: boiling, condensation, and evaporation. Thermal radiation. Heat exchangers. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 315 **Course Title:** Mass Transfer
Fundamentals of mass transfer. The control volume approach to the mass transfer processes. Diffusion coefficients. Mass transfer across phase boundary. Mass transfer coefficients. Convective mass transfer correlations. Rate based mass transfer operations in chemical engineering: absorption, membrane separation. Tools: spreadsheet software (e.g. Microsoft® Excel).

Course Code: CHEN 316 **Course Title:** Applied Physical Chemistry
The rate of reaction and its relation to chemical reaction equilibria. The general mole balance equation for reactors, conversion, and reactor sizing. Stoichiometry and rate laws. Collection and analysis of rate data. Reaction mechanisms: active intermediates and non-elementary rate laws, fundamentals of enzyme kinetics and inhibition. The adsorption theory. Electrochemistry: electrochemical cells, cell potential under standard and non-standard conditions, application of electrochemistry. Tools: spreadsheet software (e.g. Microsoft® Excel), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 317 **Course Title:** Chemical Reactor Analysis and Design
Mole balances on ideal reactors. Isothermal reactor design of constant and variable density systems. Pressure drop in reactors. Non-isothermal reactor design. Design of reactors for multiple reactions. Kinetics of heterogenous catalytic reactions. Mass transfer effects. Design of heterogeneous reactors. Bioreactors. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 321 **Course Title:** Chemical Engineering Laboratory I
Developing awareness of laboratory safety. Laboratory work in thermodynamics and unit operations involving heat and momentum transfer. Error analysis and interpretation of experimental data. Improving teamwork, technical report writing and oral presentation skills. At least one experiment should demonstrate on-line measurement and data acquisition. Tools: spreadsheet software (e.g. Microsoft® Excel).

Course Code: CHEN 323 **Course Title:** Equilibrium Stage Separation Processes
Single equilibrium stages and flash calculations. Continuous distillation: McCabe-Thiele and Ponchon-Savarit methods. Liquid-liquid extraction with ternary systems: Hunter and Nash method. Approximate methods for multicomponent multistage separations. Batch distillation with reflux. Absorption and stripping. Drying. Tools: chemical process flowsheet package (e.g. AspenTech products).

University Requirements Courses Descriptions

Course Code: ARAB 110 **Course Title:** Arabic Language Skills
This course focuses on basic Arabic skills including form, function, and meaning. It also helps the student to appreciate and understand structures and approach them from a critical point of view, through various genres in literature.

Course Code: HIST 122 **Course Title:** Modern History of Bahrain and Citizenship
Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

Course Code: HRLC 107 **Course Title:** Human Rights Principles
This course deals with the principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Economics, Social and Culture rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

Course Code: ISLM 101 **Course Title:** Islamic Culture
An introduction to the general outline and principles of Islamic culture, its general characteristics, its relationships with other cultures, general principles of Islam in beliefs, worship, legislation and ethics.

College Requirement Courses Descriptions

Course Code: CHEMY 101 **Course Title:** General Chemistry I
Significant figures, chemical formulas and equations; mass relations, limiting reactants and theoretical yield; Physical behaviour of gases; electronic structure, periodic table, covalent bonding; Lewis structures, Molecular structures, hybridization; molecular orbitals, solutions; colligative properties. Related practical work.

Course Code: ENGL 101 **Course Title:** Communication Skills
This course focuses on reading skills and strategies and language development. The reading section concentrates on high-interest contemporary topics and encourages students to increase speed and efficiency. The writing component, integrated to the reading materials, reviews grammatical structures, develops language accuracy and introduces paragraph writing. Students are required to upgrade their grammar, reading, and listening skills on the internet.

Course Code: ENGL 242 **Course Title:** Report Writing and Presentation
To develop theoretical and practical skills of technical report writing and oral presentation. Students are to be given a number of specific technical report tasks to complete and present orally.

Course Code: MATHS 101 **Course Title:** Calculus I
Algebra. Functions and graphs. Trigonometry. Conic sections. Limits and continuity. Derivatives and integrals. Applications of derivatives, which include mean value theorem, extrema of functions and optimization. Definite integrals and the Fundamental Theorem of Calculus.

Course Code: MATHS 102 **Course Title:** Calculus II
Applications of definite integrals, including areas, volumes and surface areas of solids of revolution, arc length and centroids. Transcendental functions, indeterminate form and L'Hopital's Rule. Techniques of integration and improper integrals. Infinite series, power series. Maclaurin and Taylor Theorem.

Course Code: MATHS 203 **Course Title:** Calculus III
Parametric equations and polar coordinates. Vectors and surfaces. Limits, derivatives, and integrals of vector-valued functions. Partial differentiation. Multiple and line integrals and their applications. Green's and Stokes' Theorems.

Course Code: MATHS 205 **Course Title:** Differential Equations
Differential equations of first order and their solution. Separable and exact equations. Equations convertible to separable type. Higher order linear equations with constant coefficients (homogeneous and non-homogeneous). Power series method for second order linear equations. Variation of parameters. Laplace transform technique. Applications of differential equations.

Course Code: STAT 276 **Course Title:** Statistical Data Analysis for Engineering
Introduction to statistical methods for data analysis and interpretation. Statistical concepts, probability distributions, descriptive statistics and data visualization, confidence intervals, significance tests, Analysis of Variance (ANOVA), linear and nonlinear regression analysis. Principles of design of experiments, full factorial and fractional designs, statistical quality control. Tools: spreadsheet software (e.g. Microsoft® Excel) and programming environment (e.g. MATLAB®).

Major Support Requirement Courses Descriptions

Course Code: CHEMY 102 **Course Title:** General Chemistry II
Gaseous equilibrium (equilibrium constant, Kc and Kp); acids and bases (water dissociation, pH, weak acids and bases, salts); acid-base and precipitation equilibria (buffers, indicators, titrations, pH curves); thermochemistry (calorimetry, enthalpy, thermochemical equations, heats of formation, first law of thermodynamics); rate of reaction, rate and concentration, concentration and time, activation energy, rate and temperature, catalysis, mechanisms; electrochemistry; voltaic cells; cell voltages. Organic chemistry (alkanes, alkenes, alkynes, isomerism, nomenclature, arenas, functional groups, reaction). Related practical work.

Course Code: CHEMY 220 **Course Title:** Organic Chemistry for Chemical Engineering
Isomerism; alkanes and cycloalkanes; geometric isomerism; alkenes and alkynes; petroleum; gasoline; and octane number, aromatic compounds; polycyclic aromatic hydrocarbons, Phenols and thiols, ethers and epoxides; aldehydes and ketones; tautomerism; carboxylic acids and their derivatives. Related practical work.

Course Code: EENG 263 **Course Title:** Circuits and Electronics
Fundamentals of circuit theory: Ohm and Kirchoff Laws; series/parallel AC/DC circuits; basic DC/AC circuit analysis tools and theorems; transient and steady-state analysis of RLC circuits. Fundamentals of power systems: single and three-phase balanced and unbalanced systems. Fundamentals of electronics: basic semiconductor devices; diode and transistor types with applications; ideal operational amplifier with applications. Related laboratory experiments

Course Code: PHYCS 111 **Course Title:** Fundamentals of Physics
Vectors and scalars; straight line and projectile motion; Newton's laws of motion; work, energy and power, momentum and impulse; rotational motion; periodic motion; the electric field; Gauss's law; electric potential; capacitance and dielectrics; magnetic fields and magnetic forces.

List of Courses

University Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ARAB 110	Arabic Language Skills	3	0	3	UR	------	NO
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	------	NO
ISLM 101	Islamic Culture	3	0	3	UR	------	NO
HRLC 107	Human Rights	2	0	2	UR	------	NO
	Total	11	0	11			

College Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 101	General Chemistry I	3	3	4	CR	------	NO
ENGL 101	Communication Skills I	3	0	3	CR	------	NO
ENGL 242	Report Writing and Presentation	3	0	3	CR	ENGL 101	NO
MATHS 101	Calculus I	3	0	3	CR	------	NO
MATHS 102	Calculus II	3	0	3	CR	MATHS 101	NO
MATHS 203	Calculus III	3	0	3	CR	MATHS 102	No
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	NO
STAT 276	Statistical Data Analysis for Engineering	3	0	3	CR	MATHS 102	NO
	Total	24	3	25			

Major Support Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 102	General Chemistry II	3	3	4	MSR	CHEMY 101	NO
CHEMY 220	Organic Chemistry for Chemical Engineering	3	2	3	MSR	CHEMY 102	NO
EENG 263	Circuits and Electronics	2	2	3	MSR	MATHS 101 PHYCS 111	No
PHYCS 111	Fundamentals of Physics	3	3	4	MSR	------	NO
	Total	11	10	14			

Major Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEN 101	Chemical Engineering Principles I	3	1	3	MR	CHEMY 101 MATHS 101	YES
CHEN 202	Chemical Engineering Principles II	2	3	3	MR	CHEN 101 CHEMY 102	YES
CHEN 203	Computer Programming & Applications for Chemical Engineering	0	6	3	MR	CHEN 202	Yes
CHEN 211	Chemical Engineering Thermodynamics I	3	1	3	MR	CHEN 202	YES
CHEN 213	Fluid Mechanics	3	2	3	MR	CHEN 202 MATHS 205	YES
CHEN 304	Linear Algebra and Numerical Methods	2	2	3	MR	CHEN 203 MATHS 205	Yes
CHEN 312	Chemical Engineering Thermodynamics II	2	2	3	MR	CHEN 211	Yes
CHEN 314	Heat Transfer	3	1	3	MR	CHEN 213	YES
CHEN 315	Mass Transfer	3	1	3	MR	CHEN 213	YES
CHEN 316	Applied Physical Chemistry	3	1	3	MR	CHEN 202 STAT 276 EENG 263	YES
CHEN 317	Chemical Reactor Analysis and Design	2	2	3	MR	CHEN 314 CHEN 316	Yes
CHEN 321	Chemical Engineering Laboratory I	0	6	3	MR	CHEN 312 CHEN 314 ENGL 242	Yes
CHEN 323	Equilibrium Stage Separation Processes	2	2	3	MR	CHEN 312 CHEN 315	Yes
	Total	28	30	39			

Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEN 390	Industrial Training	0	3*	1	MRT	Completion of 90 credits	YES

or

CHEN 290	Industrial Training	0	3*	1	MRT	Completion of 45 credits	YES

***** 300 hours of supervised training.

Dated: Jun 18, 2025