



Guideline Handbook

Bachelor of Science in Chemical Engineering

College of Engineering - University of Bahrain

2026

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Bachelor of Science in Chemical Engineering

1. Program Description:

The Bachelor of Science in Chemical Engineering provides students with a strong foundation in chemical engineering principles, process design, thermodynamics, fluid mechanics, heat and mass transfer, reaction engineering, process control, and process simulation. The program prepares graduates to design, operate, optimize, and improve chemical and industrial processes while addressing challenges related to energy efficiency, sustainability, safety, and environmental protection. It meets the growing industrial demand for chemical engineers in sectors such as oil and gas, petrochemicals, refining, chemicals, energy, water treatment, food processing, pharmaceuticals, and other process industries

The Bachelor of Science in Chemical Engineering provides students with a solid foundation in mathematics, statistics, physics, chemistry, and computer programming. Building on this foundation, students explore core chemical engineering principles, including thermodynamics, fluid mechanics, heat and mass transfer, and reaction engineering. Advanced topics cover separation processes, process modeling and simulation, process control, and plant design, culminating in a Capstone Plant Design project. The undergraduate program includes two laboratory courses, namely Chemical Engineering Lab I and Chemical Engineering Lab II. Students conduct experiments in thermodynamics, unit operations, reaction engineering, and process control.

Through laboratory work, industrial training, teamwork activities, and open-ended design projects, the program systematically develops critical thinking, problem-solving, communication, leadership, data analysis, and lifelong learning skills, enabling students to apply their knowledge effectively in chemical and process engineering applications. As a result, graduates are well positioned to pursue careers in oil and gas and petrochemical industries, chemical and manufacturing industries, and energy and water treatment sectors, in roles such as process engineer, production engineer, process design engineer, and plant operations engineer. They are also equipped to undertake further study at the postgraduate level or follow professional pathways in process engineering, energy and environmental engineering, and related chemical engineering fields. The program consists of 44

courses totaling 133 University of Bahrain credit hours, equivalent to 600 NQF credits, and is normally completed over four years (eight semesters) of full-time study.

2. Program Educational Objectives (PEOs):

The program seeks to achieve the following objectives:

1. Engage in productive careers in a broad range of chemical engineering professions in both the public and private sectors;
2. Engage in ongoing professional development activities by pursuing graduate studies and /or other learning opportunities;
3. Advance in responsibility and leadership in their careers.

3. Program Intended Learning Outcomes (PILOS):

Upon graduation, graduates of the Bachelor of Science in Chemical Engineering will be able to:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

4. Admission Requirements:

The target learners of the program are applicants who meet the general admission requirements of the University of Bahrain as stated in the Study and Examinations Regulation.

5. Graduation Requirements:

To graduate, students must:

1. Successfully complete all courses in the study plan, totaling 133 credit hours, within the maximum period specified in the University regulations.
2. Achieve a minimum cumulative GPA of 2 out of 4.
3. Achieve a minimum cumulative Major GPA of 2 out of 4.
4. Complete all program-specific requirements, including [senior project/internship/ capstone project].
5. Fulfil all other requirements stipulated in the University of Bahrain Study and Examinations Regulation.

5.1. Exit Degrees:

In accordance with the University of Bahrain regulations, the program includes the following exit degrees:

1. Diploma in Chemical Engineering
 - Minimum required credit hours: 62 credits
 - Minimum cumulative GPA: none
 - Notes (if any):
2. Associate Degree in Chemical Engineering
 - Minimum required credit hours: 92 credits
 - Minimum cumulative GPA: none
 - Notes (if any):

6. Program Duration

The normal duration of the program is 4 years (8 semesters).

Students are expected to complete the program within this period, with the possibility of extension in accordance with the University of Bahrain Study and Examinations Regulation.

7. Language of Instruction

The language of instruction for the Chemical Engineering Program (CHEN) is English.

8. Career Opportunities and Graduate Destinations

Those graduating Chemical Engineering (CHEN) degree can pursue careers such as:

- *Chemical engineering in process industries*
- *Chemical engineering in oil & gas sector*
- *Chemical engineering in energy sector*
- *Chemical engineering in manufacturing industries*
- *Maintenance Engineer.*
- *Consulting and Project Management Engineer.*
- *Sales and Technical Support Engineer.*
- *Research and Development (R&D) Engineer.*
- *Banking and Insurance sectors*
- *Academic and Trainor in Chemical Engineering*

9. Attendance and Learning Mode

The program follows a full-time attendance system.

The primary mode of teaching and learning is Traditional Education delivery, supported by e-learning tools and digital platforms to enhance the learning experience

10. Study Methodology

The program is delivered through the study of the topics outlined in the course syllabi, using appropriate teaching and learning methods consistent with the nature of the discipline.

Students are assessed using approved evaluation methods aligned with the intended learning outcomes of each course.

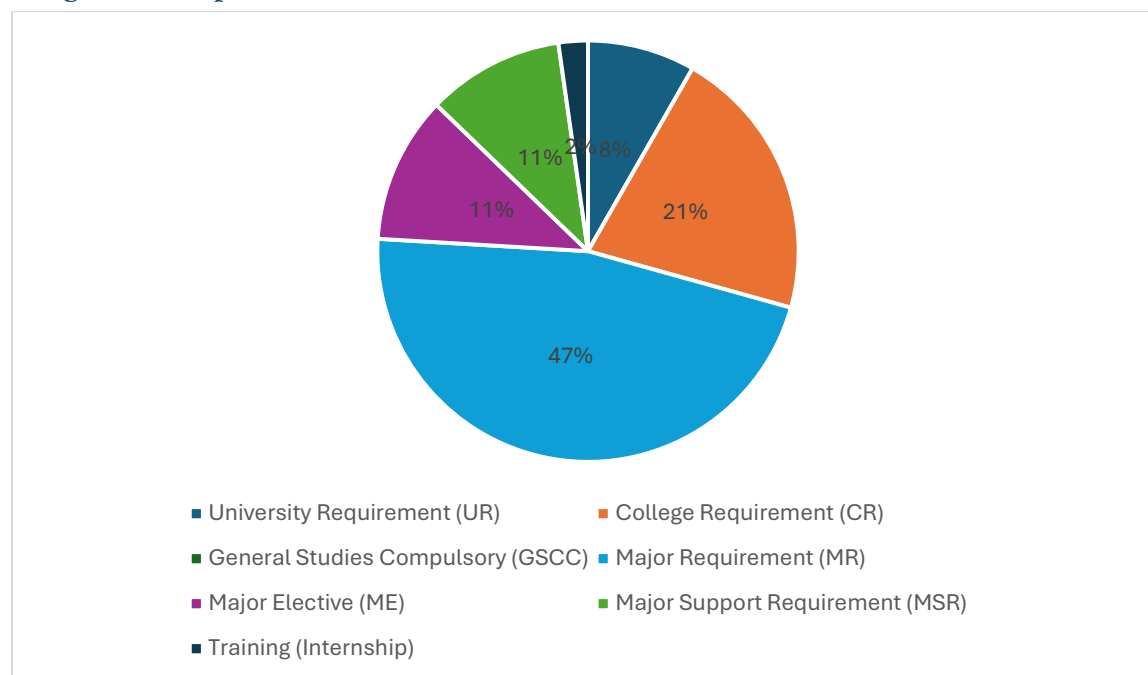
11. Academic Probation and Dismissal

Students are placed on academic probation if their cumulative GPA falls below the minimum required at the end of any semester. If the student fails to raise their GPA to a minimum in the next semester, a second academic probation is issued.

A student will be dismissed from the University in the following cases:

1. Failure to raise the cumulative GPA (2.0) after the prescribed probation period.
2. Exceeding the maximum period (14 semesters) allowed for completion of the program.
3. Committing a violation that warrants dismissal in accordance with the University regulations.

Program Components



University Requirement (UR)	11
College Requirement (CR)	28
General Studies Compulsory (GSCC)	0
Major Requirement (MR)	62
Major Elective (ME)¹	15
General Studies Elective (GSE)²	14
Training (Internship) Yes	Yes
Total Credit (CRD)	133

1. Students must select five (4XX) courses from Major Elective (ME) List. Additional to this, two courses must be selected from ME list as Job Placement Courses. This needs consultation and approval of the department.
2. Students must select three General Studies Electives, one of them must be from Humanities and Social Science.

Notes:

- Free Elective Courses any UOB course excluding: (1) courses offered for special students, (2) courses covered in the B.Sc. curriculum, (3) courses equivalent or lower

than those already taken in the curriculum and should not be a science course prepared by College of Science for other colleges.

- HU/SS Courses - Humanities and Social Science Component: Any course from the following:
 - Humanities: Fine Arts, History, American Studies, Classics, Communications, English, (Foreign Language) French, Music, Philosophy, Theatre, Literature (Arabic), Religion (comparative).
 - Social Science: Anthropology, Economics, Education, Geography, History, Psychology, Sociology, Women's Studies, Political Science

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRA C/ CLIN/ STU D	CRD				
CHEMY 101	General Chemistry I	3	2	4	MSR	None	No	Traditional Education
ENGL 101	Communication Skills I	3	0	3	CR	None	No	Traditional Education
ISLM 103	Islamic Culture	2	0	2	UR	None	No	Traditional Education
MATHS 101	Calculus I	3	0	3	CR	None	No	Traditional Education
PHYCS 111	Fundamentals of Physics	3	2	4	MSR	None	No	Traditional Education
TOTAL		14	7	16				

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRAC/ CLIN/ STUD	CR D				
CHEMY 101	General Chemistry I	3	2	4	MSR	None	No	Traditional Education

ARAB 108	Arabic Language Skills	2	0	2	UR	None	No	Traditional Education
CHEMY 102	General Chemistry II	3	2	4	MSR	CHEMY 101	No	Traditional Education
CHEN 101	Chemical Engineering Principles I	2	2	3	MR	CHEMY 101, MATHS 101	No	Traditional Education
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	None	No	Traditional Education
MATHS 102	Calculus II	3	0	3	CR	MATHS 101		Traditional Education
TOTAL		16	4	19				

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN/ STUD	CRD				
CHEMY 220	Organic Chemistry for Chemical Engineering	2	2	3	MSR	CHEMY 102	No	Traditional Education
CHEN 202	Chemical Engineering Principles II	2	2	3	MR	CHEN 101, CHEMY 102	Yes	Traditional Education
HRLC 107	Human Rights Principles	2	0	2	UR	None	No	Traditional Education
MATHS 203	Calculus III	3	0	3	CR	MATHS 102	No	Traditional Education
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	No	Traditional Education
ENTR 101	Basics of Innovation & Entrepreneurship	2	0	2				
TOTAL		14	4	16				

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN/ STUD	CRD				
CHEN 203	Computer Programming & Applications for Chemical Engineering	0	6	3	MR	CHEN 202	Yes	Traditional Education
CHEN 211	Chemical Engineering Thermodynamics I	2	2	3	MR	CHEN 202	Yes	Traditional Education
CHEN 213	Fluid Mechanics	2	2	3	MR	CHEN 202, MATHS 205	Yes	Traditional Education
EENG 264	Circuits and Electronics	2	2	3	MSR	MATHS 101, PHYCS 111	No	Traditional Education
ENGL 242	Report Writing and Presentation	3	0	3	CR	ENGL 101	No	Traditional Education
STAT 276	Statistical Data Analysis for Engineering	3	0	3	CR	MATHS 102	No	Traditional Education
TOTAL		12	12	18				

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN/ STUD	CRD				
CHEN 304	Linear Algebra and Numerical Methods	2	2	3	MR	CHEN 203, MATHS 205	Yes	Traditional Education

CHEN 312	Chemical Engineering Thermodynamics II	2	2	3	MR	CHEN 211	Yes	Traditional Education
CHEN 314	Heat Transfer	2	2	3	MR	CHEN 213	Yes	Traditional Education
CHEN 315	Mass Transfer	2	2	3	MR	CHEN 213	Yes	Traditional Education
CHEN 316	Applied Physical Chemistry	2	2	3	MR	CHEN 202, STAT 276, EENG 264	Yes	Traditional Education
TOTAL		10	10	15				

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN / STUD	CRD				
CHEN 305	Properties and Strength of Materials	2	2	3	MR	CHEN 316, PHYCS 111	Yes	Traditional Education
CHEN 317	Chemical Reactor Analysis and Design	2	2	3	MR	CHEN 314, CHEN 316	Yes	Traditional Education
CHEN 321	Chemical Engineering Laboratory I	0	6	3	MR	CHEN 312, CHEN 314, ENGL 242	Yes	Traditional Education
CHEN 323	Equilibrium Stage Separation Processes	2	2	3	MR	CHEN 312, CHEN 315	Yes	Traditional Education
MENG 302	Engineering Economics	3	0	3	CR	Completion of 70 credits	No	Traditional Education
TOTAL		9	12	15				

Training Requirement

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA
		LEC	PRAC/CLIN/STUD	CR D			
<i>CHEN 396</i>	<i>Industrial Training</i>	0	6	3	<i>MRT</i>	<i>Completion of 90 credits</i>	Yes

Option 1: Process Systems

Process Systems option includes a package of five major electives shown in italic: CHEN 431, CHEN 432, CHEN 433, CHEN 434 and CHEN 4xx.

Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning	NQF level
		LEC	PRA C/CLIN/STUD	CR D					
<i>CHEN 423</i>	<i>Process Dynamics and Control</i>	3	2	4	<i>MR</i>	<i>CHEN 317 CHEN 304</i>	<i>CHEN 423</i>	Traditional Education	8
<i>CHEN 425</i>	<i>Process Equipment Design</i>	2	2	3	<i>MR</i>	<i>CHEN 305 CHEN 314 CHEN 323</i>	<i>CHEN 425</i>	Traditional Education	8
<i>CHEN 426</i>	<i>Process Design and Economics</i>	2	2	3	<i>MR</i>	<i>CHEN 317 CHEN 323 MENG 302</i>	<i>CHEN 426</i>	Traditional Education	8
<i>CHEN 431</i>	<i>Process Optimization</i>	2	2	3	<i>ME</i>	<i>CHEN 304</i>	<i>CHEN 431</i>	Traditional Education	8
<i>CHEN 432</i>	<i>Computer-Aided Modeling and Simulation</i>	1	4	3	<i>ME</i>	<i>CHEN 304 CHEN 317 CHEN 323</i>	<i>CHEN 432</i>	Traditional Education	8

<i>CHEN 497</i>	<i>Senior Project I</i>	0	3	1	<i>MR</i>	<i>Completion of 90 credits</i>	<i>CHEN 497</i>	Traditional Education	8
TOTAL		10	15	17					

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRA C/ CLIN/ STUD	CRD				
<i>CHEN 422</i>	<i>Chemical Engineering Laboratory II</i>	0	6	3	<i>MR</i>	<i>CHEN 317 CHEN 323 CHEN 321</i>	Yes	Traditional Education
<i>CHEN 427</i>	<i>Capstone Plant Design</i>	0	6	3	<i>MR</i>	<i>CHEN 425 CHEN 426</i>	Yes	Traditional Education
<i>CHEN 433</i>	<i>Heat Integration</i>	2	2	3	<i>ME</i>	<i>CHEN 425</i>	Yes	Traditional Education
<i>CHEN 434</i>	<i>Plantwide Process Control</i>	2	2	3	<i>ME</i>	<i>CHEN 423 CHEN 431</i>	Yes	Traditional Education
<i>CHEN 498</i>	<i>Senior Project II</i>	0	9	3	<i>MR</i>	<i>CHEN 497</i>	Yes	Traditional Education
<i>CHEN 4XX</i>	<i>Elective</i>	2	2	3	<i>ME</i>		Yes	Traditional Education
TOTAL		6	27	18				

Option 2: Oil and Gas

Oil and Gas option includes a package of five major electives shown in italic: CHEN 440, CHEN 441, CHEN 442, CHEN 443 and CHEN 4xx.

Year 4 - Semester 7

Course Code	Course Title	Course Hours	Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there	Major GPA	Regular Mode of Teaching
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		LEC	PRAC	CRD		is grade for completion		and Learning
CHEN 423	Process Dynamics and Control	3	2	4	MR	CHEN 317 CHEN 304	Yes	Traditional Education
CHEN 425	Process Equipment Design	2	2	3	MR	CHEN 305 CHEN 314 CHEN 323	Yes	Traditional Education
CHEN 426	Process Design and Economics	2	2	3	MR	CHEN 317 CHEN 323 MENG 302	Yes	Traditional Education
CHEN 440	Petroleum Geology	2	2	3	ME	CHEN 213 CHEN315	Yes	Traditional Education
CHEN 442	Petroleum Refinery Engineering	2	2	3	ME	CHEMY 220 CHEN 317 CHEN 323	Yes	Traditional Education
CHEN 497	Senior Project I	0	3	1	MR	Completion of 90 credits	Yes	Traditional Education
TOTAL		10	15	17				

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRAC	CRD				
CHEN 422	Chemical Engineering Laboratory II	0	6	3	MR	CHEN 317 CHEN 323 CHEN 321	Yes	Traditional Education
CHEN 427	Capstone Plant Design	0	6	3	MR	CHEN 425 CHEN 426	Yes	Traditional Education
CHEN 445	Petroleum Engineering	2	2	3	ME	CHEMY 220 CHEN 440	Yes	Traditional Education
CHEN 443	Natural Gas Processing	2	2	3	ME	CHEMY 220 CHEN 323	Yes	Traditional Education
CHEN 498	Senior Project II	0	9	3	MR	CHEN 497	Yes	Traditional Education
CHEN 4XX	Elective	2	2	3	ME		Yes	Traditional Education
TOTAL		6	27	18				

Major Elective Courses

Course Code	Course Title	Course Hours			Course Type (as shown in credit hours distribution)	Pre-Requisite; specify if there is grade for completion	Major CGPA	Regular Mode of Teaching and Learning
		LEC	PRA C/ CLIN/ STUD	CRD				
CHEN 471	Aluminum Processing	2	2	3	ME	CHEN 316	Yes	Traditional Education
CHEN 472	Analytical Measurements	2	2	3	MR	CHEN 316	Yes	Traditional Education
CHEN 473	Bioprocess Engineering	2	2	3	ME	CHEN 317	Yes	Traditional Education
CHEN 474	Corrosion Engineering	2	2	3	ME	CHEN 305	Yes	Traditional Education
CHEN 475	Environmental Engineering	2	2	3	ME	CHEN 315	Yes	Traditional Education
CHEN 476	Process Safety	2	2	3	ME	CHEN 312	Yes	Traditional Education
CHEN 477	Quality Assurance and Reliability Engineering	2	2	3	ME	Completion of 90 credits	Yes	Traditional Education
CHEN 478	Water Desalination	2	2	3	ME	CHEN 315	Yes	Traditional Education
CHEN 479	Special Topics	2	2	3	ME	Completion of 90 credits	Yes	Traditional Education
MENG 418	Engineering Management	2	2	3	ME	MENG 302	Yes	Traditional Education

For students registered in Option 1 (Process Systems), the following courses are considered part of the list of elective courses:

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN/ STUD	CRD				
CHEN 440	Petroleum Geology	2	2	3	ME	CHEN 213 CHEN315	Yes	Traditional Education

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN/ STUD	CRD				
CHEN 442	Petroleum Refinery Engineering	2	2	3	ME	CHEMY 220 CHEN 317 CHEN 323	Yes	Traditional Education
CHEN 443	Natural Gas Processing	2	2	3	ME	CHEMY 220 CHEN 323	Yes	Traditional Education
CHEN 444	Petrochemical Processing	2	2	3	ME	CHEMY 220 CHEN 317 CHEN 323	Yes	Traditional Education

For students registered in Option 2 (Oil and Gas), the following courses are considered part of the list of elective courses:

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA	Regular Mode of Teaching and Learning
		LEC	PRAC / CLIN/ STUD	CRD				
CHEN 431	Process Optimization	2	2	3	ME	CHEN 304	Yes	Traditional Education
CHEN 432	Computer-Aided Modeling and Simulation	1	4	3	ME	CHEN 304 CHEN 317 CHEN 323	Yes	Traditional Education
CHEN 444	Petrochemical Processing	2	2	3	ME	CHEMY 220 CHEN 317 CHEN 323	Yes	Traditional Education
CHEN 481	Principles of Enhanced Oil Recovery	2	2	3	ME	CHEN 440	Yes	Traditional Education
CHEN 482	Well Testing and Performance	2	2	3	ME	CHEN 440	Yes	Traditional Education

Course Description

Major Courses Descriptions

Course Code: CHEN 101 **Course Title:** Chemical Engineering Principles I **NQF Level:** (6)

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 **NQF Level:** (6)

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 **NQF Level:** (6)

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 **NQF Level:** (6)

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 **NQF Level:** (6)

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 304 **Course Title:** Linear Algebra and Numerical Methods **NQF Level:** (7)

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 ODEs – 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 305 **Course Title:** Properties and Strength of Materials **NQF Level:** (7)

Major strands of materials. Processing, structure, properties, and performance of materials. Crystalline and amorphous materials, lattice parameter, crystalline systems, crystalline structures. Unit cells, coordinate indices, imperfect lattice and crystalline defects. Mechanical property, elastic, plastic and fracture phases. Elements of failure analysis and design/safety factors. Thermomechanical processing and materials strengthening. Design using fracture mechanics and materials selection. Fundamentals of corrosion. Related laboratory experiments. Tools: spreadsheet software (e.g. Microsoft® Excel).

Course Code: CHEN 312 **Course Title:** Chemical Engineering Thermodynamics II
NQF Level: (7)

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 **NQF Level:** (7)

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

NQF Level: (7)

Fundamentals of mass transfer. The control volume approach to 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

NQF Level: (7)

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 **NQF Level:** (7)

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 heterogeneous 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 **NQF Level:** (7)

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 **NQF Level:** (7)

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).

Course Code: CHEN 396 **Course Title:** Industrial Training **NQF Level:** (8)

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 422 **Course Title:** Chemical Engineering Laboratory II **NQF Level:** (8)

Laboratory safety awareness. Experiments in reaction engineering, process control and unit operations involving mass transfer. Error analysis and interpretation of experimental data. Teamwork and communication skills. Application of statistical Design of Experiment (DoE) for conducting at least one experiment. Tools: spreadsheet software (e.g. Microsoft® Excel), design of experiment software (e.g. Minitab), chemical process flowsheet package (e.g. AspenTech products). Applications of virtual reality experiments.

Course Code: CHEN 423 **Course Title:** Process Control **NQF Level:** (8)

Introduction to feedback control. Control loop elements. Control system instrumentation. Piping and Instrumentation Diagram (P&ID). Transfer functions. Process dynamics. Development of empirical dynamic models from step response data. Stability of closed-loop systems. Controller tuning and troubleshooting control loops. Controller design using frequency response criteria. Advanced control strategies: cascade, feed-forward control, etc. Synthesis of control systems for complete plants. Tools: programming environment (e.g. MATLAB®).

Course Code: CHEN 425 **Course Title:** Process Equipment Design **NQF Level:** (8)

Fluid flow and fluid handling, head loss calculations, economic pipe size, design of pumping systems. Compressors. Mixing and agitation of liquids. Estimation of individual, overall and fouling heat transfer coefficients. Design of shell-and-tube heat exchangers. Mass transfer operations, shortcut design methods, tray hydraulics and efficiencies. Process vessels design. Tools: chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 426 **Course Title:** Process Design and Economics **NQF Level:** (8)

Methodology of approaching open-ended design problems. Engineering method of design, hierarchy of decisions, structures of process flow sheets and evolution of process design. Evaluation of process alternatives. Safety and environmental impacts of chemical processes. HAZOP study. Economic methods of estimating capital and production costs, profitability analysis. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 427 **Course Title:** Capstone Plant Design **NQF Level:** (8)

A comprehensive design problem undertaken by students working in groups and individually. It presents an overall analysis of the major factors involved in process design, with emphasis on ethical, economic, environmental, safety and health considerations. The design project illustrates computer-aided plant design based on fundamental understanding of chemical process engineering. Written design reports and oral presentations are required periodically. Tools: chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 497 **Course Title:** Senior Project I

NQF Level: (8)

In this first phase of the project, a preliminary study is carried out in teams under the supervision of a faculty member on an approved proposal of a research project relevant to the field. The research project may be of experimental or theoretical nature, where the application of engineering knowledge towards the project development is demonstrated. This phase involves a thorough literature review, the development of a detailed implementation plan, and any preliminary studies needed for Senior Project II. An end-of-term written report is required.

Course Code: CHEN 498 **Course Title:** Senior Project II

NQF Level: (8)

In this second phase, the development and implementation of the research project are continued by the same team under the supervision of the same faculty member. This phase involves accurate implementation and completion of the project tasks, deep analysis of the results, and logical, evidence-based reasoning of the outcomes and conclusions. An end-of-term written formal report, poster, and oral presentation are required.

Major Electives Courses Descriptions – Option 1 (Process Systems)

Course Code: CHEN 431 **Course Title:** Process Optimization

NQF Level: (8)

Uses of mathematical models. Model building and solution. Formulation of the optimization problem. Basic concepts of optimization: stationary points of a function, unimodal and multimodal functions, convexity, etc. Optimization of unconstrained single- and multi-variable functions: direct and indirect search methods. Linear programming: simplex algorithm. Integer linear programming: branch and bound. Nonlinear constrained optimization problems: selected techniques. Case studies. Tools: spreadsheet software (e.g. Microsoft® Excel), programming and computing environment (e.g. MATLAB®).

Course Code: CHEN 432 **Course Title:** Computer-Aided Modeling and Simulation

NQF Level: (8)

Introduction to computer-aided design and simulation. Degree of freedom analysis. Material and energy balances in process flowsheets. Strategy of manual calculations. Sequential modular vs equation-oriented approach. General procedure for process simulation. Equation-tearing procedures. Convergence block. The single-unit case. The multi-unit case. Material integration. Tools: chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 433 **Course Title:** Heat Integration **NQF Level:** (8)

Energy targets for heat exchanger networks and utilities. Composite curves, the heat recovery pinch, threshold problems. The problem table algorithm, process constraints. Utility selection, furnaces, combined heat and power (co-generation). Heat exchangers: number of units and targets. Heat exchanger network design, the pinch design method. Use of the grand composite curve. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 434 **Course Title:** Plantwide Process Control **NQF Level:** (8)

Nature of multivariable systems. Process interactions and control loop interactions. Pairing of controlled and manipulated variables. Controllability and observability. Plantwide control fundamentals. Integrated processes, units in series, effects of recycle, reaction/separation interaction. Common plantwide control design procedures. Control of individual units: reactors, heat exchangers, distillation columns, and other common unit operations (e.g. furnaces, compressors). Industrial examples using computer-aided design software. Tools: chemical process flowsheet package (e.g. AspenTech products).

Major Electives Courses Descriptions – Option 2 (Oil and Gas)

Course Code: CHEN 440 **Course Title:** Petroleum Geology **NQF Level:** (8)

Earth structure and plate tectonics; main geological features and geometries in petroleum geology; rock types, sedimentary beds and sedimentary basins; sequence of geological events; petroleum system; hydrocarbon generation and oil fields; source rock maturation; reservoir characteristics; hydrocarbon migration and accumulation; oil trapping mechanisms and geological traps; conventional and unconventional oil fields; Bahrain Field and Khaleej Al Bahrain Field; oil exploration processes; exploration drilling; geological and geophysical surveys and geological maps; prospect volumetrics and risk analysis; field trip (optional).

Course Code: CHEN 445 **Course Title:** Petroleum Engineering **NQF Level:** (8)

Origin, composition and properties of petroleum fluids. Reservoir rocks and their properties. Prediction of oil reservoir behavior, material balance, reservoir simulation. Basic drilling techniques. Details of drilling equipment and accessories. Oil well completion, testing and production of oil and gas. Reservoir life and improving oil and gas recovery. Tools: finite element method (FEM)-based package (e.g. COMSOL Multiphysics®).

Course Code: CHEN 442 **Course Title:** Petroleum Refinery Engineering **NQF Level:** (8)

Refinery organization. Refinery feedstock and products. Crude oil characterization. Crude oil distillation. Chemical conversion processes: cracking, reforming, alkylation and polymerization. Blending processes. Design and simulation of typical equipment/unit operations. Refinery

economics and planning. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 443 **Course Title:** Natural Gas Processing **NQF Level:** (8)

Introduction to natural gas processing principles, technology and engineering design. Overview of natural gas resources. Properties and behavior of natural gas. Gas-liquid separators. Compression and transportation of natural gas. Simulation, design and cost estimation of the main gas treatment processes such as dehydration, sweetening, liquefaction, and sulfur recovery. Tools: spreadsheet software (e.g. Microsoft® Excel), chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 481 **Course Title:** Principles of Enhanced Oil Recovery **NQF Level:** (8)

Introduction to enhanced oil recovery (EOR) techniques including chemical flooding (surfactant flooding, polymer flooding), miscible-gas displacement (LPG, CO₂/N₂/flue gas), thermal processes (steam flooding, hot water/steam flooding, in-situ combustion, etc.) and environmentally friendly approaches (microbial EOR). The advantages and drawbacks of each technique are discussed and linked to typical selection criteria for target reservoirs. A simple performance prediction procedure for each process is also covered.

Course Code: CHEN 482 **Course Title:** Well Testing and Performance **NQF Level:** (8)

Introduction to the different methodologies used in well testing, including single- and multi-rate testing, single- and multi-well testing, and homogeneous and heterogeneous reservoirs. Fluid flow equations under steady-state and transient behavior, derivation of the diffusivity equation, solution of the diffusivity equation, analysis of pressure drawdown and buildup tests, wellbore storage and skin effects, behavior of vertically fractured wells, behavior of dual-porosity reservoir systems, analysis of production performance, rate forecasting using semi-analytical, empirical, and IPR methods, and deliverability testing.

Major Electives Courses Descriptions – Common

Course Code: CHEN 444 **Course Title:** Petrochemical Processing **NQF Level:** (8)

Overview of the petrochemical industry. Raw materials for the petrochemical industry. Petrochemicals from methane: synthesis gas, ammonia and methanol. Production of olefins. Petrochemicals from ethylene. Petrochemicals from propylene and higher olefins. Petrochemicals from benzene, toluene, and xylene. Synthetic petroleum-based polymers. Complete simulation and economic analysis of one selected process is introduced. Tools: chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 471 **Course Title:** Aluminum Processing **NQF Level:** (8)

Aluminum properties, production evolution and role in present industries and world economy. Upstream bauxite (ore) refining and smelting of hi-purity aluminum. Simulation of coke calcining process and anode production. Unit operations in aluminum plant. Principles of electro-chemistry. International standards of Aluminum Alloys (AA) classification. Development of cast structure and solidification essentials. Downstream processing routes. Metallurgical principles of AA thermo-mechanical processing. Technological status of AA applications. Recycling and environmental impacts. Tools: chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 472 **Course Title:** Analytical Measurements **NQF Level:** (8)

Fundamental principles of operation. Application of in-situ and real-time analyzers for industrial processes and environmental monitoring, including spectroscopic, chromatographic, chemiluminescence and electrochemical techniques. Introduction to chemometric analysis, total chemical analysis, and flow injection analysis. Miniaturization of analytical systems, including their principles, designs and applications.

Course Code: CHEN 473 **Course Title:** Bioprocess Engineering **NQF Level:** (8)

Key concepts of biotechnology/bioprocess engineering. Fundamentals of biochemistry and microbiology. The kinetics of enzyme-catalysed reaction. Growth kinetics of cells and substrate utilization. Stoichiometry of microbial growth and product formation. Engineering principles for bioprocess including the design and analysis of bioreactors, scale-up of bioreactors. Sterilization and recovery of fermentation products. Biotechnology applications in process engineering. Tools: chemical process flowsheet package (e.g. AspenTech products).

Course Code: CHEN 474 **Course Title:** Corrosion Engineering **NQF Level:** (8)

Corrosion thermodynamics and kinetics. Polarization and mixed potential theory. Corrosion mechanisms. Forms of corrosion: uniform corrosion, pitting, stress corrosion cracking, crevice corrosion, microbial corrosion, biofouling. Corrosion testing and inspection methods. Important process variables in corrosion severity. Prevention of corrosion: physical, chemical, and electrical methods. Design of corrosion prevention systems and related economics. Failure analysis. Case studies.

Course Code: CHEN 475 **Course Title:** Environmental Engineering **NQF Level:** (8)

Engineering and sustainable development. Environmental measurements. Environmental standards and legislation. Air pollution: human health, emissions, and control technologies. Greenhouse gases and climate change. Solid-waste management. Wastewater treatment: primary, secondary, tertiary treatment, and sludge disposal and treatment.

Course Code: CHEN 476 **Course Title:** Process Safety **NQF Level:** (8)

Safety awareness. Learning from disasters. Hazard, accident and risk. Types of hazards and hazard identification; HAZOP. Toxic release and dispersion models. Fires and explosions and designs to

prevent them. Reliefs and relief sizing. Inherently safer pre-design. Risk assessment and management.

Course Code: CHEN 477 **Course Title:** Quality Assurance and Reliability Engineering
NQF Level: (8)

Quality assurance, understanding, commitment, leadership, and organization. The role of quality systems, planning, and flow-charting. How to maintain plant quality and operation reliability. Causes and consequences of failure. Reliability of series, parallel, standby, and complex systems. Analytical methods including fault trees. Implementation methods, communication and training for quality. Guidelines for writing a quality manual.

Course Code: CHEN 478 **Course Title:** Water Desalination **NQF Level:** (8)

Water chemistry, types and qualities. Classification of desalination processes. Theoretical and practical aspects of seawater and groundwater desalination technologies, including thermal-based (MSF, MED, VC) and membrane-based (RO and other) processes. Design and performance of desalination processes. Fouling, scaling and cleaning. Water pre-treatment and post-treatment. Economics of desalinated water. Environmental issues in desalination.

Course Code: CHEN 479 **Course Title:** Special Topics **NQF Level:** (8)

Any important, relevant topic that is not covered in the given elective list. Topics may vary subject to students' interest and availability of staff.

Course Code: MENG 418 **Course Title:** Engineering Management **NQF Level:** (8)

Introduction to engineering management. Types and characteristics of production systems. Forecasting methods and techniques. Product design. Capacity planning. Aggregate planning. Inventory planning and materials management. Short-term scheduling. Quality management and quality control. Job design and work methods. Project planning and scheduling.

University Requirements Courses Descriptions

Course Code: ARAB 108 **Course Title:** Arabic Language Skills **NQF Level:** (6)

Study the fundamentals of the Arabic language in terms of formulation, syntax, vocabulary, and semantics, with emphasis on analyzing its styles through reading, appreciation, and critical analysis. The course also examines the aesthetic features and semantic and expressive values of the Arabic language through texts representing various literary genres, both poetry and prose.

Course Code: HIST 122 **Course Title:** Modern History of Bahrain and Citizenship **NQF Level:** (6)

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 **NQF Level:** (6)

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 103 **Course Title:** Islamic Culture **NQF Level:** (6)

Study the concept of Islamic culture, its sources, and its fundamental principles, as well as the major Islamic systems and their contemporary applications. Explain the position of Islamic values and culture on contemporary issues, including their rejection of terrorism, support for dialogue and tolerance, and emphasis on peaceful coexistence in a multicultural world.

Course Code: ENTR 101 **Course Title:** Basics of Innovation & Entrepreneurship **NQF Level:** (6)

This course introduces students to the main theories, principles and concepts of innovation and entrepreneurship, and develops a creative and entrepreneurial mindset. It equips students with the tools and skills to analyze market opportunities, construct and assess innovative business models, and plan the resourcing and marketing of a proposed venture. Through structured online sessions, applied case analyses and a sequence of venture-development tasks, students work independently to take an innovative idea from opportunity identification through to a business model, an indicative budget and a marketing plan, taking account of the ethical, social and sustainability dimensions of entrepreneurial decisions.

College Requirement Courses Descriptions

Course Code: CHEMY 101 **Course Title:** General Chemistry I **NQF Level:** (5)

Significant figures, chemical formulas and equations; mass relations, limiting reactants and theoretical yield; Physical behavior 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 **NQF Level:** (6)

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 **NQF Level:** (7)

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 **NQF Level:** (5)

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 **NQF Level:** (6)

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 **NQF Level:** (6)

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 **NQF Level:** (6)

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: MENG 302 **Course Title:** Engineering Economics **NQF Level:** (7)

Fundamentals of engineering economy. Time value of money. Present worth analysis. Annual worth analysis. Rate of return analysis. Replacement and retention analysis. Capital rationing. Breakeven analysis. Payback period analysis. Cost estimation and indirect cost allocation. Depreciation methods.

Course Code: STAT 276 **Course Title:** Statistical Data Analysis for Engineering **NQF Level:** (7)

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 **NQF Level:** (6)

Gaseous equilibrium (equilibrium constant, K_c and K_p); 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, arenes, functional groups, reactions). Related practical work.

Course Code: CHEMY 220 **Course Title:** Organic Chemistry for Chemical Engineering
NQF Level: (6)

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 264 **Course Title:** Circuits and Electronics **NQF Level:** (7)

Fundamentals of circuit theory: Ohm's and Kirchhoff's 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 **NQF Level:** (6)

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.

Mapping Courses to PILOs:

Course Code	Course Title	Course Type	PILOs						
			1	2	3	4	5	6	7
CHEN 101	Chemical Engineering Principles I	MR	✓				✓		
CHEN 202	Chemical Engineering Principles II	MR	✓				✓		
CHEN 203	Computer Programming & Applications for Chemical Engineering	MR	✓						
CHEN 211	Chemical Engineering Thermodynamics I	MR	✓						
CHEN 213	Fluid Mechanics	MR	✓	✓				✓	
CHEN 304	Linear Algebra and Numerical Methods	MR	✓		✓				
CHEN 305	Properties and Strength of Materials	MR	✓	✓	✓	✓	✓		✓
CHEN 312	Chemical Engineering Thermodynamics II	MR	✓	✓				✓	
CHEN 314	Heat Transfer	MR	✓		✓		✓		
CHEN 315	Mass Transfer	MR	✓	✓					
CHEN 316	Applied Physical Chemistry	MR	✓	✓					
CHEN 317	Chemical Reactor Analysis and Design	MR	✓	✓					
CHEN 321	Chemical Engineering Laboratory I	MR	✓	✓					
CHEN 323	Equilibrium Stage Separation Processes	MR	✓	✓					
CHEN 422	Chemical Engineering Laboratory II	MR	✓	✓					
CHEN 423	Process Dynamics and Control	MR							
CHEN 425	Process Equipment Design	MR	✓	✓					

Course Code	Course Title	Course Type	PILOs						
			1	2	3	4	5	6	7
CHEN 426	Process Design and Economics	MR	✓	✓	✓	✓	✓		✓
CHEN 427	Capstone Plant Design	MR	✓	✓	✓	✓			✓
CHEN 497	Senior Project I	MR	✓	✓	✓	✓	✓		✓
CHEN 498	Senior Project II	MR	✓	✓	✓	✓	✓	✓	✓
CHEN 396	Industrial Training	MRT	✓			✓	✓		✓
CHEN 431	Process Optimization	ME	✓	✓			✓		✓
CHEN 432	Computer-Aided Modeling and Simulation	ME	✓	✓			✓		✓
CHEN 433	Heat Integration	ME	✓	✓			✓		✓
CHEN 434	Plantwide Process Control	ME	✓	✓			✓		✓
CHEN 440	Petroleum Geology	ME	✓			✓	✓	✓	
CHEN 442	Petroleum Refinery Engineering	ME	✓	✓			✓		✓
CHEN 443	Natural Gas Processing	ME	✓	✓			✓		✓
CHEN 445	Petroleum Engineering	ME	✓	✓			✓	✓	✓
CHEN 4XX	Elective	ME	✓	✓			✓		✓
CHEMY 101	General Chemistry I	MSR	✓	✓					
CHEMY 102	General Chemistry II	MSR	✓	✓					
CHEMY 220	Organic Chemistry for Chemical Engineering	MSR	✓	✓					
EENG 264	Circuits and Electronics	MSR	✓	✓					
PHYCS 111	Fundamentals of Physics	MSR	✓	✓					
ARAB 108	Arabic Language Skills	UR	✓	✓					

Course Code	Course Title	Course Type	PILOs						
			1	2	3	4	5	6	7
ENTR 101	Basics of Innovation & Entrepreneurship	UR	✓	✓					
HIST 122	Modern History of Bahrain and Citizenship	UR	✓	✓					
HRLC 107	Human Rights Principles	UR	✓	✓					
ISLM 103	Islamic Culture	UR	✓	✓					
ENGL 101	Communication Skills I	CR	✓	✓					
ENGL 242	Report Writing and Presentation	CR	✓	✓					
MATHS 101	Calculus I	CR	✓	✓					
MATHS 102	Calculus II	CR	✓	✓					
MATHS 203	Calculus III	CR	✓	✓					
MATHS 205	Differential Equations	CR	✓	✓					
MENG 302	Engineering Economics	CR	✓			✓			
STAT 276	Statistical Data Analysis for Engineering	CR	✓	✓					