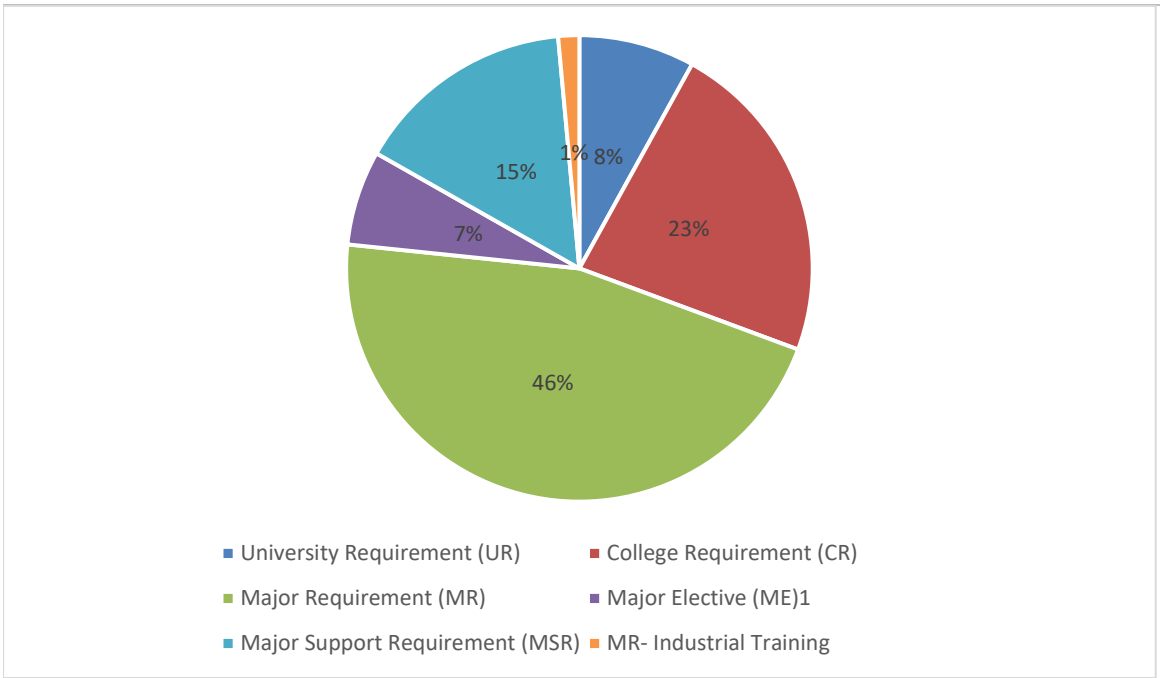
Bachelor of Science in Chemical Engineering 2014

Program Components



University Requirement (UR)	**11**
College Requirement (CR)	**31**
Major Requirement (MR)	**63**
Major Elective (ME)[1]	**9**
Major Support Requirement (MSR)	**21**
Minor Requirements (Minor)	**------**
MR- Industrial Training	**2**
Total Credit (CRD)	**137**

[1] Student must choose three elective courses from Major Elective Courses list.

Teaching Language: English

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	3	4	CR	------	No
CSC 103	Computer Programming for Scientists and Engineers	3	2	3	CR	------	No

ENGL 101	Communication Skills I	3	0	3	CR	------	No
MATHS 101	Calculus I	3	0	3	CR	------	No
PHYCS 111	Fundamentals of Physics	3	3	4	MSR	------	No

Year 1 - Semester 2

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
CHENG 111	Introduction to Chemical Engineering	4	1*	4	MR	CHEMY 101	Yes
ENGL 102	Composition and Reading II	3	0	3	CR	ENGL 101	No
ISLM 101	Islamic Culture	3	0	3	UR	------	No
MATHS 102	Calculus II	3	0	3	CR	MATHS 101	No
HRLC 107	Human Rights	2	0	2	UR	------	No

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	3	3	MSR	CHEMY 102	No
CHENG 211	Chemical Engineering Thermodynamics I	3	1*	3	MR	CHENG 111	Yes
CHENG 213	Applied Physical Chemistry	3	1	3	MR	CHEMY 102 CHENG 111	Yes
CHENG 242	Technical Report Writing and Presentation	1	1*	1	MR	ENGL 102	Yes
MATHS 203	Calculus III	3	0	3	CR	MATHS 102	No
STAT 273	Probability and Statistics	3	0	3	CR	MATHS 101	No

Year 2 - Semester 4

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
CHEMY 310	Analytical Chemistry for Chemical Engineering	2	3	3	MSR	CHEMY 102	No

CHENG 212	Chemical Engineering Thermodynamics II	3	1*	3	MR	CHENG 211	Yes
CHENG 214	Fluid Mechanics	3	1*	3	MR	CHENG 211	Yes
CHENG 290	Junior Project	0	3	1	MR	CHENG 211 CHENG 242	Yes
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	No

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHENG 312	Separation Processes I	3	1*	3	MR	CHENG 212	Yes
CHENG 314	Heat Transfer	3	1*	3	MR	CHENG 214	Yes
CHENG 315	Computer Applications in Chemical Engineering	0	6	2	MR	CHENG 211& CSC 103	Yes
CHENG 316	Numerical Analysis	3	1*	3	MR	MATHS 205	Yes
EENG 361	Circuits and Electronics	3	2	4	MSR	------	No
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	------	No

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHENG 301	Properties and Strength of Materials	3	1	3	MR	PHYCS 111	Yes
CHENG 313	Separation Process II	3	1*	3	MR	CHENG 312	Yes
CHENG 323	Chemical Reactor Design	3	1*	3	MR	CHENG 212 & CHENG 213	Yes
CHENG 324	Process Modeling and Simulation	3	1*	3	MR	CHENG 315 & MATHS 205	Yes
CHENG 325	Chemical Engineering Laboratory I	0	6	2	MR	CHENG 242 & CHENG 314	Yes
MENG 300	Engineering Economics	3	1*	3	CR	Completion of 60 credits	No

Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHENG 390	Industrial Training	0	6	2	MR-Training	Completion of 85 credits	Yes

Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHENG 415	Process Control	3	1*	3	MR	CHENG 324	Yes
CHENG 421	Process Equipment Design	3	1*	3	MR	CHENG 313 & CHENG 314	Yes
CHENG 422	Chemical Plant Design	3	1*	3	MR	CHENG 313 & CHENG 323	Yes
CHENG 490	Senior Project	0	9	3	MR	Completion of 85 credits & CHENG 290	Yes
CHENG 4xx	Elective I	3	0	3	ME	See ME List	Yes
MENG 420	Engineering Management	3	1*	3	MSR	MENG 300	No

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHENG 400	Engineering Ethics	2	0	2	MR	Completion of 85 credits	Yes
CHENG 423	Plant Design Project	0	9	3	MR	CHENG 422	Yes
CHENG 425	Chemical Engineering Laboratory II	0	6	2	MR	CHENG 313 & CHENG 323& CHENG 325& CHENG 415	Yes
CHENG 491	Seminar	0	2	1	MR	Completion of 85 credits	Yes
CHENG 4xx	Elective II	3	0	3	ME	See ME List	Yes
CHENG 4xx	Elective III	3	0	3	ME	See ME List	Yes

* Tutorial hour. Otherwise, “PRAC” refers to lab hours, or lab and Tutorial hours (MR course), or training hour.

Major Elective Coures[1]

[1] Student must choose three elective courses from Major Elective Courses list.

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHENG 443	Petroleum Refinery Engineering	3	0	3	ME	CHENG 313	Yes
CHENG 445	Petrochemical Processing	3	0	3	ME	CHEMY 220 & CHENG 323	Yes
CHENG 447	Petroleum Engineering	3	0	3	ME	CHENG 212	Yes
CHENG 457	Corrosion Engineering	3	0	3	ME	CHENG 213 & CHENG 301	Yes
CHENG 460	Quality Assurance and Reliability Engineering	3	0	3	ME	MENG 300 & STAT 273	Yes
CHENG 461	Process Integration	3	0	3	ME	CHENG 314	Yes
CHENG 462	Special Topics	3	0	3	ME	Department consent	Yes
CHENG 463	Fundamentals of Water Desalination	3	0	3	ME	CHENG 313	Yes
CHENG 464	Environmental Engineering	3	0	3	ME	CHENG 312	Yes
CHENG 465	Process Safety	3	0	3	ME	CHENG 325	Yes

Course Description

Course Code: CHENG 111 **Course Title:** Introduction to Chemical Engineering
Units and dimensions. Process and process variables. Process flowchart. Material balances with and without chemical reactions including bypass and recycle. Gas laws, compressibility factor. Multiple-phase systems. Forms of energy. Energy balance for open and closed systems. Combined material and energy balances. *(One tutorial hour)

Course Code: CHENG 211 **Course Title:** Chemical Engineering Thermodynamics I
Thermodynamic quantities and definitions. Forms of energy and energy transfer. First law of thermodynamics. Equations of state and PVT properties of pure substances. Applications of the first law to closed, steady-flow, and unsteady flow systems. The second law of thermodynamics, heat engines and heat pumps, reversible and irreversible processes, and Carnot cycle. Entropy, entropy change of pure substances, and entropy relations. Applications of the second law to steady-flow devices, vapor power cycles, and vapor-compression refrigeration cycles. *(One tutorial hour)

Course Code: CHENG 212 **Course Title:** Chemical Engineering Thermodynamics II
Review of laws of thermodynamics, energy and entropy balances, equations of state and PVT relationships. Maxwell's equations and relationships of thermodynamic properties, their estimation and representations. Thermodynamic properties of fluids. Introduction to vapor-liquid equilibrium. Solution thermodynamics theory and applications. Chemical reaction equilibria. *(One tutorial hour)

Course Code: CHENG 213 **Course Title:** Applied Physical Chemistry
Chemical kinetics: order of reactions, rate of reaction, mechanisms of homogeneous reactions. Surface chemistry: physical and chemical aspect of solid surface, adsorption theories, catalysis, kinetics of heterogeneous reactions, electrochemistry.

Course Code: CHENG 214 **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. *(One tutorial hour)

Course Code: CHENG 242 **Course Title:** Technical Report Writing and Presentation
Technical Report Writing and Presentation prepares students to design and compose effective technical documents, with particular emphasis on technical reports and oral presentation. The lecture hour is dedicated to theories, techniques and presentations. The tutorial hour is assigned to discuss the writing reports feedbacks. *(One tutorial hour)

Course Code: CHENG 290 **Course Title:** Junior Project
The course is meant to develop creative design skills in the students by exposing them to some ongoing important projects in the country and requiring them to submit report on a chosen project highlighting various design components. Field trips may be arranged in coordination with the industry. The project will emphasize independent learning and teamwork. The lectures will include introduction to chemical engineering profession, description of various areas of specialization, professional report writing techniques and the role of chemical engineers in the society.

Course Code: CHENG 301 **Course Title:** Properties and Strength of Materials
Type and structure of materials. Mechanical properties and behavior of materials. Strengthening mechanisms. Chemical and electrical properties of materials. Engineering applications of metals, ceramics and polymers. Equilibrium of rigid bodies, centers of gravity, moments of inertia, forces in beams. Concepts of stress and strain, axially loaded bars, torsion of circular shafts and pure bending of beams.

Course Code: CHENG 312 **Course Title:** Separation Processes I
Mass transfer fundamentals. Diffusion coefficients. Mass transfer coefficients, definition of the mass transfer coefficient, theoretical models for mass transfer, overall mass transfer coefficients. Analogies between mass, momentum, and heat transfer, mass transfer correlations. Applications of rate based method for packed columns: gas-liquid absorption, distillation, and cooling towers. Membrane separation, reverse osmosis, electrodialysis. *(One tutorial hour)

Course Code: CHENG 313 **Course Title:** Separation Processes II
Single equilibrium stages and flash calculations. Continuous distillation: McCabe-Thiele and Ponchon-Savarit methods. Liquid-liquid extraction for ternary systems. Batch distillation with reflux. Plate efficiency. Approximate methods for multi-component separations. Degrees of freedom and specifications for countercurrent cascades stream variables. Equilibrium-based methods for multi-component absorption: stripping, distillation, and extraction. Drying of solids, adsorption and adsorption isotherms. *(One tutorial hour)

Course Code: CHENG 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. *(One tutorial hour)

Course Code: CHENG 315 **Course Title:** Computer Applications in Chemical Engineering
Classification of chemical engineering software. MATLAB: programming and applications, control flow and looping, functions, script files, symbolic processing, selected toolboxes. SIMULINK. HYSYS: main features of process simulators. Simulation of selected unit operations and process flowsheets. Applications using other available software packages.

Course Code: CHENG 316 **Course Title:** Numerical Analysis
Selected matrix and vector operations. Numerical solution of systems of linear equations: Gauss and Gauss-Siedel. Numerical solution of nonlinear equations: bisection, Newton-Raphson and Wegstein's method. Newton's method for simultaneous nonlinear equations. Finite difference methods. Interpolation. Numerical differentiation and integration. Solution of ODE's: Euler, Runge-Kutta and shooting method. Linear and nonlinear regression. A general purpose software such as MATLAB and process engineering application examples used throughout the course. *(One tutorial hour)

Course Code: CHENG 323 **Course Title:** Chemical Reactor Design
The mole balance. Ideal reactors: isothermal reactor design of constant and variable density systems. Pressure drop in reactors. Non-isothermal reactor design. Multiple reactions and design of reactors for multiple reactions. Catalysis and kinetics of heterogeneous reactions. Heterogeneous reactors. Heat and mass transfer in heterogeneous reactors. *(One tutorial hour)

Course Code: CHENG 324 **Course Title:** Process Modeling and Simulation
Classification and uses of mathematical models. A general framework for model development, solution and validation. Modeling and simulation of the steady-state and dynamic behaviour of several processes. Review of Laplace transforms. Linearization. Transfer function and state space models. Dynamic response of first-order, second-order and more complicated processes (high-order, time delays, lead-lag, etc.). Empirical dynamic models.
*(One tutorial hour)

Course Code: CHENG 325 **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 team work, technical report writing and oral presentation skills. At least one experiment should demonstrate on-line measurement and data acquisition.

Course Code: CHENG 390 **Course Title:** Industrial Training
In this training course all students in the program must participate in an approved training program in the 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: CHENG 400 **Course Title:** Engineering Ethics
Scope of engineering ethics. Moral reasoning and resolving ethical dilemmas. Codes of ethics. Engineering as experimentation, engineers as responsible experimenters. Commitment to safety: safety and risk. Teamwork: definition, types of teams and groups. Confidentiality and conflict interest. Conflict management. Honesty, environmental ethics, global issues. Engineering and technological progress: optimism, pessimism and realism, shared responsibility, moral leadership.

Course Code: CHENG 415 **Course Title:** Process Control
Elements of a feedback control loop. P&I Diagrams. PID controller. Control system instrumentation. Block diagrams. Transient behavior of closed-loop control systems. Stability analysis. Controller tuning. Controller design: direct synthesis and frequency response methods. Feedforward, cascade, ratio, override and selective control. Time delay compensation. Multi-loop control. Introduction to intelligent and model predictive control. Interaction between process design and process control. *(One tutorial hour)

Course Code: CHENG 421 **Course Title:** Process Equipment Design
Fluid flow and fluid handling, head loss calculations, economic pipe size, design of pumping systems. Mixing and agitation of liquids. Estimation of individual, overall and fouling heat transfer coefficients. Design of shell-and-tube heat exchangers, and fired heaters. Mass transfer operations, shortcut design methods, tray hydraulics and efficiencies. Process vessels design. *(One tutorial hour)

Course Code: CHENG 422 **Course Title:** Chemical Plant Design
Methodology of approaching open-ended design problems. Engineering method of design, hierarchy of decisions, structures of process flow sheets and evolution of process design. Economic methods of estimating capital and production costs, profitability analysis. Safety and environmental impacts of chemical processes. *(One tutorial hour)

Course Code: CHENG 423 **Course Title:** Plant Design Project
The course is a comprehensive design problem, preferably of local nature, to be undertaken by students working in groups and individually. It presents an overall analysis of the major factors involved in process design, with particular emphasis, on economic, environmental, safety and health considerations. The design project illustrates computer-aided plant design. Written design reports and oral presentations are required.

Course Code: CHENG 425 **Course Title:** Chemical Engineering Laboratory II
Laboratory safety awareness. Experiments in reaction engineering, process control and unit operations involving mass transfer. Error analysis and interpretation of experimental data. Team work and communication skills. Designing and conducting at least one experiment. Applications of virtual reality experiments.

Course Code: CHENG 490 **Course Title:** Senior Project
Students are to undertake an independent project in chemical engineering, which may be of experimental or theoretical nature. It should demonstrate the ability of the student to define a proposition, to develop it logically and accurately and draw conclusions from the study. Upon completion of the study, written and oral presentations are required.

Course Code: CHENG 491 **Course Title:** Seminar
The course is intended to enhance students' capability to use available resources, like library and internet, to prepare seminars on selected topics in order to develop skills and apprise them of lifelong learning and contemporary issues. The students will work in teams on the assigned seminar topics and give oral presentations. The invited guest speakers will give talks on topics related to engineering profession. The students' attendance is compulsory and they will be required to submit summary of the lecture giving important salient features, which will be evaluated.

Course Code: CHENG 443 **Course Title:** Petroleum Refinery Engineering
Refinery organization. Refinery feed stock and products. Oil characterization using a software. Production details of light, intermediate and heavy cuts. Chemical conversion processes like cracking, reforming, alkylation and polymerization. Finishing processes. Products testing and quality control. Typical design calculations of processes and important equipment should be emphasized at every stage.

Course Code: CHENG 445 **Course Title:** Petrochemical Processing
Overview of the petrochemical industry. Raw materials for the petrochemical industry. Production of the basic petrochemical feed stocks. Petrochemical derivatives based on methane, ethylene, propylene, C4's, benzene, toluene, and xylene. Production of ammonia, methanol and urea and the various alternatives for technology suppliers, key process equipment, operating conditions.

Course Code: CHENG 447 **Course Title:** Petroleum Engineering
Origin of petroleum hydrocarbons. Driving and trapping mechanisms. Geophysical methods. Chemical composition of petroleum hydrocarbons. Rock properties. Properties of liquid petroleum and natural gas. Volumetric calculations of oil and gas in place. Material balance methods. Oil-well drilling techniques. Oil-well completion methods. Well log analysis. Oil and gas production operations. Decline-curve analysis.

Course Code: CHENG 457 **Course Title:** Corrosion Engineering
Corrosion mechanisms. Forms of corrosion. Corrosion testing and inspection methods. Important process variables in corrosion severity. Prevention of corrosion: physical, chemical, and electrical methods. Design considerations and material selection. Case studies.

Course Code: CHENG 460 **Course Title:** Quality Assurance and Reliability Engineering Quality assurance, understanding, commitment, leadership, and organization. The role of quality system, planning, 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: CHENG 461 **Course Title:** Process Integration
Energy targets for heat exchanger networks and utilities. Composite curves, the heat recovery pinch, the threshold problems. The problem table algorithm, process constraints. Utility selection, furnaces, combined heat, and power (co-generation). Integration of heat pump and refrigeration cycles. Heat exchanger: number of units and targets. Heat exchanger network design, the pinch design method. Heat integration of reactors, use of the grand composite curve. Heat Integration of distillation columns.

Course Code: CHENG 462 **Course Title:** Special Topics
Any important, relevant topic that is not covered in the given elective list. Topics may be varied subject to students' interest and availability of staff.

Course Code: CHENG 463 **Course Title:** Fundamentals of Water Desalination
Drinking and industrial water qualities. Compositions of sea water and ground water. Classification of desalination processes. Water pre-treatment. Fouling in thermal and membrane processes. MSF, MED and VC thermal desalination processes. RO desalination processes. Water post-treatment. Economics of desalinated water.

Course Code: CHENG 464 **Course Title:** Environmental Engineering
Impact of industries on environment and global effects. Air pollution: major constituents, greenhouse gases, ecological effects, and pollution monitoring and pollution control. Water pollution: wastewater standards, wastewater specifications, wastewater causes. Wastewater treatment: physical methods, chemical methods, and biological methods. Marine pollution. Thermal pollution. Solid waste: treatment, handling, land filling, incineration, composting. Environmental standards and legislation.

Course Code: CHENG 465 **Course Title:** Process Safety
Safety awareness. Learning from disasters. Hazard, accident and risk. Types of hazards and hazard identification; HAZOP. Dispersion models. Flammability characteristics and industrial process explosions. Inherently safer pre-design. Risk assessment and management.

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: CHEMY 310 **Course Title:** Analytical Chemistry for Chemical Engineering
Treatment of analytical data; gravimetric and volumetric methods of analysis, acid base equilibria; potentiometric methods of analysis; ion selective electrodes; spectrophotometric methods of analysis; UV/visible, infrared and atomic absorption spectrometry; gas and liquid chromatography.

Course Code: EENG 361 **Course Title:** Circuits and Electronics for Chemical Engineering
Introduction to electrical systems. Current and voltage sources, current and voltage conversions, Ohm's law, power and energy. Series and parallel circuits, Kirchoff's voltage and current laws. Networ theorems, mesh and nodal analysis. Superposition and Thevenin's theorem. Maximum power transfer theorem. Inductors, capacitors, impedances and AC circuits. Complex numbers and related mathematical operations. Mathematical operations with complex numbers and phasors. Diodes and bipolar junction transistors. Ideal op-amp applications (A/D and D/A converters).

Course Code: MENG 420 **Course Title:** Engineering Management

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. *(One tutorial hour)

Course Code: PHYCS 111 **Course Title:** Fundamentals of Physics for Engineering and Education

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.

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
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 reactions 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: CSC 103 **Course Title:** Computer Programming for Scientists and Engineers
Introduction to computers, their uses, development, components, hardware, and software. Internal representation and numbering systems. Algorithmic problem solving principles. Introduction to a modern programming language (e.g. C++). Input/Output, conditional statements, iteration, files, strings, functions and arrays. Lab assignments to practice programming.

Course Code: ENGL 101 **Course Title:** Communication Skills I
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 102 **Course Title:** Composition and Reading II
A continuation of English 101 which further develops the students' skills in reading and writing. The course exposes students to wider range of reading material aimed at developing their understanding of different styles of English.

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: MENG 300 **Course Title:** Engineering Economics
Introduction to engineering economics. Principles of money time relationships. Present worth analysis. Annual worth analysis. Rate of return analysis. Benefit/cost analysis. Breakeven analysis and payback period. Capital rationing among independent proposals. Replacement and retention analysis. Cost estimation and indirect cost allocation. Depreciation and depletion. Inflation and deflation. Decision making under risk. Case studies. *(One tutorial hour)

Course Code: STAT 273 **Course Title:** Probability and Statistics
Descriptive statistics, Introduction to probability and probability distributions. Some of probability Densities, Sampling distributions. Central limit theorem. t and F distributions. Estimation. Tests of hypotheses. Goodness of fit tests. Regression and correlation.