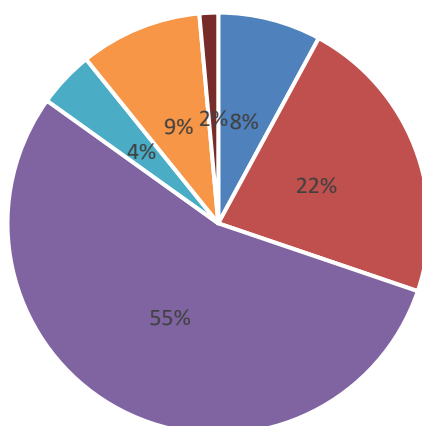


# Bachelor of Science in Mechanical Engineering 2014

## Program Components



- University Requirement (UR)
- College Requirement (CR)
- General Studies Compulsory (GSCC)
- Major Requirement (MR)
- Major Elective (ME)<sup>1</sup>
- Major Support Requirement (MSR)
- General Studies Elective (GSE)
- Training (Internship) Yes

University Requirement (UR)	11
College Requirement (CR)	31
General Studies Compulsory (GSCC)	--
Major Requirement (MR)	76
Major Elective (ME) <sup>1</sup>	6
Major Support Requirement (MSR)	13
General Studies Elective (GSE)	--
Training (Internship) Yes	2
Total Credit (CRD)	139

<sup>1</sup> Student must select two (4XX) courses from Major Elective(ME) List.

## 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			
ENGL 102	Composition and Reading II	3	0	3	CR	ENGL 101	No
MATHS 102	Calculus II	3	0	3	CR	MATHS 101	No
MENG 110	Workshop Processes	1	3	2	MR	-----	YES
MENG 160	Engineering Graphics	2	6	4	MR	-----	YES
MENG 163	Statics	3	1	3	MR	PHYCS 111	YES
PHYCS 209	Bulk Properties of Matter	3	2	3	MSR	PHYCS 111	No

### Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
HRLC 107	Human Rights	2	0	2	UR	-----	No
MENG 242	Technical Report Writing and Presentation	1	1	1	MR	ENGL 102	Yes
MATHS 203	Calculus III	3	0	3	CR	MATHS 102	No
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	No
MENG 201	Materials Science	3	1	3	MR	CHEMY 101	Yes
MENG 231	Engineering Thermodynamics	3	1	3	MR	PHYCS 209	Yes
MENG 263	Dynamics	3	1	3	MR	MENG 163	Yes

### Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 211	Linear Algebra	3	0	3	MSR	MATHS 101	No
MENG 210	Manufacturing Processes I	3	1	3	MR	MENG 110	YES
MENG 235	Applied Thermodynamics	3	1	3	MR	MENG 231	YES
MENG 274	Numerical Analysis	2	3	3	MR	MATHS 205	YES
MENG 290	Junior Project	0	3	1	MR	MENG 160 & MENG 242	YES
STAT 273	Probability and Statistics	3	0	3	CR	MATHS 101	No

### Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
EENG 301	Elements of Electrical Engineering	3	1	3	MSR	-----	No
MENG 310	Manufacturing Processes II	3	1	3	MR	MENG 210	YES
MENG 334	Fluid Mechanics	3	1	3	MR	MATHS 205	YES
MENG 371	Mechanics of Materials	3	1	3	MR	MENG 201	YES
MENG 373	Kinematics and Dynamics of Machinery	3	1	3	MR	MENG 263	YES
MENG 380	Computer Applications in Mechanical Engineering	0	6	2	MR	MENG 274	YES

### Year 3 - Semester 6

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
MENG 300	Engineering Economics	3	1	3	CR	Completion of 60 credits	YES
MENG 375	Design of Mechanical Elements	2	3	3	MR	MENG 371	YES
MENG 381	Measurements and Instrumentation	2	3	3	MR	EENG 301	YES
MENG 384	Vibration	3	1	3	MR	MENG 373	YES
MENG 335	Heat Transfer	3	1	3	MR	MENG 334	YES

### Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MENG 390	Industrial Training	0	6	2	<b>MR-Training</b>	Completion of 85 credits	YES

### Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ISLM 101	Islamic Culture	3	0	3	UR	-----	No
MENG 400	Engineering Ethics	2	0	2	MR	Completion of 85 credits	YES
MENG 420	Engineering Management	3	1	3	MR	MENG 300	YES
MENG 475	Design of Mechanical Systems	2	3	3	MR	MENG 375	YES
MENG 485	Systems and Control	3	1	3	MR	MENG 274	YES
MENG 490	Senior Design Project	0	9	3	MR	Completion of 85 credits & MENG 290	YES

### Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	-----	No
MENG 430	Power Plant and Desalination	3	1	3	MR	MENG 335	YES
MENG 440	Refrigeration and Air Conditioning	3	1	3	MR	MENG 335	YES
MENG 491	Seminar	0	2	1	MR	Completion of 85 credits	YES
MENG 4xx	Major Elective I	3	1	3	ME	As per ME list	YES
MENG 4xx	Major Elective II	3	1	3	ME	As per ME list	YES

## Major Elective Courses

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MENG 441	Energy Conversion and Management	3	1	3	ME	MENG 335	Yes
MENG 442	Fluid Machinery	3	1	3	ME	MENG 334	Yes
MENG 444	Internal Combustion Engines	3	1	3	ME	MENG 235	Yes
MENG 446	Design of Thermal Systems	3	1	3	ME	MENG 335	Yes
MENG 401	Materials and Process Selection	3	1	3	ME	MENG 310	Yes
MENG 410	Production and Processing of Aluminum	3	1	3	ME	MENG 210	Yes
MENG 423	Computer Aided Manufacturing (CAM)	3	1	3	ME	MENG 310	Yes
MENG 471	Failure Analysis	3	1	3	ME	MENG 371	Yes
MENG 473	Tribology	3	1	3	ME	MENG 375	Yes
MENG 476	Control Systems Design	3	1	3	ME	MENG 485	Yes
MENG 477	Machine Health Monitoring	3	1	3	ME	MENG 384	Yes
MENG 455	Special Topics	3	1	3	ME	Department Consent	Yes

## Course Description

**Course Code:** MENG 110

**Course Title:** Workshop Processes

Safety in workshop. Engineering materials. Measurements: linear and angular measurements, gauges and comparison measurements. Layout tools and procedures. Hand tools and bench works. Material removal processes: shaping, turning, milling, drilling and grinding. Casting and forming processes: sand casting, centrifugal casting, forging, rolling, and sheet metal works. Joining processes: gas welding, arc welding, resistance welding and plastic welding.

**Course Code:** MENG 160

**Course Title:** Engineering Graphics

Introduction to AutoCAD, basic AutoCAD 2-D drawing and modifying commands: isometric and oblique views, orthographic projection, sectional and auxiliary views, linear dimensioning, fundamentals of interpenetrations and developments of surfaces. Limits and fits: geometric tolerances, fasteners and fastenings, surface finish notations, welds and welding symbols and representations of standard elements.

**Course Code:** MENG 163

**Course Title:** Statics

Introduction to statics, forces in plane, forces in space, equilibrium of particles and rigid bodies in two and three dimensions, centroid and center of gravity, distributed forces, moment of inertia, analysis of trusses, frames and machines, forces in beams, friction in square-threaded screws and bolts, method of virtual work.

**Course Code:** MENG 201

**Course Title:** Materials Science

Introduction and classification of materials. Bonding. Structure of Materials. Imperfections in solids. Phase diagrams and microstructure. Diffusion. Phase transformations. Mechanical behavior of materials. Viscoelasticity. Electrical and magnetic properties. Effect of environment on behavior of materials. Introduction to failure analysis. Materials selection in mechanical design. Case studies. Use of computers in materials science.

**Course Code:** MENG 210

**Course Title:** Manufacturing Processes I

Production of iron and steel. Production of aluminum. Metal casting: sand casting, die casting, and investment casting. Bulk deformation processes: hot and cold working, forging, rolling, extrusion and drawing. Joining of materials: welding of metals, adhesive joining.

**Course Code:** MENG 231

**Course Title:** Engineering Thermodynamics

Thermodynamic systems, property, state, process, cycle and equilibrium. Energy and the first law of thermodynamics: Energy balance for closed systems, energy analysis for cycles. Properties of pure substances. Control volume energy analysis. Second law of thermodynamics: statements of second law, Carnot cycle. Maximum performance measures for power, refrigeration and heat pump cycles operating between two reservoirs.

**Course Code:** MENG 235

**Course Title:** Applied Thermodynamics

Second law of thermodynamics. Irreversibility and availability: second law efficiency, non-flow exergy and flow exergy. Exergy destruction. Vapor power cycles and exergy analysis: basic Rankine cycle, Otto cycle, Diesel cycle, Brayton cycle. Refrigeration: vapor-compression refrigeration, refrigerant properties, absorption refrigeration. Heat pump systems. Nonreacting ideal gas mixtures and Psychrometrics. Dry-bulb and wet-bulb temperatures. Psychrometric charts and psychrometric applications.

**Course Code:** MENG 242

**Course Title:** Technical Report Writing and Presentation

Technical Report Writing prepares students to design and compose effective technical documents, with particular emphasis on technical reports and oral presentations. The lecture hour is dedicated to theories, techniques and presentations. The tutorial hour is assigned to discuss the written reports feedbacks.

**Course Code:** MENG 263

**Course Title:** Dynamics

Rectilinear and curvilinear motion of the particles, kinetics of particles, linear and angular momentum, work, energy and power, principle of impulse and momentum, impact: kinematics of rigid bodies, kinetics of rigid bodies, introduction to three-dimensional dynamics of rigid bodies. Computer applications are employed throughout the course.

**Course Code:** MENG 274

**Course Title:** Numerical Analysis

Taylor series, Matrix algebra: Gauss-Jordan elimination, EVP. Interpolating polynomials, least square method, integration rules: trapezoidal, Simpson's, improper integrals. Finite difference formulation; differentiation schemes, roots of equations. Initial and boundary value problems of ODE: Euler and Runge-kutta methods. Finite Element: shape functions, elemental matrices, global coordinates, elements assembly. Applications using commercial packages.

**Course Code:** MENG 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:** 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.

**Course Code:** MENG 310

**Course Title:** Manufacturing Processes II

Sheet metal processes: Piercing, coining, stamping, deep drawing, and stretch forming. Metal cutting: theory of metal cutting, multi-point cutting, abrasive cutting, machinability and economics of metal cutting. Non-traditional machining. CNC machining. Powder and polymer processing. Metrology: Surface texture and geometrical feature measurement.

**Course Code:** MENG 334

**Course Title:** Fluid Mechanics

Fluid kinematics, energy and Bernoulli's equation. Dimensional analysis and similitude. Differential relations in three dimensions: velocity and acceleration, Navier Stokes relations, energy relation, introduction to stream and potential functions, introduction to boundary layer theory with applications to flat plates, cylinders, internal and external pipe flows. Compressible flow, normal shock waves.

**Course Code:** MENG 335

**Course Title:** Heat Transfer

Basic modes of heat transfer. Thermal circuits, surface energy balance. Steady one-dimensional heat conduction, conduction across flat plate, cylindrical and spherical shells. Fins. Convection fundamentals and correlations, external flow, internal flow, tube banks, impinging jets, packed beds. Types of heat exchangers, overall heat transfer coefficient, design of heat exchanger. Radiation, black body and gray radiation, view factor, radiation exchange between surfaces.

**Course Code:** MENG 371

**Course Title:** Mechanics of Materials

The concept of stress and strain, types of stresses, types of loading: axial loads, pure bending symmetric and unsymmetrical bending, torsion. Deflection of beams, statically indeterminate beams, curved beams, buckling of columns, shear centre, thin and thick-walled pressure vessels. Analysis of interference fit applications, fatigue strength, marine factors, introduction to fatigue failure theories, finite element applications, introduction to the theory of elasticity and plasticity.

**Course Code:** MENG 373

**Course Title:** Kinematics and Dynamics of Machinery

Basic concepts of mechanisms and machines, analysis of displacement, velocity and acceleration of mechanisms, static and dynamics force analysis, cam design, spur, helical, bevel and worm gears, ordinary and epicycle gear trains, balancing of rotating and reciprocating machinery, and flywheels. Computer applications are employed throughout the course.

**Course Code:** MENG 375

**Course Title:** Design of Mechanical Elements

Design consideration; Assembly loading analysis, stresses and strain analysis for static and fatigue loading. The design, selection, analysis, and synthesis of springs, joining and fastening methods, shafts, and other elements. Design project using computer facilities.



**Course Code:** MENG 380                      **Course Title:** Computer Applications in Mechanical Engineering  
Fundamentals of MATLAB programming and basic commands, 2D and 3D graphics. Data manipulation and presentation, model building, application of linear and nonlinear algebraic and differential equations in mechanical engineering systems, numerical solution of optimization problem, virtual prototyping, finite element applications, case studies.

**Course Code:** MENG 381                      **Course Title:** Measurements and Instrumentation  
The process of measurements, error analysis and experimental data representation, analogue and digital signal processing and conditioning, aliasing, leakage, windowing, DFT, FFT, dynamic response of measuring systems, sensors. Applications including the measurements of speed, displacement, force, torque, pressure, fluid flow, temperature, vibration and acoustic noise.

**Course Code:** MENG 384                      **Course Title:** Vibration  
A review of simple harmonic motion and Fourier series, undamped and damped free vibration of SDFS, Coulomb damping, torsional vibration, forced vibration of SDFS: equivalent viscous damping, vibration isolation and control, transient vibration to arbitrary excitation, multi-degree of freedom systems, modal analysis, dynamic absorber, forced vibration of lumped mass system. Lagrange's equation, applications using computer facilities.

**Course Code:** MENG 390                      **Course Title:** Industrial Training  
In this industrial 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:** MENG 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:** 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.

**Course Code:** MENG 430                      **Course Title:** Power Plant and Desalination  
Power stations classifications, steam power plant, feed water heaters, performance. Steam generators, fuels and combustion processes, turbine, water systems. Gas power stations and diesel power plant, characteristics and performance. Combined power cycles. Co-generation concepts and systems. Power generation and environmental impact. Water desalination, reverse osmosis, multiple flash evaporator.

**Course Code:** MENG 440                      **Course Title:** Refrigeration and Air Conditioning  
Applications of Refrigeration and Air Conditioning: Major uses. Air-conditioning processes and cycles. Refrigerant and refrigeration cycles. Outdoor design conditions and indoor design criteria. Load calculation. Refrigeration components and evaporative coolers. Air system basics: fan and duct systems, fan combinations in air-handling units and packaged units. Absorption systems: the absorption cycle. Air conditioning systems and selection.

**Course Code:** MENG 475                      **Course Title:** Design of Mechanical Systems  
Design and analysis of mechanical systems based on critical studies of high performance machinery. Applications of design fundamentals to mechanical components, and integration of components to form systems. Advanced techniques such as optimization and finite element analysis, design case studies using the computer facilities (at least 2 case studies).

**Course Code:** MENG 485

**Course Title:** Systems and Control

Concept of systems, concept of open & closed loop systems, modeling of systems, state variable models, systems performance and characteristics, stability and sensitivity analysis, basic control actions, root-locus analysis & design, frequency response analysis & design, introduction to modern control, applications.

**Course Code:** MENG 490

**Course Title:** Senior Design Project

Senior students are required to carry out a design project using knowledge and skills obtained in prior courses wherein they incorporate engineering standards and multiple realistic constraints such as economic, ethical, social, political, environmental, health and safety, manufacturability and sustainability. The students are expected to work in teams and are required to submit a written report and conduct an oral presentation.

**Course Code:** MENG 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:** MENG 401

**Course Title:** Materials and Process Selection

Interrelation between materials processing and design. Effect of stress, temperature and environment on material performance. Principles of materials and process selection. Materials and process selection charts. Economics of materials and process selection. Industrial design. Case studies.

**Course Code:** MENG 410

**Course Title:** Production and Processing of Aluminum

Flow diagrams and process description of various sections of aluminum plant including raw materials preparation, carbon plant, anode and cathode preparation, pot-house and finished product, and furnace operation. Principles of electrochemistry and current efficiency. Production of aluminum alloys. Cast Aluminum Alloys: Development of cast structure. Cold work and annealing of aluminum and its alloys. Recrystallization during hot working. Metallurgical principles of solid solution and precipitation hardening aluminum alloys.

**Course Code:** MENG 421

**Course Title:** Operations Research

Linear Programming: formulation of Linear Programming models, graphical solution, and simplex method. Duality theory and sensitivity analysis. Transportation problem, assignment model, and transshipment model. Introduction to Dynamic, Integer and Goal Programming. Decision theory and analysis. Simulation modeling. Queuing theory: Poisson queuing models, queuing decision models, and applications.

**Course Code:** MENG 423

**Course Title:** Computer Aided Manufacturing (CAM)

Concept of computer aided manufacturing, numerical control, group technology, computer aided process planning, computer aided production planning and control, computer integrated manufacturing systems (CIM) including CAD, CAM, FMS, bar coding and optical scanning, and robotics. Evaluation of Software and hardware systems involved, implementation of CAM.

**Course Code:** MENG 425

**Course Title:** Reliability and Maintainability

Reliability definitions. Computing reliability parameters. Reliability Predictions. Evaluating data for failure rate estimation. Graphical Evaluation for reliability prediction. Restorability. Reliability modeling for system prediction.

**Course Code:** MENG 426

**Course Title:** Quality Management

The meaning of quality and quality improvement. Quality philosophies and management strategies. TQM. Quality Systems and standards: ISO 9000:2000, Malcolm Baldrige National Quality Award, and Six Sigma. Quality Costs. Benchmarking. Methods of measurement and basic statistical tools. Methods of Statistical Process Control and Capability analysis. Control charts for variables and attributes. Lot-by-Lot Acceptance Sampling for Attributes. Basic Quality Auditing.

**Course Code:** MENG 441

**Course Title:** Energy Conversion and Management

Solar energy and applications: solar radiation, solar water heating, photovoltaic generation. Power from wind: turbine types and terms, characteristics of wind. Energy storage and distribution. Fuel cells and hydrogen applications. Nuclear, tidal and geothermal energy. Analysis methods and energy saving potentials, energy audit in domestic, transport and industry, economic evaluation of energy conservation opportunities.

**Course Code:** MENG 442

**Course Title:** Fluid Machinery

Classifications of fluid machinery. Momentum and energy transfer between fluid and rotor. Principles and practice of scaling laws. Performance characteristics of centrifugal and axial flow fans, compressors and pumps. Positive displacement pumps. Cavitations and water-hammer problems. Valves, types and characteristics. Performance characteristics of axial and radial flow turbines. Fluid machinery noise.

**Course Code:** MENG 444

**Course Title:** Internal Combustion Engines

Basic engine operation, introduction to engine cycles. Air standard cycles, fuel-air and actual cycles, volumetric efficiency. Performance and the effects of operating variables on it. Two stroke engine air capacity and scavenging. Ideal combustion of S.I engines, real combustion of S.I engines, abnormal combustion of S.I engines, diesel combustion. Emission sources, exhaust after treatment, emission reduction systems and diesel emissions.

**Course Code:** MENG 446

**Course Title:** Design of Thermal Systems

Application of principles of fluid mechanics, heat transfer, and thermodynamics in the component design of thermal systems. Examples are drawn from power generations, environmental control, and industrial processes. Students work on group projects for integration of these components in the design of thermal systems.

**Course Code:** MENG 455

**Course Title:** Special Topics

Any important, relevant and possibly hot topic in the field that is not covered in the approved elective list. Topics may vary based on students' interest and availability of staff.

**Course Code:** MENG 471

**Course Title:** Failure Analysis

Course goals, materials selection, material processing, aesthetics and environmental considerations. Macroscopic and microscopic fracture analysis, Principles of fracture mechanics and failure analysis, tribological failure, types of complete failure: distortion, buckling, yielding, plastic instability, creep, fatigue, cumulative failure, and crack propagation. Fail-safe design analysis, diagnostics methods and control of mechanical failures, case studies of failure analysis.

**Course Code:** MENG 473

**Course Title:** Tribology

Surface properties and surface contact stress; Friction, measurement of friction, theories of friction, thermal effects in sliding friction; Types of wear, wear of lubricated surfaces. Tribological properties of solid materials, solid lubricants, polymers and composites, the pv factor, lubricant properties, fluid lubricated thrust bearings. Fluid-lubricated journal bearings, oil supply grooves, wear failure analysis, and industrial preventive maintenance: case studies.

**Course Code:** MENG 476

**Course Title:** Control Systems Design

Introduction, concept of optimal designs, gain adjustment design methods, closed loop tracking performance, cascade & feedback compensation, root locus compensation, frequency response design, PID Controls, state-space design methods, industrial controllers, actuators, introduction to advanced design methods (QFT, LQG, H<sub>2</sub> & H<sub>∞</sub>), case studies.

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## University Requirements Courses Descriptions

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**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 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.

## Major Support Requirement Courses Descriptions

**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.

**Course Code:** PHYCS 209      **Course Title:** Bulk Properties of Matter

Elasticity; fluid statics and dynamics; mechanical waves; vibrating bodies; acoustic phenomena; kinetic theory of gases; first and second law of thermodynamics; geometrical optics.

**Course Code:** EENG 301      **Course Title:** Elements of Electrical Engineering

Circuit Elements: Resistance, capacitance and inductance. Fundamental circuit laws. Resistive circuit analysis. Sinusoidal steady-state analysis of AC circuits. Three phase circuits. Magnetic circuits and transformers. Three and single phase induction motors: Operating principles, equivalent circuits, torque-speed characteristics, speed control. DC motors: Operating principles, equivalent circuits, torque-speed characteristics, speed control.

**Course Code:** MATHS 211      **Course Title:** Linear Algebra

Fields. Vector spaces. Linear dependence and independence. Bases. Dimensions. Subspaces. Quotient spaces. Linear transformations. Connection with matrices. Change of bases (PAQ and PAP). Eigen-values. Characteristic polynomial. Minimal polynomial. Canonical forms in simple cases. Real and complex inner-product spaces. Orthonormal bases. Orthogonal and complex unitary matrices and their eigen-values. Orthogonal and unitary reduction of real symmetric and complex Hermitian matrices.