

0102100	Introduction to Civil Engineering	2	CH	Prereq:	None
		2	0		

This course is an introduction to the civil engineering profession and its role in society. It discusses creative thinking and critical thinking as integral parts of the engineering decision process, engineering methods of analysis, and problem solving. Students learn about the design process through practice and implementation. Some design projects are team based and students learn how to work effectively with peers. Career opportunities are discussed. Information on typical activities of civil engineers, professional engineering practice, undergraduate program curriculum, and department policies are explained.

0102200	Engineering Drawing	2	CH	Prereq:	None
		0	3		

Introduction to engineering drawing and sketching, type of lines, scales, engineering construction and geometry, theory of orthographic projection, pictorial drawing, isometrics and oblique, drawing sections, working drawing, dimensioning and introduction to computer Aided Drafting (AutoCAD). AutoCAD fundamentals create and save an AutoCAD drawing template, create new drawings, modifying commands, layers, text and dimensions.

0102201	Statics	3	CH	Prereq:	0903101+ 0904101
		3	0		

This course teaches principles of force vectors and resultant, free-body diagrams of forces and equilibrium of particles using concepts of rigid bodies, moment of a force about a point and about an axis, equilibrium of rigid bodies, analysis of trusses and frames, shear forces diagrams, bending moment diagrams, center of area, and moment of inertia of an area.

0102231	Engineering Geology	3	CH	Prereq:	None
		3	0		

A study of earth materials, formation of rocks, surface features, surface and internal structures and their relationship to engineering works. The course discusses analysis of the agents of weathering, erosion, diastrophism and their effect on engineering construction, surface water and groundwater, earthquakes and earth movements, geology and engineering construction, site investigation.

0102251	Surveying	3	CH	Prereq:	0903101
		3	0		

The course teaches theory and practice of plane surveying, including the use of instruments for measuring distances, angles, and elevations, plotting of surveying data and topographic mapping, fundamentals of construction layout.

0102252	Surveying Lab	1	CH	Prereq:	0102251
		0	3		

Concepts taught include fundamentals of surveying methods as applied to construction layout, use of level and total station for location and control of structures, vertical and horizontal control, and area determination.

0102259	Land Surveying	2 CH	Prereq: 0903104
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This course teaches surveying principles and techniques — measurement of distances, triangulation, taping errors/corrections, differential and cross sectional leveling, compass use, measuring heights, elevations, computing angles (amplitude, azimuth), construction and topographic surveys, using traditional and advanced techniques. Tools and methods of architectural surveying are examined. Fieldwork is applied to surveying, documentation, and the analysis of factors contributing to the distinctive aspects of Jordanian regional architecture.

0102271	Construction Materials	3 CH	Prereq: 0104212
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The course examines aspects of construction materials including: production, types, properties and uses of cementitious materials and aggregate, fresh concrete properties, concrete operations, concrete testing, destructive and non-destructive testing of existing concrete structures, durability aspects of concrete, design of concrete mixes, production and properties of masonry units including building stones, concrete blocks and calcium-silicate and clay bricks.

0102310	Engineering Mechanics	3 CH	Prereq: 0903101
		3 0	

This course examines force vectors and resultant Free-Body-Diagram (FBD) forces, supports, equilibrium of particles, moment of a force about a point and about an axis, equilibrium of planar rigid bodies, analysis of simple trusses, internal axial and shear forces and bending moment in beams, shear force and bending moment diagrams in beams, stresses and strains, Hook's law, torsional stresses, axial deformation, introduction to kinematics and kinetics of particles and of planar rigid bodies.

0102311	Structural Analysis (1)	3 CH	Prereq: 0104212
		3 0	

This class includes: classification of structures, supports and loads; equilibrium equations in plane and space; determination of reactions at supports; analysis of trusses; internal forces and moment analysis, axial, shear, and bending moment diagrams for beams and frames; influence lines for determinate structures, and analysis of trusses and beams subjected to the loads of moving vehicles; deflections and rotations, first and second moment area theorems, conjugate beam method, virtual work method; and introduction to methods of analysis for statically indeterminate structures.

0102312	Structural Analysis (2)	3 CH	Prereq: 0102311
		3 0	

This course discusses: determinate, indeterminate stable and unstable structures; analysis of statically indeterminate structures; equilibrium and compatibility equations; virtual work method and Castigliano's second theorem; three moment equations; slope deflection, moment distribution for beams and braced frames, and introduction to matrix structural analysis.

0102313	Structural Laboratory	1 CH	0	3	Prereq: 0102311
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This lab course is an introduction to instrumentation and testing techniques, equilibrium of forces, equilibrium of parallel forces, forces in a truss, bending moment in a beam, shear force in a beam, continuous and indeterminate beams, beam and cantilever deflection, bending moment influence lines, bending stress in a beam, two hinged arch, deflection of trusses, beams, and frames, reinforced concrete beams.

0102319	Structural Systems I	3 CH	3	0	Prereq: 0903104 + 0904104
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The course is an investigation of the basic principles of structural systems through the analysis of overall structural behavior with specific attention to statics and system modeling. This course covers behavior of building structural systems; moment distribution, forces, stability, and mechanical properties of structural materials; analysis of stress, reactions, shear and bending; structural classifications — linear, planar, volumetric; choice of structural systems — column and beam, truss and frame systems, arch and barrel vault systems; and choice of construction materials — reinforced concrete and steel.

0102321	Transportation Engineering	3 CH	3	0	Prereq: 0102251
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This course looks at the operation of various modes of transportation; characteristics of the driver, pedestrian, vehicle and the road; fundamental principles of traffic flow; introduction to intersection design and control, planning, and geometric design; and transportation issues and safety.

0102322	Highway Geometric Design	3 CH	3	0	Prereq: 0102321
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This course considers principles of highway construction to include: selection of route location; horizontal alignment; design and setting out (circular curve element, setting out of circular and transition curves, and super-elevation); vertical alignment; design and setting out (properties of vertical curves); coordination of horizontal and vertical curves; capacity of two-lane highways; and geometric design of intersections.

0102331	Geotechnical Engineering	3 CH	3	0	Prereq: 0104212
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Geotechnical Engineering examines the composition and structure of soils including phase relations and index properties, soil classification, soil compaction, the principle of effective stress, stresses due to self-weight, stresses due to applied loads, soil permeability, and seepage (one and two dimensional), flow net, consolidation theory and consolidation settlement analysis (immediate and consolidation settlement), secondary compression, and shear strength of soils (introductory).

0102341	Fluid Mechanics	3 CH	3	0	Prereq: 0102201
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This study of fluid properties and their significance includes: fundamental mechanics of compressible and incompressible fluid motion with application to engineering problems, resistance of fluids in laminar and turbulent flow, open channel flow, fluid statics, dimensional analysis and similitude.

0102342	Hydraulics	3 CH	3	0	Prereq: 0102341
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This course examines hydraulics of pipe networks, groundwater flow, design criteria, open channel flow, flow measurements, hydraulic structures, pumps and turbines, seepage, hydraulic modeling, and hydrology of surface and ground water.

0102343	Fluid Mechanics and Hydraulics Lab	1 CH	1	0	Prereq: 0102342
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This laboratory course is designed to provide insight into and experience with the fundamental principles taught in fluid mechanics and hydraulics lecture courses. These principles include: fluid properties; density, specific gravity, viscosity; flow characteristics; continuity, conservation of energy; fluid behavior; center of pressure, pipe flow, open channel flow, and pump performance.

0102372	Construction Materials Lab	1 CH	0	3	Prereq: 0102271
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This lab course investigates normal consistency and setting time of cement paste, fresh and mechanical properties of mortar, sieve analysis of aggregate, specific gravity of aggregate, unit weight of aggregate, abrasion test of aggregates, fresh and mechanical properties of concrete, mechanical properties of steel, tests on wood (mechanical and visual), and hardness tests on metals.

0102411	Reinforced Concrete (1)	3 CH	3	0	Prereq: 0102311+ 0102271
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Reinforced concrete structures course includes the examination of ultimate strength and limit state design methods; stress-strain relationships for concrete and steel; ACI requirements; flexural analysis and design of beams; singly reinforced rectangular beams, doubly reinforced rectangular beams, and T-beams; analysis and design of compression members, tied and spiral columns; shear and diagonal tension, bond, anchorage and development length; and analysis and design of one-way solid and ribbed slabs.

0102412	Reinforced Concrete (2)	3 CH	3	0	Prereq: 0102411
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This advanced class discusses working stress design versus ultimate strength and limit state design approaches; tension-controlled and compression-controlled members strain limits; yield line analysis; serviceability analysis, deflection and cracking control, shrinkage and creep deflection; analysis and design for combined effects of shear and torsion in beams; slender

columns and biaxial bending of columns; two-way slabs, column-supported slabs, direct design method, and the equivalent frame method; and design of stairs.

0102413	Steel Structures	3 CH	3	0	Prereq: 0102312
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Included in this course are: steel material properties and design, specification and codes, material behavior in structures, design and behavior of tension members, bolted connections, welded connections, and flexural behavior of stable beam systems. The course also includes axial stability, torsional stability, and behavior of bracing systems. The design of structural steel elements found in bridges and building structures, including plate girders and other built-up members are considered. Structural beams and slender columns, detailing of steel structures.

0102419	Structural Systems II	3 CH	3	0	Prereq: 0102319
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This course presents advanced building construction systems — suspension structures, geodesic domes, folded plates, space frames, single and multi-layer systems; shells; folded plates; pneumatic systems; choice of structural systems and construction materials; assessment of their potentials and limitations. Focus is also on integration of structures, environmental systems, construction materials and architectural detailing and basic principles of structural design. Teaching focus is on craftsmanship, innovation, conceptual and lateral thinking, new technologies, construction, interdisciplinary work, and collaboration with industries.

0102421	Pavement Design	3 CH	3	0	Prereq: 0102322
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This course includes: fundamentals of pavement analysis and design, traffic loading and volume, characterization of pavement materials, design of flexible pavements, stresses and deflections in rigid pavements, design of rigid pavements, design of overlays, flexible pavement rehabilitation, rigid pavement rehabilitation, evaluation of pavement performance.

0102422	Highway Engineering Lab	1 CH	0	3	Prereq: 0102421
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This lab course examines properties of highway materials, including aggregates, asphalt binder, and mixtures, hot mix asphalt (HMA) aggregate gradation, blending procedure, volumetrics, superpave binder testing and their specifications.

0102432	Geotechnical Engineering Lab	1 CH	0	3	Prereq: 0102331
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The lab investigates soil description and identification, Moisture Content, Organic content, Specific gravity, Sieves and Hydrometer Analysis; Atterberg Limits (Liquid, Plastic and Shrinkage Limits); Compaction; Permeability tests (constant and falling head); Consolidation; Swell test; Direct Shear; Unconfined Compression test; Triaxial Compression test.

0102433	Foundation Engineering	3 CH	3	0	Prereq: 0102331
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A review of basic soil mechanics, types of shallow foundations, bearing capacity of foundations: equations and correlations, settlement, design of isolated footings, special types of footings, rectangular combined and strap footings, lateral earth pressure and retaining walls constitute the topics of this course.

0102441	Environmental Engineering	3 CH	3	0	Prereq: 0102342
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This course discusses: quantities and units, environmental systems and transformation processes, material balance relationships and reactor concepts, energy fundamentals, thermodynamics and equilibrium constants, environmental chemistry: stoichiometry, chemical equilibrium, and organic chemistry; transport processes; interphase mass transfer; interphase partition phenomena: fugacity and mass transfer; water pollution; air pollution; basic environmental microbiology; and the mathematics of growth.

0102442	Environmental Engineering Laboratory	1 CH	0	3	Prereq: 0102441
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This laboratory is intended to practice basic water quality analyses. Gravimetric, volumetric and spectrophotometric analytical methods are used to determine quality parameters of raw water, finished water and wastewater. Parameters tested include alkalinity, hardness, salinity and solids, BOD and COD, among others.

0102460	Engineering Economics	2 CH	2	0	Prereq: 0903101
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Introduction to the concepts in the determination of the economic feasibility of engineering undertakings, time value of money, interest rates, depreciation, replacement, economic life, present value, rate of return, payback period, supply and demand, private and social cost estimations, secondary and intangible benefits and costs, benefit-cost models, economic risk analysis, economic optimization.

0102461	Specifications and Quantity Surveying	2 CH	2	0	Prereq: 0102411
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The contracts portion of the course covers contracting process, elements of contracts, tendering and methods of contract awards, bid preparation and bid evaluation. Types of contracts are also discussed: engineering service contracts, design build contracts, and construction contracts. The FIDIC conditions of contracts are explained including: engineer, employer, and contracts role and responsibilities, interim and final payments certification, testing and inspection, variation orders, force majeure and employer risks, termination of contracts, claims and arbitration. The specifications module covers the types of specifications, including: standard and special specifications, open, closed, and restricted specifications, prescription and performance specifications, writing specifications; and key specifications of major civil works including those of concrete, reinforced steel, lumber, masonry, tiles, plastering, and paint. The quantity

surveying module covers understanding plans and specifications, standard forms; and performing quantity takeoffs of major civil works, excavations, concrete, reinforced steel, lumber, masonry, tiles, plastering, sanitary, and painting.

3 CH	Prereq:	Completion of 120 CH
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0102470	Civil Engineering Practical Training	0	0
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As part of their graduation requirements, undergraduate students should undergo training in a professional capacity at an engineering organization in Jordan or abroad. Such training is an integral part of the program and is typically done during the Summer Semester after the fourth year of studies. This experience consists of an eight-week internship in an engineering project with a professional organization that provides opportunities for training and exposure to the real engineering practice. Venues for such experiences have to be approved by the department and include local, regional, and international engineering organizations. In order to demonstrate attaining their practical experience, students are required to submit at the end of their training a written report describing their experience.

3 CH	Prereq:	0102412
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0102511	Pre-stressed Concrete Design	3	0
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This course looks at basic principles of pre-stressed concrete design including: short- and long-term properties of constituent materials, pre-stressing and post tensioning, calculation of losses, flexural behavior, analysis and design of pre-stressed concrete beams, classes, cracking, pre-tensioning, post-tensioning, service load design, load balancing, strength design, strain limits, flexural efficiency.

3 CH	Prereq:	0102411
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0102514	Earthquake Engineering	3	0
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This course is an introduction to the multi-disciplinary field of earthquake engineering. Topics covered in the course include tectonics, ground motion characterization, probabilistic hazard analysis, response spectra, elastic and inelastic structural analysis, single degree and multi-degrees structural system, earthquake-resistant design.

3 CH	Prereq:	0102412
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0102515	Advanced Structural Analysis and Design	3	0
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This course includes analysis and design of composite structures — water tanks, box culverts and arches; the Virtual Work Method, Elastic Center; analysis and design of beams and frames with non-prismatic members; the Column Analogy Method, the Moment Distribution Method for unbraced frames; influence lines for indeterminate structures, Betti's Law, Muller Preslaus's Principal; analysis and design of thin cylindrical shells, domes, cones, plates and folded plates, Navier solution; plastic analysis; and an introduction to structural dynamics.

0102521	Traffic Engineering	3 CH	3	0	Prereq: 0102321
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Course topics include: capacity and level of service analyses of highway facilities, intersection signal timing design, introduction to traffic control devices, volume, speed and delay studies, use of traffic data for design, planning and operational levels of analyses.

0102542	Hydrology	3 CH	3	0	Prereq: 0102342
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This course examines: hydrologic cycle evaporation; transpiration; precipitation; runoff; hydrographs, aquifers; Darcy's law; well hydraulics, watershed characteristics, channel routing, and frequency analysis.

0102543	Design of Environmental and Wastewater Systems	3 CH	3	0	Prereq: 0102441
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The basis of this course is the design of municipal water and wastewater treatment plants. The characterization of water and wastewater, physical, chemical and biological treatment methods; sewer design; processing of sludge; water reuse; and advanced treatment methods are considered.

0102561	Construction Engineering Management	3 CH	3	0	Prereq: 0102461
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The construction business and processes are the concern of this course including: project phases, managerial duties, responsibilities and authorities, project planning, WBS, networking techniques, scheduling, resource profiling and leveling, cash flow projections and budgeting, project monitoring and directing, actual progress reporting, and updating the project plan, project control, earned value analysis of cost and schedule variance, evaluating performance and identifying areas of potential improvement, forecasting time and cost to complete and at completion, computer applications in project planning and control, calculating equipment cost and estimating productivity, economic life and process production cost, optimizing process production and production cost.

0102571	Graduation Project (1)	1 CH	0	0	Prereq: Completion of 120 CH
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Each student will work with a project advisor and should meet at least once a week to present and discuss the progress of the project. The project scope is developed, tasks laid out and a schedule to complete the two parts of the Graduation Project: (1) and (2) is be set. Data, specifications, engineering drawings and other needed information is gathered. Analysis and design of major elements of the project are carried out. A report for the Graduation Project (1) is submitted by the student and evaluated by the advisor.

0102572	Graduation Project (2)	2 CH	0	0	Prereq: 0102571
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Graduation Project (2) is a continuation of Graduation Project (1) and builds on and integrates the engineering concepts developed in prior course work towards a complete document, ready to execute, of a practical civil engineering project. Analysis and design of major and minor elements, accompanied with required details, of the project should be completed. A comprehensive professional engineering report that includes all required documentations — descriptions, specifications, literature review, data, theoretical background, calculations, engineering plans, results and conclusions — should be submitted. The course requires a written and an oral presentation of the completed project documents conducted by the student and evaluated by a three-member jury.

0102573	Special Topics in Structural Engineering	3 CH	3	0	Prereq: 0102312
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The objective of this course is to introduce advanced and new topics in one of the areas of structural engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

0102574	Special Topics in Transportation	3 CH	3	0	Prereq: 0102321
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The objective of this course is to introduce advanced and new topics in one of the areas of transportation engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

0102575	Special Topics in Water/Environmental Engineering	3 CH	3	0	Prereq: 0102441
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The objective of this course is to introduce advanced and new topics in one of the areas of Water/Environmental engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

0102576	Special Topics in Geotechnical Engineering	3 CH	3	0	Prereq: 0102331
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The objective of this course is to introduce advanced and new topics in one of the areas of Geotechnical engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

0103212	Electric Circuits (1)	3 CH	3	0	Prereq: 0904102
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This introductory course covers the following topics: circuit variables and elements, Kirchhoff's laws, simple resistive circuit analysis, voltage and current dividers, Delta to Wye and Pi to Tee equivalent circuits, circuit analysis techniques (mesh and nodal analysis), Thevenin's and Norton's equivalent circuits, basics of active circuit elements, transient analysis of RL, RC and RLC circuits.

0103213	Electric Circuits (2)	3 CH	3	0	Prereq: 0103212+ 0103250
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This course covers sinusoidal steady-state analysis and power calculations, and balanced three phase circuits. It also covers the complex frequency and its use in circuit analysis, the frequency response, and two-port networks.

0103214	Electric Circuits Lab	1 CH	0	3	Prereq: 0103213
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This lab course examines: DC circuits including Kirchhoff's laws and mesh analysis, Thevenin's and Norton's theorems, superposition theorem, Wheatstone bridges; transient response including: RL, RC, and RLC circuits; AC circuits including: impedance concept, frequency response, three-phase circuits; and Y Δ transformation, maximum power transfer, and two-port networks.

0103215	Electromagnetics (1)	3 CH	3	0	Prereq: 0903202+ 0904102
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This course reviews coordinate systems and vector calculus, electrostatic fields, electric fields in material space, magneto static fields, magnetic fields in material space, and Maxwell's equations.

0103220	Electronics (1)	3 CH	3	0	Prereq: 0103212
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Basic semiconductor concepts are discussed including: diodes — DC and AC analysis, special type diodes; theory of Bipolar Junction Transistors (BJT) — biasing techniques, BJT amplifier analysis; and field effect transistors (FET) — biasing techniques, FET amplifier, simple applications of BJTs and FETs.

0103221	Electronics Lab. (1)	1 CH	0	3	Prereq: Concurrent 0103220
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This is an introduction to electronics laboratory course. Experiments include diode and transistor characteristics, voltage rectification, biasing, single and multistage amplifiers, and h-parameters. Computer-aided electronic circuit analysis and design are used.

		3 CH	Prereq:	None
0103240	Digital Logic Design	0	3	

This course includes: numbering systems, basic gates and logic functions, Boolean algebra, Boolean expressions, logic minimization techniques, combinational logic building blocks — decoders, encoders, multiplexers, demultiplexers and magnitude comparators, digital arithmetic — adders and subtractors, basics of sequential circuits — latches and flip-flops, timing diagrams, counters and shift registers, basic PLDs, CPLDs, FPGAs, state machines, system design with state machines using VHDL, and memory devices and systems — RAM, ROM, FIFO, LIFO, DRAM.

		1 CH	Prereq:	0103240
0103241	Digital Logic Design Lab	0	3	

The lab involves building combinational circuits using gates, parallel adder, decoders, multiplexers, ROM, RAM, register, counters. This lab starts with the basic logic components, and continues with an FPGA development kit. A simple design project may be assigned during this lab.

		2 CH	Prereq:	0401222
0103250	Simulation Tools	0	3	

This course is an introduction to simulation concepts solving mathematical models through simulation models using the following software tools: MATLAB, PSPICE, and Multisim. It also covers constructing and analyzing electrical circuits and signals, time domain and frequency domain analysis of systems, and introduction to digital sources and signals.

		3 CH	Prereq:	0103215
0103311	Electrical Machines (1)	3	0	

This course examines: transformers — construction, principles and operation, ideal and practical, performance characteristics, three-phase, auto transformers; DC machines — construction, classifications, performance equations of generators and motors; synchronous machines — construction, generator and motor operations; and three-phase induction motors — construction, operation, performance calculations, starting and speed control.

		3 CH	Prereq:	0103220
0103312	Measurements and Instrumentation	3	0	

This course discusses measurements and error, systems of units, standards of measurements, potentiometers, DC and AC bridges, DC and AC indicating instruments, Galvanometers, electro-dynamometers, ammeters, voltmeters, wattmeters, watt-hourmeters, power factor meters, loading effects, ohmmeters, Meggers, frequency counters, instrument transformers, oscilloscopes, and spectrum analyzers.

		3 CH	Prereq:	0904102
0103318	Introduction to Electrical Engineering	3	0	

This course is a review of electrical circuit principles, principles of single-phase, three-phase transformers, basic principles and characteristics of DC generators, DC motors, basic principles and characteristics of AC generators, and AC motors.

0103319	Electrical Machines Lab for Mechanical Engineers	1 CH	0	3	Prereq: 103318
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In this lab student do experiments on transformers, DC motors, generators, single, three phase induction motors, single- and three-phase synchronous generators, motors, and torque-speed characteristics.

0103320	Electronics (2)	3 CH	3	0	Prereq: 0103220
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The class examines: operational amplifiers — basic theory, characteristics and applications; differential and multistage amplifiers — frequency response of single and multistage amplifiers; and negative feedback analysis — feedback topology, properties and stability analysis.

0103321	Electronics Lab. (2)	1 CH	0	3	Prereq: 0103221+ Concurrent 0103320
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The lab investigates MOSFET characteristics and amplifiers, operational amplifier characteristics and use, functional circuits, power supply design using computer-aided electronic circuit analysis and design.

0103325	Digital Electronics	3 CH	3	0	Prereq: 0103320
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This class looks at the dynamic operation of the BJT switch, early form of the digital circuit, study of DTL and TTL circuits, characteristics of the standard TTL circuit, TTL families with improved performance, emitter-coupled logic (ECL) circuits, and design and performance evaluation of CMOS logic circuits. Also investigated are the types of the CMOS logic circuits — pass transistor, dynamic logic, latches, flip-flop, architecture of memories (SRAM, DRAM, ROM), logic gate based multi vibrator circuits, BiCMOS and GaAs logic circuits, interface of various logic gates, sampling circuit, and D/A and A/D conversion techniques.

0103326	Digital Electronics Lab	1 CH	0	3	Prereq: 0103321+ Concurrent 0103325
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The lab evaluates basic TTL circuits, TTL characteristics, basic MOS logic circuits, MOS characteristics, logic gate based oscillators, interfacing techniques, sampling circuits, A/D and D/A converters.

0103340	Microprocessors and Assembly Language	3 CH	3	0	Prereq: 0103240
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This class addresses assembly language instruction set, addressing modes, arithmetic instructions, logical and bit manipulating instruction, I/O instructions, microprocessor pin out

and timing diagram, address decoding circuits, memory interfacing, input/output interfacing, serial and parallel communications, counter and timers, interrupts, and DMA controllers.

		3 CH	Prereq:	0103213
0103350	Signals and Systems	3	0	

The following subjects are covered in this class: signal classifications and system properties — discrete and continuous time systems; application of Laplace and Fourier transforms to linear systems, Z-transform, system function, frequency response and simulation in the frequency domain.

		3 CH	Prereq:	0103350
0103410	Control Systems	3	0	

This class discusses transfer functions — block diagrams and signal flow graphs; mathematical modelling of physical systems, state space representations, control systems characteristics, time response of systems and closed loop performance of second order systems, stability and Routh-Hurwitz stability criterion, root locus analysis, frequency domain analysis, and design of control systems.

		3 CH	Prereq:	0103311
0103411	Power Systems (1)	3	0	

Topics in this class include basic concepts and introduction to power systems — components, generation, transmission, distribution, symmetrical components, P.U. system, and single-line diagram; load flow analysis using Gauss-Seidel method; transmission line — classification, parameters' calculations, R, L and C. ABCD representation; and fault analysis — balanced and unbalanced.

		1 CH	Prereq:	0103411
0103412	Electrical Machines and Power Lab	0	3	

Topics in the class include single-phase transformers and simulation, three-phase transformers; DC machines — motors and generators; synchronous machines — motors and generators; special motors — induction and stepping; simulated three-phase transmission lines, three-phase reactive power compensation, power factor improvement. protection relays — over-current, over-voltage, under-voltage, directional.

		1 CH	Prereq:	0103410
0103413	Control Lab	0	3	

This lab examines analog simulation, first and second order systems, transient and steady state for step, ramp, and parabolic inputs, time and frequency response of second order systems, DC motor control, application of PID controllers, phase lead, and phase lag controllers, applications of MATLAB control toolbox and Simulink, level control, and PLC control.

		3 CH	Prereq:	0103410+ 0102310
0103415	Introduction to Robotics	3	0	

This course is an introduction to robotics that involves concepts from the fields of electrical engineering, mechanical engineering and computer science. Topics covered include: sensor

performance and integration, electric and pneumatic actuators, power transmission, materials and static force analysis, controls and programmable embedded computer systems, system integration and robotic applications.

0103416	Power Transmission and Distribution	3 CH	3	0	Prereq: 0103411
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This course discusses components of transmission and distribution systems (TD), planning of TD, overhead lines, cables, bulk power transmission, TD grid, losses, HVDC, FACT, and substations. Also discussed are distribution networks — radial and interconnected; cost of electrical power TD, electricity market of TD, control and reliability of TD.

0103419	Environmental Systems Design II	2 CH	2	0	Prereq: 0903104 + 0904104
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The course introduces the operation and design of building systems for electrical supply, illumination, transportation (elevators and escalators), and noise control. Systems are analyzed for their effect on building form, construction cost and operating efficiency.

0103420	Communications Electronics	3 CH	3	0	Prereq: 0103320+ 0103450
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This course discusses power amplifiers — classification of output stage; Class A, B, C, and AB, efficiency analysis of power amplifiers and basic techniques in heat sink design; Tuned amplifier — theory and design; oscillators — op-amp oscillators, LC and crystal oscillators; waveform generation and shaping; linear and nonlinear waveforms, modulation and demodulation circuits; phase locked loop (PLL) — theory and design; and active and passive filters.

0103421	Communications Electronics Lab.	1 CH	0	3	Prereq: 0103420+ 0103321
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In this lab students learn about power amplifiers, oscillators, waveform generation; multivibrators — astable and monostable circuits; 555 timers, modulation and demodulation circuits, phase locked loop (PLL) circuits, and active filters.

0103441	Embedded Systems	3 CH	3	0	Prereq: 0103340
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Discussed are embedded system characteristics, microprocessors versus microcontrollers, microcontrollers' characteristics, general purpose microcontrollers, examples of microcontroller architectures, interrupts, counters/timers, input/output ports, microcontroller programming, instruction set, program development and use of assemblers, memory maps and addressing modes, digital to analog and analog to digital conversion in microcontrollers, data acquisition and distribution, serial and parallel communications, real time systems and its constraints, interfacing to external devices, power consumption consideration, applications.

0103442	Microprocessor and Embedded Systems Lab.	1 CH	0	3	Prereq: 0103441
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Discussed are software developments using PC assembly language, implementation of simple I/O interfacing circuits, keyboard and 7-segment displays scanning, and a simple interfacing circuit project. Also given is an introduction to PIC, MPLAB, IDE; interfacing switches and LED displays, use of mechanical and solid state relays, interrupts and counters, A/D conversion, temperature measurement, waveform generation, and PWM techniques.

0103444	Database Systems	3 CH	3	0	Prereq: 0103443
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This course discusses basic concepts of databases, DBMS components, transaction managements, data modeling, entity relationships diagrams, relational databases, database integrity constraints, relational algebra, query languages, dependencies, schema designs normalization, redundancy elimination.

0103445	Computer Organization	3 CH	3	0	Prereq: 0103240
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The class discusses register transfer and micro-operations, basic computer organization and design, design of arithmetic logic unit, design of accumulator, central processing unit, hardwired control, micro programmed control, execution of instructions, pipelining, introduction to memory hierarchy.

0103450	Analog Communications	3 CH	3	0	Prereq: 0103350
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In this course the following subjects are investigated: spectral densities, correlation function, power-bandwidth product, distortion and distortionless channels; analog modulation — DSB-SC, DSB-AM, SSB; vestigial AM, modulator and demodulator — coherent, non-coherent; angle modulation — FM, PM, modulator, demodulator; baseband modulation — sampling theorem, PAM, PWM, PPM; and noise in analog communications — noise types, signal to noise ratio, the additive white Gaussian noise, signal interference.

0103451	Digital Communications	3 CH	3	0	Prereq: 0103450+ 0903281
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Discussed are baseband digital modulation techniques — PCM, DM, D- Σ , and DPCM; line coding; intersymbol interference — M-ary signaling, bandwidth, data rate; multiplexing — FDM, TDM, CDM; passband digital modulation and demodulation techniques — ASK, FSK, PSK, DPSK, M-ary, coherent and non-coherent detection; bit error rate performance; channel coding theory — convolution coding, block codes; and error performance using coding.

0103455	Digital Signal Processing	3 CH	3	0	Prereq: 0103450
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This course discusses discrete-time signals and systems, frequency analysis of discrete-time signals and systems, sampling and quantization, Discrete Fourier Transform, windowing effect, z-transform, FIR and IIR digital filter design, digital filter realization, and Fast Fourier Transform.

0103457	Analog Communications Lab.	1 CH	0	3	Prereq: Concurrent 0103450
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The lab investigates RF amplifiers, noise, oscillators, frequency conversion, AM generation and reception, phase-locked loops, angle modulation, and frequency modulations.

0103458	Digital Communications Lab	1 CH	0	3	Prereq: 0103457+ Concurrent 0103451
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The class discusses a variety of modulations schemes and encoding formats, such as pulse code modulation (PCM), frequency shift keying (FSK), and phase shift keying (PSK). PCM line codes including RZ, NRZ, and Manchester are also discussed.

0103490	Electrical Engineering Training	3 CH	0	0	Prereq: Completion of 99 CH
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As part of their graduation requirements, undergraduate students should undergo training in a professional capacity at an engineering organization in Jordan or abroad. Such training is an integral part of the program and is typically done during the Summer Semester after the fourth year of studies. This experience consists of an eight-week internship in an engineering project with a professional organization that provides opportunities for training and exposure to the real engineering practice. Typical venues for such experiences have to be approved by the department and include local, regional, and international engineering organizations. In order to demonstrate attaining their practical experience, students are required to submit at the end of their training a written report describing their experience.

0103512	Power Systems (2)	3 CH	3	0	Prereq: 0103411
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This course examines power system component modeling, power system protection against overcurrent and earthing faults, load flow analysis, transient stability of power systems, economic operation of power systems.

0103515	Electrical Machines (2)	3 CH	3	0	Prereq: 0103311
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This course discusses transformers, special transformer connections; three-phase synchronous motors — starting, pull out torque and conditions for maximum power, applications; DC machines — starting and speed control; three-phase induction motors — starting, speed control, deep-bar double cage rotor, circuit diagram, induction generator; fractional HP machines; single

phase induction motor — principle of operation, torque/speed characteristics, equivalent circuit, analysis and performance evaluation; single-phase 2-winding motors — starting methods, performance evaluation; stepper motors, and brushless DC motors.

3 CH	Prereq:	Department Approval
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0103517	Special Topics in Power Engineering	3	0
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The objective of this course is to introduce advanced and new topics in one of the areas of power engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

3 CH	Prereq:	0103411+ 0103320
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0103522	Power Electronics	3	0
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This course discusses switching operation, and commutation; thyristors — static and dynamic characteristics, turn-on, DI, DV turn-off, and specification sheets; single-phase and three-phase controlled rectifiers, AC voltage controllers; DC choppers — buck, boost, buck-boost and full bridge converters; and thermal consideration in design and use of specification sheets and energy graphs.

3 CH	Prereq:	Department Approval
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0103525	Special Topics in Electronics Engineering	3	0
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The objective of this course is to introduce advanced and new topics in one of the areas of electronics engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

3 CH	Prereq:	Department Approval
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0103544	Special Topics in Computer Engineering	3	0
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The objective of this course is to introduce advanced and new topics in one of the areas of computer engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

3 CH	Prereq:	0103445
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0103545	Computer Architecture	3	0
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This course examines computer evolution and performance, system buses and memory, input/output; computer arithmetic, CPU structure and function, multimedia instruction set, reduced instruction set computers (RISCs), instruction-level parallelism and superscalar processors, control unit operation, parallel processing, SMPs, clusters, and NUMA systems.

0103550	Communication Systems	3 CH	3	0	Prereq: 0103451
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The class discusses elements of cellular radio systems — specifications, cell coverage for signal traffic, cell site, mobile antenna, frequency management and channel assignment and GSM network systems with an introduction to the latest developments.

0103552	Wireless Communications	3 CH	3	0	Prereq: 0103451
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The topics of this course are elements of cellular radio systems — specifications, cell coverage for signal traffic, cell site, mobile antenna, frequency management and channel assignment and GSM network systems including introduction to the latest developments.

0103558	Special Topics in Communications Engineering	3 CH	3	0	Prereq: Department Approval
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The objective of this course is to introduce advanced and new topics in one of the areas of communications engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

0103591	Graduation Project (1)	1 CH	1	0	Prereq: Completion of 120 CH
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Each student will work with a graduation project advisor, and should meet with the advisor at least once a week to present and discuss the project progress. The project scope will be developed, tasks will be laid out and a schedule to complete the two parts of the Graduation Project: (1) and (2) will be set. Data, specifications, engineering drawings and other needed information should be gathered. Analysis and design of major elements of the project should be carried out. A report for Graduation Project (1) should be submitted by the student and evaluated by the advisor.

0103592	Graduation Project (2)	2 CH	2	0	Prereq: 0103591
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Graduation Project (2), a continuation for Graduation Project (1), builds on and integrates the engineering concepts developed in prior course work towards a complete document, ready to execute, of a practical electrical engineering project. Analysis and design of major and minor elements, accompanied with all required details, of the project should be completed. A comprehensive professional engineering report that includes all required documentations: description, specifications, literature review, data, theoretical background, calculations, engineering plans, results and conclusions should be submitted. The course requires a written and an oral presentation of the completed project documents conducted by the student and evaluated by a three-member jury.

0104100	Engineering Workshops	1 CH	Prereq:	None
		0	3	

Development of basic skills in fields of hand filing, turning, welding, piping and plumbing, carpentry, sand casting, glass works, sheet metal fabrication, metal forming, household electric circuits.

0104211	Dynamics	3 CH	Prereq:	0102201
		3	0	

This course deals with kinematics of particles; displacement, velocity, and acceleration relationships, equations of motion for constant acceleration; two-dimensional motion of particles, projectiles; kinetics of particles, force-acceleration, work-energy, impulse-momentum; kinematics of planar rigid bodies, pure rotation, general motion; kinetics of planar rigid bodies, force-acceleration, work-energy, impulse-momentum; and an introduction to three-dimensional dynamics of rigid bodies; and an introduction to vibrations.

0104212	Mechanics of Materials	3 CH	Prereq:	0102201
		3	0	

In this course there is an introduction to mechanics of deformable bodies, concepts of stress and strain, classification of materials behavior, stress-strain relations and generalized Hook's law, applications to engineering problems involving members under axial loads, torsion of circular rods and tubes, bending and shear stresses in beams, combined stresses in beams, transformations of stresses, and buckling.

0104220	Thermodynamics (1)	3 CH	Prereq:	0904101+ 0902101
		3	0	

This course is an introduction to engineering thermodynamics, properties of pure substances, first law and second law of thermodynamics, analysis applied to different systems and control volumes, and entropy.

0104230	Mechanical Engineering Drawing	2 CH	Prereq:	0102200
		0	3	

This course is an introduction to mechanical engineering drawing utilizing a 3-D solid modeler; using Pro/Engineer to design and produce mechanical drawings in a parametric drawing scheme, mechanical drawing concepts, constructing detailed and working drawings, projections, auxiliary views, geometric tolerancing, limits and fits.

0104316	Mechanics of Materials Lab	1 CH	Prereq:	0104212
		0	3	

In this lab a set of experiments are performed that cover the following: tensile, compression, torsion, bending shear, creep, fatigue, impact, and hardness tests.

3 CH	Prereq	0903102+ 0904102
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0104320	Fluid Mechanics (1)	3	0
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This course presents fluids and their properties, classification of fluids and fluid flows, fluid statics, conservation of mass, momentum, energy in fixed and moving control volumes, potential flow, Bernoulli's equation, dimensional analysis and similitude, introduction to boundary layers and fluid flow in pipes.

3 CH	Prereq	0104320
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0104322	Heat Transfer (1)	3	0
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This course examines one dimensional conduction heat transfer, steady-transient, convection heat transfer, external and internal flows, heat exchangers, free convection, introduction to radiation heat transfer, radiation heat exchange between ideal surfaces.

3 CH	Prereq	0104220
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0104323	Thermodynamics (2)	3	0
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This course is an examination of thermodynamics: power and refrigeration cycles, availability and irreversibility, general thermodynamic relations, equations of state, ideal and real gas mixtures, chemical reactions, and combustion.

3 CH	Prereq	0104320
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0104324	Fluid Mechanics (2)	3	0
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This course is a continuation of Fluid Mechanics (1) and deals with: differential analysis of fluid motion, Navier-Stokes equations, incompressible viscous flow, pipes and ducts, flow measurements, external incompressible viscous flow, boundary layers, flow about immersed bodies, fluid machinery, pumps and compressors, introduction to compressible flow, and introduction to computational fluid mechanics.

1 CH	Prereq	0104320
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0104326	Fluid Mechanics Lab	0	3
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A set of experiments are performed that cover the following: evaluating fluid properties, center of pressure in immersed bodies, flow measurements, drag forces, head loss in pipes, impulse turbine, and water jets.

3 CH	Prereq	0104211+ 0104230
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0104330	Theory of Machines	3	0
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This course involves a kinematic analysis of mechanisms — description of basic mechanisms, velocity, acceleration polygons; static and inertia force analysis of machinery, dynamic analysis of cams, gears, gear trains, and balancing of machines.

3 CH	Prereq	0904101
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0104350	Materials Science	3	0
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This course discusses atomic structure and bonding, structure of crystalline solids, crystallography Miller's indices and Miller-Bravias indices, imperfections in solids, dislocations

and strengthening mechanisms, phase diagrams and alloy formation, ferrous and nonferrous metal and alloys.

		3 CH	Prereq	0104100+ 0104350
0104352	Manufacturing Processes	3	0	

In this course a general view of production of ferrous materials, production of non-ferrous materials, sand casting, powder metallurgy, rolling, forging, extrusion, drawing, and metal cutting processes speeds and feeds are given.

		1 CH	Prereq	0104350+ 0104352
0104356	Materials and Manufacturing Lab	0	3	

Students are asked to perform experiments in the field of material science and manufacturing process.

		2 CH	Prereq:	0900130
0104400	Topics in Engineering Profession	2	0	

Professional Ethics: safety and responsibility, professional responsibility to customers and to employers, codes of ethics and honor, standard ethics theories, case studies.

Technical Writing: basic technical writing concepts and techniques including report writing, numbering systems, order of arrangements of results and recommendations, preparing a detailed proposal on any technical and scientific work.

		3 CH	Prereq	0903102+ 0104211
0104410	Mechanical Vibrations	3	0	

Properties of oscillatory motion, derivation of governing differential equations, free and forced vibrations, damped and un-damped vibrations, harmonically excited motion, rotating and reciprocating unbalance, support motion, vibration measurements, vibration isolation, transient vibrations, free and forced vibrations in multi-degrees-of-freedom systems, vibration absorbers, and continuous systems are discussed.

		1 CH	Prereq	0104410
0104416	Mechanical Vibrations Lab	0	3	

A set of experiments is performed that cover the following: simple and compound pendulum, acceleration due to gravity, mass spring systems, torsional oscillations, free and damped vibration.

		3 CH	Prereq	0104323
0104421	Energy Conversion Systems	3	0	

This course examines energy classification, sources and utilization, thermal energy power plants, conversion of nuclear energy to thermal energy, steam turbine power plants, gas turbine power

plants, environmental aspects, renewable energy power plants, solar, wind, economics of energy systems and energy storage.

0104422	Heat Transfer (2)	3 CH	3	0	Prereq	0104322
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This course discusses 3-D conduction heat transfer, steady and transient approximate solutions, finite difference solution, boiling and condensation, radiation heat transfer; radiation properties, radiation exchange between gray surfaces, multimode heat transfer.

0104423	Heating, Ventilation and Air Conditioning	3 CH	3	0	Prereq	0104322+ 0104323
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This course discusses air-conditioning processes, psychometric and humid air calculations, heating and cooling load calculations, hot-water systems, theory and design, duct systems, theory and design.

0104426	Thermal Lab	1 CH	0	3	Prereq	0104322+ 0104323
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A set of experiments is performed to cover heat transfer and thermodynamic subjects including: water boiling and condensation, thermal conductivity, natural convection, forced convection, calorific value, heat exchangers, heat pump and air coolers, radiation heat transfer.

0104429	Environmental Systems Design I	2 CH	2	0	Prereq:	0903104 + 0904104
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The course introduces the operation and design of building systems for climate control, water and drainage, life safety. It also highlights the design of heating, ventilating, and air conditioning (HVAC) systems for buildings. Systems are analyzed for their effect on building form, construction cost and operating efficiency.

0104431	Mechanical Design (1)	3 CH	3	0	Prereq	0104212
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This course is an introduction to design process, design considerations, tolerances, fits and surface finish. Also discussed are stress analysis and deflection of mechanical elements, energy methods, statistical considerations in machine design, failure of machine elements, fatigue.

0104432	Mechanical Design (2)	3 CH	3	0	Prereq	0104330+ 0104431
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This class discusses design of screws, fasteners, connections, welded joints, mechanical springs, spur gears, shafts, belts, chains and rolling bearings, lubrication and journal bearings.

0104433	Exercise in Design	1 CH	Prereq	0104432
		3	0	

This class practices exercise problems in design.

0104440	Engineering Instrumentation and Measurements	2 CH	Prereq	0104320+ 0903102
		2	0	

This class does analysis of experimental data, basic electrical measurement and sensing devices, displacement, area, pressure, flow, temperature, thermal and transport properties, force, torque and strain measurements, data acquisition and processing.

0104442	Automatic Control	3 CH	Prereq	0104410
		3	0	

This class examines linear feedback control theory, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graph, time domain analysis of control systems, test signals, transient response, time domain specifications, steady-state error and stability, root locus techniques, time domain design, PID controllers, phase-lead and phase-lag controllers, introduction and frequency domain analysis, Nyquist criterion, bode plots and Nicholas charts.

0104490	Engineering Training	3 CH	Prereq	Completion of 120Cr. Hr.
		-	-	

As part of their graduation requirements, undergraduate students should undergo training in a professional capacity at an engineering organization in Jordan or abroad. Such training is an integral part of the program and is typically done during the Summer Semester after the fourth year of studies. This experience consists of an eight-week internship in an engineering project with a professional organization that provides opportunities for training and exposure to the real engineering practice. Typical venues for such experiences have to be approved by the department and include local, regional, and international engineering organizations. In order to demonstrate attaining their practical experience, students are required to submit at the end of their training a written report describing their experience.

0104520	Internal Combustion Engines	3 CH	Prereq	0104422
		3	0	

This course teaches an analytical approach to the engineering problem, performance analysis of internal combustion engines, study of thermodynamics, combustion, heat transfer, friction, and other factors affecting engine power, efficiency, and emissions, design and operating characteristics of different types of engines.

0104521	Renewable Energy	3 CH	Prereq	0104421
		3	0	

In this class students learn the definition of renewable energy, advantages of renewable energy, availability of various types of renewable energy, solar energy and Its application, wind energy

and its devices, geothermal energy, tidal energy, hydraulic energy, energy efficiency and its relation to renewable energy.

		3 CH	Prereq	0104330+ 0104410+ 0104520
0104522	Automotive Engineering	3	0	

This course examines engine performance, engine operating systems, automobile transmission systems, brakes, front axle and steering mechanism, suspensions, automotive electric systems, electronics, control, engines' main components design.

		3 CH	Prereq	0104423
0104527	Advanced Solar Energy	3	0	

This class discusses solar beam spectral, extra-terrestrial solar beam, solar angle and solar tracking, available solar energy on ground, modeling of solar beam, PV systems and their design, solar water heaters, concentrated solar power.

		3 CH	Prereq	0104532+ 0903381
0104530	Finite Element Analysis	3	0	

This course is an introduction to finite elements, integral formulation and variational methods, one dimensional problem, derivation of element equations, assembly of element equations, imposition of boundary conditions, solution of equations, introduction to two dimensional problems, error analysis, computer applications.

		3 CH	Prereq	0104330
0104531	Machine Dynamics	3	0	

This class teaches a knowledge of the basic laws of dynamics, application of dynamics to the analysis, design of machines and mechanical components, motions resulting from applied loads, and the forces required to produce specified motions, introduction to mechanical vibration, free and forced response of discrete and continuous systems.

		3 CH	Prereq	0104432+ 0903381
0104532	Computer Aided Design	3	0	

This course teaches basic computer aided drafting skills using the latest release of CAD software. The course includes file management, Cartesian coordinate system, drawing set-ups, drawing aids, layer usage, drawing geometric shapes, editing objects, array, text applications, basic dimensioning, and Help access.

				3 CH	Prereq	0104442+ 0104531
0104543	Introduction to Mechatronics Systems Design	3	0			

In this class there is a review of sensors, actuators-electro-pneumatic, electro-hydraulic systems, digital logic systems microprocessor technology, software analog, digital interfacing, microprocessor-based industrial controllers, programmable logic controllers (PLCs), applications to mechatronic systems.

				1 CH	Prereq	104440+ 104442
0104546	Engineering Measurements and Control Lab	0	3			

In this lab a set of experiments is performed that covers the material in automatic control and in instrumentation and measurements including measurements of resistance, temperatures, operational amplifiers, strain gauges, linear variable differential transformer, level sensors, PID controller, temperature control, position and speed control.

				3 CH	Prereq	0104212+ 0104352
0104551	Mechanics of Composite Materials	3	0			

This course teaches about fiber reinforced composites, stress, strain, strength of composite laminates, failure criteria, environmental effects, design of composite structures.

				3 CH	Prereq	Department Approval
0104590	Special Topics in Mechanical Engineering	3	0			

This course varies with the instructor's course syllabus.

				1 CH	Prereq	Completion of 120 Cr.
0104591	Graduation Project 1	-	-			

This is part one of a two-semester project. The project aims at tackling an applied mechanical engineering problem to strengthen the student's capability and skills through a comprehensive and integrated approach. In this part the student, along with his advisor, will develop the scope of work of the project, collect data, review literature and any other work request by his advisor. The student will submit a report to be evaluated by his advisor.

				2 CH	Prereq	Completion of 120 Cr. + 0104591
0104592	Graduation Project 2	-	-			

In this part of the project the student will implement the scope of work developed in part one. The student will submit a comprehensive professional engineering report describing the project with results and conclusions. The student is required to give an oral presentation of the project to a committee that will evaluate both the report and the presentation.