AER 150

Course ID 027017

Short Title Aerospace History

Long Title Aerospace History

Long Descr Aerospace technologies have shaped our life and culture and are at the centre of some of the greatest changes faced by our highly technological society. This course describes the non-technical aspects of history of aviation and space exploration in Canada and worldwide. The technological issues associated with flight are discussed in detail. The memorable historical events, past, present, and future trends in aerospace are presented. Some basic concepts, including how aircraft and rockets work, will also be discussed.

Academic Org Aerospace Engineering

Components Lecture: 3.00

Requisites Not available to students in Engineering
Equivalencies

Attributes Lower Level Liberal Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 222

Course ID 003691

Short Title Eng Design and Graphical Comm

Long Title Engineering Design and Graphical Communication

Long Descr Technical sketching in compliance with Canadian standards: orthographic views and auxiliary views, sections views, dimensioning and tolerancing, assembly and working drawings. Basic skills of computer aided design. Introduction to engineering design: role of design in engineering, problem analysis, conceptual design and analysis, systems thinking and detailed design.

Academic Org Aerospace Engineering

Components Lecture: 2.00 / Laboratory: 2.00

Requisites
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 222E

Course ID	003691
Short Title	Eng Design and Graphical Comm
Long Title	Engineering Design and Graphical Communication
Long Descr	Technical sketching in compliance with Canadian standards: orthographic views and auxiliary views, sections views, dimensioning and tolerancing, assembly and working drawings. Basic skills of computer aided design. Introduction to engineering design: role of design in engineering, problem analysis, conceptual design and analysis, systems thinking and detailed design.
Academic Org	Aerospace Engineering
Components	Lecture: 2.00 / Laboratory: 2.00
Requisites	
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 309

Course ID 005517

Short Title Basic Thermodynamics

Long Title Basic Thermodynamics

Long Descr Introductory concepts and definitions: Thermodynamic systems, fluid properties. Energy, work, heat, power. First law. Cycles. Properties of a pure, simple compressible substance: substances that appear in different phases, ideal gas model. Control volume analysis: conservation of mass and energy. Second law: irreversible and reversible processes, Carnot cycle. Entropy: Clausius inequality, entropy change, entropy balance for closed and open systems, isentropic processes and efficiencies. Gas power systems; Air Standard ,Otto, Diesel, Dual and Brayton cycles.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CPS 125 and MTH 240 and PCS 211
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 309E

Course ID 005517

Short Title Basic Thermodynamics

Long Title Basic Thermodynamics

Long Descr Introductory concepts and definitions: Thermodynamic systems, fluid properties. Energy, work, heat, power. First law. Cycles. Properties of a pure, simple compressible substance: substances that appear in different phases, ideal gas model. Control volume analysis: conservation of mass and energy. Second law: irreversible and reversible processes, Carnot cycle. Entropy: Clausius inequality, entropy change, entropy balance for closed and open systems, isentropic processes and efficiencies. Gas power systems; Air Standard ,Otto, Diesel, Dual and Brayton cycles.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CPS 125 and MTH 240 and PCS 211
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

AER 316

Course ID	003148
Short Title	Fluid Mechanics
Long Title	Fluid Mechanics
Long Descr	Dimensions and units, continuum fluid mechanics. Fluid Statics: Properties of fluids. Manometry and pressure measurement. Flow characteristics: laminar and turbulent flow, steady and unsteady flow, streamlines. Flow analysis: control volume/control system and differential approaches for mass, momentum and energy conservation. Applications of the conservation equation, Euler and Bernoulli equations. Dimensional analysis, similitude and model testing. Surface resistance. Flow in conduits.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 240 and PCS 125 and PCS 211
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 316E

Course ID	003148
Short Title	Fluid Mechanics
Long Title	Fluid Mechanics
Long Descr	Dimensions and units, continuum fluid mechanics. Fluid Statics: Properties of fluids. Manometry and pressure measurement. Flow characteristics: laminar and turbulent flow, steady and unsteady flow, streamlines. Flow analysis: control volume/control system and differential approaches for mass, momentum and energy conservation. Applications of the conservation equation, Euler and Bernoulli equations. Dimensional analysis, similitude and model testing. Surface resistance. Flow in conduits.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 240 and PCS 125 and PCS 211
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 318

Course ID	005569
Short Title	Dynamics
Long Title	Dynamics
Long Descr	Particles in motion. Kinematics and kinetics of a particle. Planar motion of rigid bodies. Planar kinematics and kinetics of a rigid body. Equations of motion. Work and energy. Impulse and momentum. Applications: wheels, gears, pulleys, springs, and mechanical linkage systems.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 222 and MTH 141 and MTH 240 and PCS 211
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 318E

Course ID 005569

Short Title Dynamics

Long Title Dynamics

Long Descr Particles in motion. Kinematics and kinetics of a particle. Planar motion of rigid bodies. Planar kinematics and kinetics of a rigid body. Equations of motion. Work and energy. Impulse and momentum. Applications: wheels, gears, pulleys, springs, and mechanical linkage systems.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 222 and MTH 141 and MTH 240 and PCS 211
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 320

Course ID 002782

Short Title Statics/Strength of Materials

Long Title Statics and Intro to Strength of Materials

Long Descr The statics will cover rigid body equilibrium. Two and three-force members. Trusses, frames and machines. Method of joints, section, members. Dry friction. The introduction to strength of materials will cover stress and strain, Hooke's Law. Axial loading and statically indeterminate problems. Flexural analysis of beams: shear and moment diagrams, introduction to bending stresses, singularity functions.

Academic Org Aerospace Engineering

Components Lecture: 4.00 / Laboratory: 1.00

Requisites Prerequisites: AER 222 and MTH 141 and MTH 240 and MTL 200 and PCS 211
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 320E

Course ID	002782
Short Title	Statics/Strength of Materials
Long Title	Statics and Intro to Strength of Materials
Long Descr	The statics will cover rigid body equilibrium. Two and three-force members. Trusses, frames and machines. Method of joints, section, members. Dry friction. The introduction to strength of materials will cover stress and strain, Hooke's Law. Axial loading and statically indeterminate problems. Flexural analysis of beams: shear and moment diagrams, introduction to bending stresses, singularity functions.
Academic Org	Aerospace Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 222 and MTH 141 and MTH 240 and MTL 200 and PCS 211
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 403

Course ID	000997
Short Title	Mechanisms and Vibrations
Long Title	Mechanisms and Vibrations
Long Descr	Displacement, velocity, and acceleration analysis of simple link and rotating systems using vector polygons and complex-polar numbers. Inertia forces and moments acting on simple link systems. Single and multi-degree of freedom systems, continuous systems. Forced and free excitation with system damping. Vibration absorbers and static and dynamic balancing of rotating shafts.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 318 and MTH 425
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 403E

Course ID 000997

Short Title Mechanisms and Vibrations

Long Title Mechanisms and Vibrations

Long Descr Displacement, velocity, and acceleration analysis of simple link and rotating systems using vector polygons and complex-polar numbers. Inertia forces and moments acting on simple link systems. Single and multi-degree of freedom systems, continuous systems. Forced and free excitation with system damping. Vibration absorbers and static and dynamic balancing of rotating shafts.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 318 and MTH 425
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 404

Course ID 024298

Short Title Intro to Aerospace Engineering

Long Title Intro to Aerospace Engineering Design

Long Descr This course provides students with an introduction to the principles and practice of engineering design. Course instructors provide one or more engineering challenges and students work in design teams to provide innovative design solutions. Students learn to provide, clarify and satisfy project requirements. Projects are structured to encourage trade-offs between possibly conflicting goals. Design lab sessions are supplemented by special-topic lectures that include: occupational safety, systems thinking, environmental impact.

Academic Org Aerospace Engineering

Components Laboratory: 3.00 / Lecture: 2.00

Requisites Prerequisites: AER 222 and AER 318 and AER 320 and CEN 100
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 404E

Course ID	024298
Short Title	Intro to Aerospace Engineering
Long Title	Intro to Aerospace Engineering Design
Long Descr	This course provides students with an introduction to the principles and practice of engineering design. Course instructors provide one or more engineering challenges and students work in design teams to provide innovative design solutions. Students learn to provide, clarify and satisfy project requirements. Projects are structured to encourage trade-offs between possibly conflicting goals. Design lab sessions are supplemented by special-topic lectures that include: occupational safety, systems thinking, environmental impact.
Academic Org	Aerospace Engineering
Components	Laboratory: 3.00 / Lecture: 2.00
Requisites	Prerequisites: AER 222 and AER 318 and AER 320 and CEN 100
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 416

Course ID 001130

Short Title Flight Mechanics

Long Title Flight Mechanics

Long Descr Aircraft and spacecraft anatomy. Atmospheric properties. Basic Aerodynamics, source of aerodynamic forces, and aerodynamic shapes. Lift, drag and moment characteristics of aircraft. Mach number effects on lift and drag. Piston, turboprop and turbofan engine performance characteristics. Introduction to steady level flight, climb and descent. Introduction to helicopter flight mechanics. Introduction to orbital flight.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: AER 316
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 416E

Course ID 001130

Short Title Flight Mechanics

Long Title Flight Mechanics

Long Descr Aircraft and spacecraft anatomy. Atmospheric properties. Basic Aerodynamics, source of aerodynamic forces, and aerodynamic shapes. Lift, drag and moment characteristics of aircraft. Mach number effects on lift and drag. Piston, turboprop and turbofan engine performance characteristics. Introduction to steady level flight, climb and descent. Introduction to helicopter flight mechanics. Introduction to orbital flight.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: AER 316
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 423

Course ID	001484
Short Title	Thermodynamics Heat Transfer
Long Title	Thermodynamics and Heat Transfer
Long Descr	The Clausius inequality. Entropy change. Isentropic processes. Entropy balance for closed and open systems. Processes and cycles depicted on temperature, entropy and enthalpy axes, isentropic efficiencies. Combustion. Gas turbines; nozzles, engine intakes, compressors, combustion chambers, extended surface (fins and pins). Two-dimensional conduction; transient conduction, forced convection, free convection.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 309 and AER 316
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 423E

Course ID 001484

Short Title Thermodynamics Heat Transfer

Long Title Thermodynamics and Heat Transfer

Long Descr The Clausius inequality. Entropy change. Isentropic processes. Entropy balance for closed and open systems. Processes and cycles depicted on temperature, entropy and enthalpy axes, isentropic efficiencies. Combustion. Gas turbines; nozzles, engine intakes, compressors, combustion chambers, extended surface (fins and pins). Two-dimensional conduction; transient conduction, forced convection, free convection.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 309 and AER 316
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 504

Course ID 001998

Short Title Aerodynamics

Long Title Aerodynamics

Long Descr Finite wings and effects of wing geometry, viscosity and compressibility. Aerodynamic forces on wings and bodies. Lift, drag and moment coefficients. Scalar and vector fields, stream function and velocity potential. Rotation; vorticity; circulation and lift. Sources, sinks, vortices. Fluid dynamics; substantive derivative, Euler and Bernoulli equations. Flow about a body, superposition of flows, doublets. Kutta-Jukowski theorem and Kutta condition. Thin airfoil theory, symmetrical and cambered airfoils. Introduction to computational fluid dynamics. Panel methods.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 416 and CEN 199 and CMN 432 and MTH 425
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 507

Course ID	001385
Short Title	Materials and Manufacturing
Long Title	Materials and Manufacturing
Long Descr	Mechanical properties of materials, materials testing: tensile properties, hardness, impact, fatigue; engineering materials systems, interrelationships of structure, properties, and processing; processing and application of engineering materials, manufacturing methods and manufacturing systems.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 320 and AER 423 and CEN 100
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 509

Course ID 000035

Short Title Control Systems

Long Title Control Systems

Long Descr Mathematical model representation of physical control systems which involve mechanical, hydraulic, pneumatic and electrical components. System modelling in time domain and its time response analysis; Open and closed-loop control system analysis and steady-state error analysis. Block diagram algebra. First, second and higher order system stability analysis using techniques such as: Bode diagrams, Routh-Horowitz analysis, Root Locus analysis Control system design via root locus and frequency response.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.50

Requisites Prerequisites: AER 403 and CMN 432 and EES 612
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 520

Course ID 000223

Short Title Stress Analysis

Long Title Stress Analysis

Long Descr Torsion of shafts, angle of twist and statistically indeterminate torque-loaded members; Shear force and bending moment analysis and graphing; Transverse shear stress analysis and shear flow determination; Stress analysis for combined loadings; Analysis of deflection, bending moment in statically determinate/indeterminate members; discontinuity function method and superposition method ; Strain energy and Castigliano's theorem for beam and frame deflections; Strain and stress transformations and Mohr's circle; Experimental stress analysis in the laboratory.

Academic Org Aerospace Engineering

Components Lecture: 4.00 / Laboratory: 1.00

Requisites Prerequisites: AER 320 and CEN 199 and CMN 432 and MTH 410 and MTH 425
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

AER 606

Course ID	002152
Short Title	Component Des and Matl Selectn
Long Title	Component Design and Material Selection
Long Descr	The course addresses the principles of mechanical component design from a perspective of failure prevention. Learning objectives include selecting appreciate materials; applying appreciate static failure theory and fatigue failure theory; and designing for creep resistance and surface durability. The learning is reinforced via design examples of machine elements such as bearings, springs, gears and shaft, and a substantial design project wherein students model and design a mechanical system that is relevant to a real application.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: AER 404, AER 507, AER 520, ECN 801
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 615

Course ID 004907

Short Title Aircraft Performance

Long Title Aircraft Performance

Long Descr Legislated performance and related safety requirements: FAR and other airworthiness standards. Takeoff and landing performance, including calculations for balanced field length with critical engine inoperative. Range-payload characteristics block properties, aircraft utilization and capacity. V-n diagram. Energy concept: accelerated rate of climb. Determination of cruise costs and minimum cost cruise. Elements of route analysis, overall flight fuel prediction and flight control and navigation using various sensors. Automatic flight control systems with auto pilot and instrument landing systems.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: AER 504
Equivalencies AER713/AER615

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 621

Course ID 005427

Short Title Aerospace Structural Design

Long Title Aerospace Structural Design

Long Descr Aircraft structural integrity concepts and stress analysis methods. Fail-safe vs. safe-life design. Component life estimation. Load spectra, damage tolerance. Aerodynamic manoeuvre, gust, pressurization and landing loads. V-n diagrams. Wing design: stress analysis. Strength vs. stiffness. Torsional and bending divergence. Introduction to control reversal and flutter. Fuselage analysis. Effect of cutouts. Buckling of columns, thin plates and stiffened panels under a variety of loading conditions are examined. Lab work will entail the design of aircraft primary structure.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 404 and AER 504 and AER 507 and AER 520 and CMN 432 and ECN 801
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

AER 622

Course ID 001155

Short Title Gas Dynamics

Long Title Gas Dynamics

Long Descr Review of basic equations. Wave propagation in compressible media. Isentropic flow of a perfect gas. Normal shock waves. Unsteady flow. Oblique shock waves. Prandtl-Meyer flow. Subsonic, transonic and supersonic flow over wings and bodies. Flow measurement. Computational fluid dynamics applications; supersonic flow over a cone, flow in a supersonic nozzle, shock waves on re-entry type bodies.

Academic Org Aerospace Engineering

Components Lecture: 3.00

Requisites Prerequisites: AER 423 and AER 504
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 626

Course ID 003726

Short Title Applied Finite Elements

Long Title Applied Finite Elements

Long Descr Fundamentals of finite elements method will be explained. Application of finite elements to stress analysis, heat transfer and free vibrations will be discussed. Trusses, beams and frame elements will be introduced. Applications using engineering software.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 520 and CPS 125 and MTH 510
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 627

Course ID 024766

Short Title Introduction to Space Robotics

Long Title Introduction to Space Robotics

Long Descr This course is an introduction to the topics of space robotics. The purpose of this course is to provide a working knowledge of basic and applied concepts in both manipulators and mobile robots. Topics covered include the kinematics of manipulators, velocity control, Jacobians, dynamic modeling, position and force control, path and trajectory planning, rover fundamentals, robot vision, localization, navigation, and processing architectures. Examples are drawn from existing and proposed planetary and orbital missions.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: AER 403
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 699

Course ID 027052

Short Title Aerospace Sensors

Long Title Aerospace Sensors

Long Descr Principles of transducers and signal conditioners will be introduced, for both analog and digital systems. Various sensors and their applications in avionics systems will be studied including pitot tubes, magnetometers, gyroscopes, accelerometers, inertial measurement units, lidar, optical flow, depth cameras, and others. Lab experience will include practicing with analog and digital circuits, sensor boards, communication interfaces, signal processing and microcontroller programming.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: EES 512 and MTH 425
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 710

Course ID 000671

Short Title Propulsion

Long Title Propulsion

Long Descr Introduction to aerospace propulsion. Review of gas dynamics and thermodynamics. Propellers, theory and design. Internal combustion engines: spark-ignition, compression-ignition, rotary. Turbosupercharging. Gas turbine engines. Cycle analysis of turbojets. Design considerations for intake, compressor, combustor, turbine, afterburner, and exhaust nozzle. Cycle analysis of turbofans. Cycle analysis of turboprop engines. Rocket propulsion introduction. Solid rocket motors. Liquid-propellant rocket engines. Hybrid rocket engines. Air-breathing rocket engines. Advanced propulsion techniques for space applications.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 622
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

AER 715

Course ID	001327
Short Title	Avionics and Systems
Long Title	Avionics and Systems
Long Descr	Fundamentals of avionics and aircraft systems will be introduced, including avionics systems framework and design; instrument and crew-plane interface, displays and man-machine interaction; sensors; flight control systems including fly-by-wire control, environmental and engine control systems; electrical power systems; fuel and hydraulic systems.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 416 and AER 509 and MTH 410
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 716

Course ID	003606
Short Title	Aircraft Stability and Control
Long Title	Aircraft Stability and Control
Long Descr	The fundamentals of stick-fixed and stick-free static stability are considered. Manoeuvre margins and corresponding required control column forces are assessed. The dynamic stability of a given aircraft is evaluated through consideration of the equations of motion, and approximation methods presented for the longitudinal and lateral modes of transient motion. Longitudinal and lateral-directional responses to control applications are also considered.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00
Requisites	Prerequisites: AER 320 and AER 509 and AER 615
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 721

Course ID	003323
Short Title	Orbital Dynamics
Long Title	Orbital Dynamics
Long Descr	Astrodynamics: two-body problem in three dimensions, orbital elements, orbit types (circular, elliptical, hyperbolic), reference frames and time-keeping, orbit determination, position and velocity, introduction to three-body problem. Earth Orbits: orbital perturbations (earth, environment, third-body effects), orbit lifetime, ballistic trajectories, types and uses of orbits (low, mid, high, sun-synchronous, geosynchronous). Orbit Control: basic orbital maneuvering, delta-V considerations, interplanetary transfer and rendezvous, method of patched conics, orbital swing-by, orbit station-keeping, Hill's geometry, eclipse, sun incidence, earth viewing and coverage geometry, calculation of contact time and duration, constellations. Launch Vehicle Considerations: various rocket configurations, staging, ascent to orbit.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00
Requisites	Prerequisites: AER 403 and MTH 510; Corequisites: AER 622
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0

Repeat for Credit N
Total Completions 1
Course Topics

AER 722

Course ID 005526

Short Title Aeroelasticity

Long Title Aeroelasticity

Long Descr Wing divergence. Control surface effectiveness. Flexibility effects on aircraft stability and control. Quasi-Steady and unsteady aerodynamics. Flutter analysis of two-dimensional wings with discussion of three-dimensional effects. Introduction of other aeroelastic phenomena such as stall flutter and buffeting. Prevention of aeroelastic instabilities. Flight flutter testing.

Academic Org Aerospace Engineering

Components Lecture: 3.00

Requisites Prerequisites: AER 403 and AER 621
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 723

Course ID	003451
Short Title	Intro to Space Systems Design
Long Title	Introduction to Space Systems Design
Long Descr	Overview of a typical space mission; mission analysis; space environment and its effect on spacecraft design; spacecraft structures and mechanisms; spacecraft propulsion and launch; attitude and orbit control systems; spacecraft thermal control; spacecraft electrical power systems; communications.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 509 and AER 606 and MTH 510
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 813

Course ID	002083
Short Title	Space Systems Design Project
Long Title	Space Systems Design Project
Long Descr	This course brings together the knowledge gained in many previous courses and requires that the student work as part of a small team. The requirement is to complete the design of a special purpose spacecraft or a major space system, complete with interim design reviews, final reports and presentations.
Academic Org	Aerospace Engineering
Components	Laboratory: 3.00 / Lecture: 2.00
Requisites	Prerequisites: AER721 and AER723
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 814

Course ID 004869

Short Title Aircraft Design Project

Long Title Aircraft Design Project

Long Descr This course brings together the knowledge gained in many previous courses and requires that the student work as part of a small team. The requirement is to complete the design of a special purpose airplane, complete with interim design reviews, final reports and presentations.

Academic Org Aerospace Engineering

Components Laboratory: 3.00 / Lecture: 2.00

Requisites Prerequisites: AER 626, AER 715, AER716, and AER 722
Equivalencies AER714/AER814

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 817

Course ID 001287

Short Title Systems Engineering

Long Title Systems Engineering

Long Descr Aerospace systems engineering standards and practices. Working knowledge of all elements involved in the systems engineering of aerospace projects. Project management. Requirements derivation and analysis. Systems modelling, simulation and documentation. Cost analysis. Risk management. Systems safety, system integration and verification. Students will work in teams to apply systems engineering principles and processes to the design of aerospace systems.

Academic Org Aerospace Engineering

Components Lecture: 2.00 / Laboratory: 2.00

Requisites Prerequisites: AER 606 and MTH 410
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 818

Course ID	010210
Short Title	Manufacturing Management
Long Title	Manufacturing Management
Long Descr	Aerospace materials, design, manufacturing, assembly, testing, certification, commission. Bill of materials (BOM) including materials, off-the-shelf parts, components, sub-assembled components, tooling, interface design. (Using Excel.) Bill of Labour (BOL) including metal forming, sheet metal working, metal removal, special processing methods, joining and assembly, testing. Development cycle including design (CAD), component simulation (FEM), system simulation (ADAMS). Cost analysis including return on investment (ROI), technical risks, past lessons learned. Matrix organization, enterprise resource planning (ERP), supply-chain management, production planning and scheduling. Material flow control, production time control, product quality control, product cost control, Statistics process control (SPC), Six Sigma.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 507 and ECN 801
Equivalencies	
Attributes	Case Studies
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

AER 821

Course ID	010223
Short Title	Spacecraft Attitude Dynamics
Long Title	Spacecraft Attitude Dynamics and Control
Long Descr	Review of rotational dynamics: Euler's equations, major/minor axis spins, asymptotic stability, role of energy dissipation, integrals of motion. Space-Vehicle Attitude Dynamics: rigid-body motion, typical configurations (non-spinning, spinning, momentum-bias), applications. Applied Classical Control: Discrete-time control systems, real-time considerations, bandwidth, sampling, other practical considerations. Basics of Modern Control Theory: State-space formulations, LQR/LQG controllers, comparison to classical methods. Space-Vehicle Attitude Control: Typical sensor and actuator devices, strategies for attitude control, gravity gradient control, effects of flexibility.
Academic Org	Aerospace Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: AER 509 and AER 721
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	

GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 822

Course ID 022864

Short Title Avionics Design Project

Long Title Avionics Design Project

Long Descr This course brings together the knowledge gained in many previous courses and requires that the student work as part of a small team. The requirement is to complete the design of avionics and systems for a special purpose aircraft, with interim design reviews, final reports and presentations.

Academic Org Aerospace Engineering

Components Laboratory: 3.00 / Lecture: 2.00

Requisites Prerequisites: AER 699, AER 715, AER 716, and EES 508
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 827

Course ID 025323

Short Title Composite Materials

Long Title Composite Materials

Long Descr This is a comprehensive course in composite materials, especially those commonly used in aerospace industry. Topics include design of composite laminates, properties of composite materials, characterization methods, manufacturing process and design of products made from these materials. Design considerations associated with composite materials and new developments will also be covered.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: AER 507 and AER 520
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 850

Course ID 027111

Short Title Intro to Machine Learning

Long Title Introduction to Machine Learning

Long Descr Fundamentals of machine learning will be introduced, including supervised, unsupervised and reinforcement learning, regression and classification problems, and the common machine learning algorithms e.g., linear regression, logistic regression, support vector machines, decision trees, random forest, and deep neural networks. Students will learn how to apply different concepts on aerospace engineering problems, e.g., smart cabin management, control systems, parts inspection and/or fault detection systems.

Academic Org Aerospace Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CPS 125, MTH 425, MTH 410
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

AER 870

Course ID 010297

Short Title Aerospace Engineering Thesis

Long Title Aerospace Engineering Thesis

Long Descr The course is an optional elective course and is intended to provide the student with an opportunity for independent development through solo performance of a design/research project. There is no guarantee of admission to the course since the number of thesis topics is limited. Students considering enrolment in the course must have a CGPA of at least 3.00, and must have department consent. Interested students will select a project topic from a published list and make an application to the corresponding faculty member who will be responsible for advisement of engineering content. The nature of the projects will involve some aspect of the design of an aerospace related component, process or system. The student will submit a formal technical report and conduct an oral presentation both of which will be judged on technical and design content and on communication ability. See teaching department for consent criteria.

Academic Org Aerospace Engineering

Components Laboratory: 4.00

Requisites
Equivalencies

Attributes Lab Work, Research Project
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 89A

Course ID 020414

Short Title Co-operative Internship-A

Long Title Co-operative Internship Program-A

Long Descr An optional 12 to 16 month work assignment for students in the Aerospace Engineering program. The selected students will have completed all the academic curricular requirement of the Third Year of the program, and achieved a clear standing. Enrolment in this course is conditional on the student obtaining and accepting an internship placement offer from an approved corporate partner. Interns will be visited as required by the course coordinator to assess their progress. This course is graded on a pass/fail basis. Grade achieved at the successful completion of the assignment and the submission of an acceptable work term report is PSD.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 89B

Course ID 020415

Short Title Co-operative Internship-B

Long Title Co-operative Internship Program-B

Long Descr An optional 12 to 16 month work assignment for students in the Aerospace Engineering program. The selected students will have completed all the academic curricular requirement of the Third Year of the program, and achieved a clear standing. Enrolment in this course is conditional on the student obtaining and accepting an internship placement offer from an approved corporate partner. Interns will be visited as required by the course coordinator to assess their progress. This course is graded on a pass/fail basis. Grade achieved at the successful completion of the assignment and the submission of an acceptable work term report is PSD.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites Prerequisite: WKT 89A
Equivalencies WKT89B/WKT89

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0

Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 118

Course ID 027080

Short Title Work Term I Aerospace Eng

Long Title Work Term I - Aerospace Engineering

Long Descr Co-operative work placement in the aerospace: design, manufacturing, propulsion, and controls industries. Working directly with engineers and other skilled professionals, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 218

Course ID 027081

Short Title Work Term II - Aerospace Eng

Long Title Work Term II - Aerospace Engineering

Long Descr Co-operative work placement in the aerospace: design, manufacturing, propulsion, and controls industries. Working directly with engineers and other skilled professionals, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 298

Course ID 027372

Short Title Double Work Term - Aerospace E

Long Title Double Work Term - Aerospace Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 318

Course ID 027082

Short Title Work Term III Aerospace Eng

Long Title Work Term III - Aerospace Engineering

Long Descr Co-operative work placement in the aerospace: design, manufacturing, propulsion, and controls industries. Working directly with engineers and other skilled professionals, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 418

Course ID 027083

Short Title Work Term IV Aerospace Eng

Long Title Work Term IV - Aerospace Engineering

Long Descr Co-operative work placement in the aerospace: design, manufacturing, propulsion, and controls industries. Working directly with engineers and other skilled professionals, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Aerospace Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ARC 721

Course ID 026524

Short Title Theorizing Technology

Long Title Theorizing Technology in Architecture

Long Descr This course examines the reciprocal relationship between architecture and technology, broadly defined to include building technology as well as the role of technology in the design process, considering digitalisation, communication, virtualisation, visualisation and fabrication. This course explores the philosophical underpinnings of technology and technology's role in architectural culture. Current discourses are examined, and technology is studied in relation to ethics, sustainable practices, aesthetics, politics, culture and society in a variety of contexts.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 406
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ARC 821

Course ID 026525

Short Title The Architect in Society

Long Title The Architect in Society

Long Descr This course examines the architect’s role in society from multiple perspectives: professional responsibility,disciplinary expertise and citizen activism. This course engages with contemporary social theories and their impact on architecture. Emphasis is placed on the role of ethics and professional judgement, responsibility to the public good, and the role of architecture - both as a professional discipline and as built form - in the establishment, maintenance and/or transformation of social values and political structures.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 406
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

ARC 920

Course ID	026570
Short Title	Advanced Architecture Studio
Long Title	Advanced Architecture Studio
Long Descr	Option Studios are offered each term, per demand, availability and faculty interest. (Examples of typical themes include: housing, urban design, sustainable design, competitions, technology, etc). Students in ARC Concentration must complete two sections of this studio in different terms and different Topics.
Academic Org	Architectural Science
Components	Laboratory: 9.00
Requisites	Prerequisite: ASC 620, ASC 622, ASC 623
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	3.00/3.00
Billing Units	2.0
Course Count	1.0
Repeat for Credit	Y
Total Completions	2
Course Topics	1. Housing 2. Urban Design 3. Architectural Competitions 4. Architectural Heritage 5. Adaptive Reuse 6. Materiality and Tectonics 7. Digital Design Studio 8. Sustainable Design 9. Green Infrastructure 10. Futurecasting 11. Technological Explorations 12. Representation 13. Critical Explorations 14. Travel Studio 15. Urban Infrastructure 16. Cultural Explorations 17. Sacred Architecture 18. Design Build Studio 19. Zero Carbon Design 20. Speculative Architecture 21. Community Collaborations 22. Healthy Environments

ASC 101

Course ID 022271

Short Title Communications Studio

Long Title Communications Studio

Long Descr Representation and Composition. This studio course introduces the basic techniques of visual communication through drawing (both manually and by computer), model building, etc. Techniques and theories of representation, composition and spatial organization are presented and developed through exercises and projects which relate the themes of the other first term courses, culminating in the design of a very simple building. Accompanying lectures provide students with background principles and theory for graphic communication.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Available only to students in Architectural Science
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 102

Course ID 022272

Short Title The Built World

Long Title The Built World

Long Descr Management of Finite Resources. This course provides the foundation for understanding how elements such as natural resources, time, money and human capital influence the creation of the built environment. Consideration is given as to how these resources can best be managed and integrated into the built environment to meet social, economic, environmental and cultural needs in projects that vary in scale from the individual building to the city or region.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 103

Course ID	022273
Short Title	The Built Context
Long Title	The Built Context
Long Descr	Concepts and Themes for Architecture. An introductory overview to the study of architecture and the built environment. Basic concepts, which are universal in most if not all times and places, will be discussed: shelter, protection, convenience, program, setting, light, air, beauty, etc. The role of the architect and of the architectural profession is discussed, as well as the role of the client or patron. Students will develop skills in research and analysis as well as a range of conceptual tools for examining the built environment.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 120

Course ID 026569

Short Title Introduction to Architecture

Long Title Introduction to Architecture

Long Descr This course introduces students to architecture as a cultural and intellectual undertaking, as well as a prime contributor to the design of our built world. Lectures, media presentations readings, assignments, and other explorations will provide students with opportunities to develop architectural vocabulary and an understanding of architectural concepts. Through such lenses and activities they will evolve insights into the theoretical, historical, economic, and technological aspects of architecture as they have evolved over time. This is a lower level liberal elective course.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites
Equivalencies Not Available to Architectural Science Students.

Attributes Lower Level Liberal Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 121

Course ID 027018

Short Title Sustainable Architecture

Long Title Sustainable Architecture

Long Descr This course introduces non-architecture students to how the principles of sustainability can be applied to the built environment. Examples of architectural projects that demonstrate sustainable futures are presented and discussed. Students become familiar with the environmental and social impacts of the built environment and approaches for implementation of environmentally conscious design. Various behavioural, cultural and technical strategies to reduce the impact of the built environment are discussed as are the means of measuring their success.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites
Equivalencies

Attributes Lower Level Liberal Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

ASC 200

Course ID	022274
Short Title	Sustainable Practices
Long Title	Sustainable Practices
Long Descr	Principles. This course addresses the means by which the principles of sustainability can be addressed in architectural design. The importance of the environmental, social and economic aspects of sustainability is presented and students become familiar with the process of implementation of environmentally conscious design. Various strategies to reduce the environmental impact of construction are discussed as are the means of measuring their success.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Corequisite: ASC 102
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 201

Course ID 022275

Short Title Design Studio I

Long Title Design Studio I

Long Descr Program and Site. This studio course introduces context, through an exploration of program and site, as a primary influence on architectural design. Principles and techniques of functional programming, program analysis, site investigation and site analysis form a framework for the development of a holistic design process. This is accompanied by an introduction to concepts ranging from human needs to means of defining space to create enclosure that are in turn applied to the site and context. Issues are assimilated into the architectural design process through a range of individual and team design exercises and projects.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisite: ASC 101
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 202

Course ID 022276

Short Title The Building Project

Long Title The Building Project

Long Descr Components. This course introduces the methods and materials of building construction with an examination of construction systems and components including: foundations, walls, floors, roofs, doors and windows, and finishes. Materials of construction are introduced and placed into the context of the interconnected systems that make up buildings.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 102
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 203

Course ID	022277
Short Title	Structures I
Long Title	Structures I
Long Descr	Structural Concepts. This introductory course focuses on structure in architectural design. It investigates a variety of typical structural elements, namely: columns, beams, trusses, arches, and cables operating in compression, tension, bending, or torsion to achieve structural equilibrium. This theme is expanded further through the application of these elements to form a structural system, with an overview of one- and two-way spanning systems, and of load transfer through the structural system. Optimal selection of structural systems and reasons for structural failure are reviewed.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Available only to students in Architectural Science
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 205

Course ID 022278

Short Title Collaborative Exercise I

Long Title Collaborative Exercise I

Long Descr This is the first of two connected courses (ASC205 and ASC605). Each year the department organises an all-school intensive design charrette. The subject of this changes each year to be topical to the entire program and relate to some currently relevant issue with architectural science implications. Students are placed in vertically integrated teams composed of students from all levels of the program. Each student must complete ASC205 in year one or year two of the program. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Laboratory: 3.00

Requisites Available only to students in Architectural Science
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 206

Course ID 022279

Short Title Ideas, Tech and Precedents I

Long Title Ideas, Tech and Precedents I

Long Descr This course provides a global view of the ideas shaping architecture from prehistory to the end of the 1500s, and how they impact us today. The relationships between built form, site, materials, meaning, and technology are explored through examples from around the world. Students will research, discuss, analyze, and write about the form, composition, and context of buildings. The course will situate current architectural ideas and practice within the larger history of the relationships between building, nature, and culture.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 103
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

ASC 301

Course ID	022280
Short Title	Design Studio II
Long Title	Design Studio II
Long Descr	Intention and Expression. This studio course continues the series of design studios begun in the previous semester with design exercises and projects of increasing complexity. It continues the development of skills in architectural representation and presentation. Adding to themes discussed in previous semesters, the studio and its accompanying lecture component focuses on the formulation of architectural intent (formal, material, political, or other) and its means of expression through architectural form (geometry, composition, materiality, light, and space).
Academic Org	Architectural Science
Components	Laboratory: 9.00
Requisites	Prerequisite: ASC 201
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	
Grd Basis	Graded
Hegis Code	
GPA Weight	3.00/3.00
Billing Units	2.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 302

Course ID 022281

Short Title Envelope Systems

Long Title Envelope Systems

Long Descr This course examines how environmental forces acting on building envelope components and building systems guide decision-making in building design. Building science theory and principles are applied to the control of heat, air and moisture flows across building envelope systems and to the design of a range of building envelope systems. Analytical techniques are used to assess the suitability of examples of building conditions. Life safety driven separator issues are addressed in reference to the Ontario Building Code. Related issues are reviewed within the context of existing and emerging building technology.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 202
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 303

Course ID 022282

Short Title Structures II

Long Title Structures II

Long Descr Materials and Detailing. This course applies principles of structural behaviour to material properties and construction methods. Students are introduced to properties of basic construction materials - steel, concrete, wood, and masonry. The design of structural components is addressed in conceptual terms, focusing on the advantages and possibilities that each material offers. Connections specific to each material are addressed. The issues of structural application of each material, such as deterioration due to exposure, fire performance and environmental impact are discussed. Methods are presented for determining the size of basic building components in the various materials for known forces.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 203
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

ASC 304

Course ID 022283

Short Title The Construction Project

Long Title The Construction Project

Long Descr Processes and Resources. This course introduces students to the broad scope of the AEC industry, and to the participants, practices and underlying principles that define activities related to it. Fundamental concepts are presented that are the foundation of the provision of architectural services, the roles of various participants in the construction process and the sequential project phases typical of any construction project. Project communications between members of the design team, contractors, authorities, and stakeholders and alternative approaches to project delivery are discussed.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 202
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 306

Course ID 022284

Short Title Ideas, Tech and Precedents II

Long Title Ideas, Tech and Precedents II

Long Descr This course provides a global view of the ideas shaping architecture and urbanism in the world from the 15th to the 18th centuries. This historical and theoretical overview explores ideas, trends, and major buildings during a period of increased urbanization and greater contact across civilizations using architectural examples from many cultures. Topics are explored through lectures, group discussions, and a variety of media, including numerous primary sources. Students will engage critically with architecture and history through research and writing.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 206
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 401

Course ID 022285

Short Title Design Studio III

Long Title Design Studio III

Long Descr Technical and Regulatory Issues. Students carry out design exercises and projects of increasing complexity, and develop skills in architectural representation and presentation. Adding to themes discussed in previous semesters, this studio and its accompanying lecture component considers technical and regulatory issues including The Ontario Building Code and their contribution to the design process, and focuses on the seamless relationship between technical resolution and tectonic expression. Constructability and durability in the Canadian climate is an area of focus.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisite: ASC 301
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

ASC 402

Course ID	022286
Short Title	Bodily Comfort Systems
Long Title	Bodily Comfort Systems
Long Descr	This course introduces the design and assessment of environmental control systems in conformity with current codes and standards. Heating, ventilation and air-conditioning (HVAC) systems that provide anticipated indoor environmental conditions in the Canadian climate are investigated. Techniques for the design and performance of environmental control systems are presented through simulation exercises. Passive (non-mechanical) techniques for heating, cooling and ventilation of buildings are also explored.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 302
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 403

Course ID 022287

Short Title Site Development and Planning

Long Title Site Development and Planning

Long Descr This course presents techniques for the analysis and planning of sites that respond to human, contextual and infrastructural criteria. The role of analysis is emphasized as the basis for site development, and various analytical approaches are surveyed. Methods of developing both large and small scale sites are explored with reference to the constraints and opportunities of the natural, controlled and built environment, project constructability, and the appropriate legal and planning setting.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 103
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 405

Course ID 022288

Short Title Collaborative Exercise II

Long Title Collaborative Exercise II

Long Descr Social Responsibility. Students will explore the tools and elements of architecture and their appropriate use for social responsibility and equity. Such explorations will take place through involvement in a real-world collaborative exercise. This may comprise participation with a community group to realize a project, engagement with professionals in the development of a project of social consequence, or in other ways. The objective is to expose students to an understanding of the relationship between the work of the architect and the advancement of goals of social responsibility, community development and social equity. Projects may be carried out locally or on an off-site location. Expectations: Students will be required to present the documentation of their work, which they undertook in Collaborative Exercise II, in an appropriate form and medium. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Laboratory: 3.00

Requisites Prerequisite: ASC 205
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00

Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 406

Course ID 022289

Short Title Ideas, Tech and Precedents III

Long Title Ideas, Tech and Precedents III

Long Descr This course provides a global view of architecture and urbanism in the increasingly industrialized world from the 19th century to the present day. This historical and theoretical overview focuses on architectural examples from the various traditions and events that shaped the heterogeneous world we live in today. Topics are explored through lectures, group discussions, and a variety of media, including numerous primary sources. Students will engage critically with architecture and history through research and writing.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 306
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 520

Course ID 022290

Short Title Integration Studio I

Long Title Integration Studio I

Long Descr Complex Building Feasibility Study. In this studio course students will prepare a feasibility study and schematic design for a complex, multi-use building on an urban site. The project builds on the knowledge gained to date in years 1 and 2 and extends students' understanding and capability by requiring that they fully integrate co-requisite lecture course material. Site analysis, economic and functional feasibility studies are undertaken as pre-design research. These will directly inform schematic design work that will be the basis for further development of the project in 6th semester.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisites: ASC 401, ASC 403, ASC 406, CVL 407; Corequisites: ASC 621, ASC 523

Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 521

Course ID 022291

Short Title Light/Sound in Architecture

Long Title Light/Sound in Architecture

Long Descr This course presents the fundamentals of lighting and acoustic design in buildings. Subjective responses to light and sound are explored, and simple calculations are used to evaluate spatial acoustic and lighting performance. Natural lighting processes and energy management techniques are investigated. Fundamentals of acoustic separation are presented. Students will analyse case studies of a variety of room types, including interior office spaces, public galleries and performance spaces that present opportunities to evaluate sound and light in various applications. Model testing of room acoustic performance and lighting will be introduced.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 401
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0

Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 522

Course ID 022292

Short Title Project Economics

Long Title Project Economics

Long Descr Fundamentals from Feasibility through Construction. This course investigates economic decision-making by participants in the architecture, engineering and construction industry by presenting and developing the concept of construction as an important economic activity. The course explores the application of financial analysis, cost and value determination for a range of project delivery methods, forms of tenure and building types. Students will apply techniques of value engineering and life cycle analysis including time value of money, price inflation, and dollar devaluation. They will also consider risk and sensitivity analysis in decision-making, and methods of cost planning and control and quantity take-off techniques for building design evaluation using traditional approaches and current software.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 401
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 523

Course ID 026829

Short Title Theories of Urbanism

Long Title Theories of Urbanism

Long Descr This course introduces the histories, theories, and policies that create urban environments in a global context, along with a set of tools to measure, assess, and design within them. Cities in this case are considered not only by their apparent built forms. Students are invited to look holistically at cities and their position as part of a complex web of consumption and production, including the ecosystem services and multiple networks that support their existence.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 401, ASC 403, ASC 406; Corequisites: ASC 520, ASC 621
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 605

Course ID 022293

Short Title Collaborative Exercise II

Long Title Collaborative Exercise II

Long Descr This is the second of two connected courses (ASC 205 and ASC 605). Each year the department organises an all-school intensive design charrette. The subject of this changes each year to be topical to the entire program and to relate to some currently relevant issue with architectural science implications. Students are placed in vertically integrated teams composed of students from all levels of the program. Each student must complete ASC 605 in the final two years of study as a upper student member of a team, setting the tone, and driving the team’s work on the charrette. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Laboratory: 3.00

Requisites Prerequisites: ASC 205
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 620

Course ID	022294
Short Title	Integration Studio II
Long Title	Integration Studio II
Long Descr	Complex Building - Design Development. This studio course continues to develop the technical and design features of students' projects from 5th semester, including systems integration, material development, technical detailing, and preparation of a limited set of contract documents. The course depends heavily on the integration of concepts from co-requisite lecture courses. Further economic analysis, building code review and construction documentation including specifications are addressed as part of the complex building design development project.
Academic Org	Architectural Science
Components	Laboratory: 9.00
Requisites	Prerequisites: ASC 520, ASC 523, ASC 621; Corequisites: ASC 622, ASC 623
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	3.00/3.00
Billing Units	2.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 621

Course ID 022295

Short Title Tectonics and Materiality

Long Title Tectonics and Materiality

Long Descr This course looks in depth at the means by which architects combine various materials in order to express an architectural intent. Properties of materials are discussed, as well as the major tectonic hierarchies: rigid and sheet materials, frames and skins, heavy and light volumes, bearing walls and screens. Methods of expressing joints between materials (hidden, expressed, revealed, exaggerated, trimmed) are also explored. Students are asked to carry out a number of tectonic and material design exercises, taken from and in connection with their studio work of the same term. This course is complementary to ASC 623, which looks at many of the same issues from a technical standpoint.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 401, ASC 406, CVL 407; Corequisites: ASC 520, ASC 523
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 622

Course ID 022296

Short Title Document and Const Contract

Long Title Documentation and Construction Contract

Long Descr This course develops in detail an understanding of the design and construction documentation systems used in the AEC industry, focusing on the design development, construction documents, and construction procurement phases of the construction project. Central to this course is the preparation of construction documents as a means of communicating design intent. Principles such as accuracy, clarity, consistency, coordination and completeness are to be represented in these documents. These will be considered with regard to a range of project delivery methods, and their impact on relationships among the various parties to a construction contract will also be discussed.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 621; Corequisites: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0

Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 623

Course ID 022297

Short Title Principles of Detailing

Long Title Principles of Detailing

Long Descr This course presents principles and criteria for the technical design of the detail. These principles and criteria will be applied to the development of details, found in a variety of conditions in a building. For each condition, approaches toward detailing and performance specification are discussed, and design strategies developed. Students will critically analyse case studies of the performance of existing details. The communication of detail design by the designer to the constructor, and the role of critical analysis in drawing review in ensuring appropriateness of details are discussed.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 621; Corequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 704

Course ID 001032

Short Title Independent Study

Long Title Independent Study

Long Descr This course gives students an opportunity to explore subject areas which are not part of the regular curriculum. The student must submit a written proposal of independent study for approval by the Department - see Architectural Science for information. To be eligible to take this course students must have a minimum CGPA of 2.67. This course is graded on a pass/fail basis. See teaching department for consent criteria.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes Research Project
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 730

Course ID 023884

Short Title Construction Case Studies Adva

Long Title Construction Case Studies Advanced

Long Descr Through lectures and a case study approach, students investigate recently completed architectural projects, analysing their tangible, material resolution as an expression of design intent. A major component of this course will involve students undertaking a detailed case study of one such architectural project.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies ASC 730/ARC 730

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 731

Course ID 023885

Short Title Architecture of Urban Housing

Long Title The Architecture of Urban Housing

Long Descr This course explores the impact that globalization has had on the design and development of urban housing and its implications for critical practice in Canada. Through the lens of critical practice, students will be exposed to cultural, political, economic and other factors that have an effect on the design of contemporary housing and associated living environments. This reading-intensive course will include discussion sessions led by the instructor and/or invited guests on one or more of the subject's core themes, augmented by comparative analysis of seminal housing projects located in major urban centres worldwide.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies ASC 731/ARC 731

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 732

Course ID 023886

Short Title Architectural Theory 1968 -

Long Title Architectural Theory Since 1968

Long Descr This course surveys the major trajectories in architectural theory since 1968 that form part of the context for current architectural practice. The first half of the course will focus on a number of trajectories that can now be treated historically; semiotics, critical histories, phenomenology, deconstruction, critical regionalism, and identity politics. Building on this foundation, the second half of the course will consider current and emerging theoretical frameworks for architecture.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies ASC 732/ARC 732

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

ASC 733

Course ID	023887
Short Title	Canadian Architecture 1945 -
Long Title	Canadian Architecture Since 1945
Long Descr	This course exposes students to the recent history of Canadian architecture, from the immediate post-war to the present. The conditions will be examined that led to and facilitated the spread of modernism as an important mode of architectural production and expression in post-war Canada, and how these contributed to a national architectural identity, particularly in the context of Canada's celebration of the 1967 centennial of Confederation. (Formerly ARC 733).
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 620
Equivalencies	ASC 733/ARC 733
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 734

Course ID 023888

Short Title Advanced Digital Design

Long Title Advanced Digital Design

Long Descr Digital design using computer software has evolved through a number of modes of design practice. Recent software applications have introduced more fluid interfaces that allow for serendipitous design discovery that can emerge from sketching and experimenting with forms. Students in this course will explore the potential of a number of types of software to support the digital process. These digital tools will be examined within a general creative context.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies ASC 734/ARC 734

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 735

Course ID 023889

Short Title Heritage Conservation Theory

Long Title Heritage Conservation Theory and Practice

Long Descr A course on the theoretical and practice issues of heritage conservation, particularly with regard to the preservation of buildings and sites of architectural, historical and cultural significance in the Canadian context. The course reviews theories of conservation and explores methods of documenting heritage resources and methodologies and techniques available for physical interventions into heritage structures.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies ASC 735/ARC 735

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 736

Course ID 027406

Short Title Architectural Representation

Long Title Architectural Representation

Long Descr This class is designed to be an exploration of Representation. Representation is a key element in how we read and provide meaning in architecture. This class is not about the how of making buildings but why we build. In other words, it is not simply a technical communications course. It is presented as a theory course on Representation. One important goal of this class is for students to learn how concepts of Representation impact the architecture that we make and the architecture that we experience. It is the understanding of the 'why' that pertains to all aspects of architecture, both complex relationships and abstract concepts, that is of importance.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620; Antirequisite: ASC 900 Topic Architectural Representation
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 737

Course ID 027405

Short Title Designing the Productive City

Long Title Designing the Productive City

Long Descr Architects can contribute to transforming our cities into more sustainable environments. This task encompasses designing higher density living and working environments and also includes enhancing local food quality and food security. Architectural contributions to this aspect of sustainable urbanism includes the design of farmers' markets, greenhouses, edible landscapes, living walls, productive green roofs, community gardens, and other elements that contribute to a robust regional food strategy. The course will review these strategies and apply them to a real-world project in Toronto, looking at actual and proposed development projects that allow food production and provision inside planned and existing neighbourhoods.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620; Antirequisite: ASC 900 The Productive Landscape
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 738

Course ID 027404

Short Title Arch. Research Excursions

Long Title Architecture Research Excursions

Long Descr An advanced level seminar which includes a significant travel component exposing students to the implications of cultural, historic and social factors on architecture. Topics offered and locations for travel vary and will be determined by the department based on instructor availability and expertise. Students will be expected to demonstrate supporting analysis and significant synthesis of research. Enrollment will be at the department's discretion, and numbers will be limited. Not offered every year.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620; Antirequisite: ASC 900, Topic Kultour-Travel Course
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

ASC 750

Course ID 022255

Short Title Architecture and Public Policy

Long Title Architecture and Public Policy

Long Descr This course investigates the application of architectural principles and processes to facets of public policy not traditionally addressed by the discipline of architecture. The intent is to identify how such principles and processes can shed new light on, and positively contribute to, the evolution of public policy. Some of the public policy issues to be considered include: infrastructure (transportation, waste handling, supply of water, energy and communication), social policy (relating to poverty, homelessness and health), education and governance.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 751

Course ID 022254

Short Title Architectural Writing

Long Title Architectural Writing

Long Descr The objective of the course is to provide students with exposure to the various forms of writing related to architecture as a professional practice and critical/cultural discipline. The goal is to improve students' writing and verbal communication in the context of architectural practice and discourse. The process of critical assessment and documentation of architecture will help students focus and clarify the intentions underlying their own design work.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 752

Course ID 022256

Short Title Business Practices in AEC

Long Title Business Practices in the AEC Industry

Long Descr The structure of the AEC industry is examined from the perspective of the shareholders and stakeholders of a design, management or construction firm. The application of tools essential for the effective management of resources in a firm is considered. Principles of business negotiations as they apply to scope of work, professional fees and value for services are also considered. Students are exposed to fundamental theories of ethics encountered in professional practice.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 753

Course ID 022257

Short Title Contemp Theories of Urbanism

Long Title Contemporary Theories of Urbanism

Long Descr This course considers relationships between contemporary theories of urbanism, the role of urbanism as an instrument of analysis and criticism, and associated implications for critical practice in Canada. Theoretical issues surrounding urban design and strategy are investigated through the lenses of architecture, urbanism, and the humanities. Through an engagement of the writings and projects of contemporary urban theoreticians, and with strong emphasis on relationships between key theoretical concepts and the generation of new urban forms, this reading-intensive course offers a comparative analysis of the changing nature of urban theory in the context of globalization.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 754

Course ID 022258

Short Title Creative Space Simulation

Long Title Creative Space Simulation

Long Descr Increasingly, computer modeling allows designers to simulate a range of performance factors of a building, including thermal performance, ventilation, lighting, acoustics, structure and others. This course will allow students to experience the use of such software and explore the opportunities for the design of spaces and for current architectural practice. Students will use simulation software to analyze spaces and develop design proposals based on the results of simulation.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 755

Course ID 022259

Short Title Digital Tools

Long Title Digital Tools

Long Descr Digital Tools: Ways of conceiving and communicating architectural ideas. An advanced level seminar taught by department faculty members, either singly or as a team. Topics offered in various semesters will be determined by faculty expertise available at the time.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 756

Course ID 022260

Short Title Fire Safety in Built Environmt

Long Title Fire Safety in the Built Environment

Long Descr This course provides students with an introduction to fire safety engineering. The principal objective of fire safety engineering is to provide an acceptable level of safety when an accidental fire occurs. Computational simulation software packages will be used to demonstrate fire growth and smoke movement under different scenarios. This course is designed for architecture students who have developed some basic understanding of fire and knowledge about regulations associated with fire safety in buildings.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 805

Course ID 022300

Short Title Collaborative Exercise IV

Long Title Collaborative Exercise IV

Long Descr This is a student-run and adjudicated competition. A competition brief is prepared by students in the second year of the Master of Architecture program. Students in fourth year (B. Arch. Sci.) will team up with first year Master of Architecture students in this competition. Expectations: Students will be required to present the documentation of their work, which they undertook in Collaborative Exercise IV, in an appropriate form and medium. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 605
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 850

Course ID	022262
Short Title	Globalization and Construction
Long Title	Globalization and Construction
Long Descr	The objective of this course is to encourage students to think globally and to understand the growing importance of international business and globalization and how they relate to construction at large and to the Canadian construction industry.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 620
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 851

Course ID 022263

Short Title How Buildings Work

Long Title How Buildings Work

Long Descr Knowledge of how our buildings work is crucial to creating better architecture. Without feedback loops informing architects of the performance of their designs, most buildings become prototypes and the knowledge that could be gained from each building is lost. This course will allow students the opportunity to study, examine and understand in detail the performance of an existing building. This will help develop a perspective for the long term performance of buildings and develop an understanding of buildings as they develop after architects have completed their design. Students may be asked to select an existing building and collect detailed information on performance from users, management, designers and clients, and present a critical analysis to the group.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 852

Course ID 022264

Short Title Landscape Ecological Design

Long Title Landscape Ecological Design

Long Descr In this course students will explore the fundamentals of landscape design principles and applied ecological form. This course will focus on theories of both designed and natural composition of landscapes elements. The course objectives are achieved through lectures, field trips, case studies and in-class assignments.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

ASC 853

Course ID	022265
Short Title	Landscape Design, Theory
Long Title	Landscape Design, Theory and Application
Long Descr	This course in landscape design, site and environmental planning engages students in the development and application of personal design philosophy towards the built and naturalistic environment. This is achieved through researching the professional work, styles and paradigms of internationally recognized architects, landscape architects, artists, planners and designers from the 19th-21st Century.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 620
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 854

Course ID 022266

Short Title Performance Modelling

Long Title Performance Modelling

Long Descr This course investigates issues associated with modelling, and very specifically its application to building performance. Principles associated with modelling of a structure, building envelope, part of a buildings and energy performance will be addressed and relevant examples will be given. The relevance of results and verification means will be addressed. The focus of this course will be energy consumption modelling and day lighting.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 855

Course ID 022267

Short Title Sustainable Ratings Systems

Long Title Sustainable Ratings Systems

Long Descr The course will critically evaluate current and emerging practices in the assessment of environmental impacts of built environments. Students will investigate different approaches to the assessment and rating of sustainable buildings, how these are reflected in various rating systems such as LEED, Living Building Challenge, Green Globes, Passive House, and new initiatives as they transpire. The course addresses rating systems as tools for analysis, and critically examines how they inform the design process.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 856

Course ID	022268
Short Title	The Small Building
Long Title	The Small Building
Long Descr	Throughout history, the small building has engaged the landscape and been part of the urban environment. This course will study the small building in many cultures and will provide a greater understanding of human scale, meaning, symbol, and function, and the relationship of these factors to architecture.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 620
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ASC 857

Course ID 022269

Short Title Glass in Architecture

Long Title Glass in Architecture

Long Descr This course will take us on an in-depth study of that most expressive of modern materials, glass. The material will be looked at in a holistic manner, that is, we will approach our study from technical, historical, theoretical, and expressive directions.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 858

Course ID 022270

Short Title Toronto: Architecture/Urbanism

Long Title Toronto: Architecture/Urbanism

Long Descr An in depth study of Toronto, architecture and urbanism, from its founding to the present. The course will examine conditions which led to the development of the city form and its architecture. This will reflect urban development, evolving building typologies, the role of the practitioner and builder, material and technological developments, and changing demographics. Topics for study include: Toronto's urban morphology, domestic and institutional precedents, transportation and impact on architecture/urbanism, and economic growth in the post-war metropolis.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ASC 900

Course ID 004190

Short Title Selected Topics in Arch. Sci.

Long Title Selected Topics in Architectural Science

Long Descr An advanced level course taught by Department faculty members either singly or as a team. Topics offered in any semester determined by faculty expertise available. Open to all three options and to graduate students as a professional elective. Registration may be limited to students in a specific year of the program at the Department's discretion and numbers will be limited.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit Y
Total Completions 3
Course Topics 1. Health, Comfort and Indoor Environment
3. Sustainable Housing
4. Transformable Environments
5. Inclusive Design
7. Japanese Architecture
8. Healthy Homes
10. Design for Forced Migration
11. Modernism Studies
12. Vernacular Design

BSC 720

Course ID 022301

Short Title Building Performance Studio

Long Title Building Performance Assessment Studio

Long Descr This studio course deals with the practical assessment of the performance of existing buildings. Students will have the opportunity to apply investigative, survey, measurement and testing techniques, use assessment protocols to assess the performance of real buildings, and use this information to suggest ways to improve performance. The course includes assessment of the building fabric, mechanical systems, energy use, indoor environment, and user satisfaction. An important component of student evaluation is the preparation of a comprehensive technical report including an interpretation of results.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisites: ASC 620, ASC 622, ASC 623
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BSC 721

Course ID 022302

Short Title Existing Building Forensics

Long Title Existing Building Forensics

Long Descr Looking at Existing Buildings. This course examines the role of the building forensic consultant. Students learn the processes, methodologies and techniques used for diagnosing failures in building systems and/or building components. The theories behind protocols for testing and surveying are discussed and familiarity with the role of Codes, Standards and construction documentation is developed. Post-occupancy evaluation of buildings, and how this can be used as a diagnostic tool, is presented and developed. There will also be a focus on the theory and practice of decision-making related to building performance, including economic considerations using techniques presented in ASC 522.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisite: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

BSC 722

Course ID	022303
Short Title	Sustainable Enviro Control Sys
Long Title	Sustainable Environmental Control Systems
Long Descr	This course explores the role of sustainable mechanical, electrical and control systems for buildings. Students explore innovative ways of heating, cooling, ventilating and lighting buildings. The course will consider renewable energy technologies, such as solar, wind, geothermal, and biomass energy, and the implications of their use on architectural form and details. Analysis techniques for choosing appropriate options are presented.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 620
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BSC 820

Course ID 022304

Short Title Building Science Design Studio

Long Title Building Science Detail Design Studio

Long Descr Investigating Details. Students will undertake an individual research project of a particular technology, material or component. Areas for possible student research include: innovative use, reduction of environmental impact and practical application to the construction industry. Outcomes of this project may be the design of a new component or detail, the application of a material or component in a small design project, or the development of a prototype.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisite: ASC 620, ASC 622, ASC 623
Equivalencies

Attributes Research Project
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BSC 821

Course ID 022305

Short Title Sustainable Detail Design

Long Title Sustainable Detail Design

Long Descr Sustainable Detail Design. This course focuses on issues of detail design, particularly with reference to sustainable buildings. It addresses the concept of integrated design of components and systems, and strategies for innovations to reduce environmental impacts. Students develop a detailed knowledge of the issues related to construction systems aimed to minimize environmental impact. The course develops some of the underlying theories of appropriate decision-making such as the role of statistics in data analysis and synthesis, and the importance of Life Cycle Assessment. Students become knowledgeable in green building ratings, and are introduced to environmental modeling programs.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

BSC 822

Course ID	022306
Short Title	Advanced Envelopes/Components
Long Title	Advanced Envelopes/Components
Long Descr	This course develops an advanced level of understanding of the design of building envelopes and cladding. Students investigate new and advanced forms of cladding and cladding systems, and develop an understanding of complex detail design. Sustainability aspects of alternative materials and systems are considered.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisites: ASC 620
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

PMT 720

Course ID 022307

Short Title PMT Studio in Development

Long Title Project Management Studio in Development

Long Descr In this studio, students will apply and integrate their knowledge gained in their lower years to develop a Response to a Request for Proposal for a building project. Students will learn the many key stages in developing a Proposal from inception to completion and the importance of collaboration between related disciplines. They will use Building Information Management (BIM) tools to communicate and develop their work on a variety of project management issues and problems.Students will also learn how to further develop and execute their proposal, taking into account site and regulatory constraints.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisites: ASC 620, ASC 622, ASC 623
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

PMT 721

Course ID 022308

Short Title Economics for Project Mgmt

Long Title Economics for Project Management

Long Descr Financing, cost planning and control are addressed in depth. In the course, the physical factors affecting the value of real property, methods of budget determination, quantity and scope of work estimation, elemental cost analysis and determination, and planning, scheduling and control are explored. These are considered in the programming, planning and approvals stages of developments, and are applied to a range of ownership options and building types. Tools and techniques for building programming, decision-making, implementation control and life cycle costing will be evaluated.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 620, ASC 522
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

PMT 722

Course ID	022309
Short Title	Information Systems
Long Title	Information Systems
Long Descr	This course provides students with an in-depth exposure to the information systems, tools and techniques that are commonly used in the AEC industry. The course examines how management information systems, using current computer technology, can provide project managers with the data necessary to perform their management functions. Information systems currently in use in the industry are examined, with particular emphasis on project planning, scheduling, resource allocation and the control of time and cost, from both practical and theoretical standpoints. Innovative approaches are also explored.
Academic Org	Architectural Science
Components	Lecture: 3.00
Requisites	Prerequisite: ASC 620
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

PMT 820

Course ID 022333

Short Title PMT Studio in Procurement

Long Title Project Management Studio in Procurement

Long Descr In this studio, students will learn how construction projects are procured in the industry by way of a simulated bid process.Besides cost and schedule, students will also learn the legalities and formalities required for the submission of a valid bid.This course will make aware to students the real-life challenges that are present within the construction bidding and estimating process, including carrying out a financial feasibility study for a building project using appropriate software. In addition to up-to-date regulatory requirements and charges, students will be required to research current and projections of future costs and revenues.

Academic Org Architectural Science

Components Laboratory: 9.00

Requisites Prerequisite: ASC 620, ASC 622, ASC 623
Equivalencies

Attributes Lab Work, Research Project
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 3.00/3.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

PMT 821

Course ID 022334

Short Title Construction Practices / Mgmt

Long Title Construction Practices and Management

Long Descr Students undertake a detailed study of the materials and methods of construction service, delivery and control as applied to a variety of building types. Included are investigations of building materials, construction techniques, and contract and cost control methodologies. Attention is given to the context of the AEC industry, organizations and the project manager's roles and responsibilities. Students will appraise the multiple aspects of site operations and evaluate site management performance. There is a focus on the role of value engineering as an integrated decision making tool throughout all phases of a construction project. Students must complete both PMT 721 and PMT 722 prior to taking this course.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00

Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

PMT 822

Course ID 022310

Short Title Procurement and Const Mgmt

Long Title Procurement and Construction Management

Long Descr This course presents a study of the project management process as applied to projects of the built environment, with an emphasis on novel methods of project delivery and procurement procedures, site management, commissioning, and facility management. The use of project control systems in the management of these phases is studied, as are techniques of construction management in relation to the planning and control of site operations. Students are introduced to contemporary construction methods and equipment. The importance of the role of the project manager in ensuring the build-ability and cost efficiency of the project is stressed and environmental management issues in the construction process are presented. In a review of the construction industry, the changing roles of the participants, and current trends and problems are discussed.

Academic Org Architectural Science

Components Lecture: 3.00

Requisites Prerequisites: ASC 620
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 106

Course ID 025037

Short Title Work Term I Architecture

Long Title Work Term I - Architectural Science

Long Descr Co-operative work placement in the architecture, engineering and construction (AEC) industry. Working directly with architects, engineers and other skilled professionals from the AEC, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 206

Course ID 025038

Short Title Work Term II Architecture

Long Title Work Term II - Architectural Science

Long Descr Co-operative work placement in the architecture, engineering and construction (AEC) industry. Working directly with architects, engineers and other skilled professionals from the AEC industry, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 306

Course ID 025039

Short Title Work Term III Architecture

Long Title Work Term III - Architectural Science

Long Descr Co-operative work placement in the architecture, engineering and construction (AEC) industry. Working directly with architects, engineers and other skilled professionals from the AEC industry, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 406

Course ID 025040

Short Title Work Term IV Architecture

Long Title Work Term IV - Architectural Science

Long Descr Co-operative work placement in the architecture, engineering and construction (AEC) industry. Working directly with architects, engineers and other skilled professionals from the AEC industry, participants will gain experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Architectural Science

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 70A

Course ID	026576
Short Title	BME Engin Capstone Design-A
Long Title	Biomedical Engineering Capstone Design-A
Long Descr	This two-term course provides a training platform for systematic open-ended design process and project management. Student groups apply their acquired knowledge and engineering skills to develop and build a design project from concept to working prototype. The lecture component provides advice and information on the design process, project management, reliability, system components, documentation, safety, and program specific aspects. In the laboratory component, once a project topic is assigned, student groups plan, design, source components, build, test/debug, and analyze, under the supervision of a faculty lab coordinator and submit a final design project report.
Academic Org	Biomedical Engineering
Components	Lecture: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: BME 501, BME 516, BME 632, BME 639, BME 674, BME 634, MTH 410
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Multi-Term Course: Not Graded
Hegis Code	
GPA Weight	0.00/0.00
Billing Units	1.0
Course Count	0.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 70B

Course ID	026577
Short Title	BME Engin Capstone Design-B
Long Title	Biomedical Engineering Capstone Design-B
Long Descr	This two-term course provides a training platform for systematic open-ended design process and project management. Student groups apply their acquired knowledge and engineering skills to develop and build a design project from concept to working prototype. The lecture component provides advice and information on the design process, project management, reliability, system components, documentation, safety, and program specific aspects. In the laboratory component, once a project topic is assigned, student groups plan, design, source components, build, test/debug, and analyze, under the supervision of a faculty lab coordinator and submit a final design project report.
Academic Org	Biomedical Engineering
Components	Laboratory: 5.00
Requisites	Prerequisite: BME 70A
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	2.00/2.00
Billing Units	1.0

Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 100

Course ID 022884

Short Title Intro to Biomedical Eng

Long Title Introduction to Biomedical Engineering

Long Descr This course will deal with the terminology of the medical profession; anatomy and physiology of the human body, from overall system and functional approaches; survey of present-day medical measurements and consideration of those areas in which engineering may be applied advantageously to medicine. The course will also include seminars from guest speakers from biomedical profession. Exposure to medical equipment in hospitals, and small animal handling training will also be provided. Bioethics will also be covered in the course. This course is graded on a pass/fail basis.

Academic Org Biomedical Engineering

Components Lecture: 1.00 / Laboratory: 1.00

Requisites
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 229

Course ID	022885
Short Title	Biomedical Physics
Long Title	Biomedical Physics
Long Descr	Applications of physics in medicine. This survey course will address basic concepts of medical imaging, nuclear medicine and radiation isotopes, radiation therapy, gamma spectroscopy and trace element analysis, and biomedical laser applications.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00
Requisites	Prerequisites: BME 100, CHY 102, CPS 188, ELE 202, MTH 240, PCS 125, PCS 211
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 323

Course ID	022886
Short Title	Statics and Mechanics of Mat
Long Title	Statics and Mechanics of Materials
Long Descr	Statics will cover rigid body equilibrium, including: two and three-force members, trusses, frames and machines. Mechanics of materials will cover introductory stress and strain, including Hooke's Law, axial and torsional loading, and statically indeterminate problems.
Academic Org	Biomedical Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: BME 100, CHY 102, CPS 188, ELE 202, MTH 240, PCS 125, PCS 211; Antirequisite: MEC 323
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 328

Course ID	022887
Short Title	Digital Systems
Long Title	Digital Systems
Long Descr	This course covers the basics digital logic circuits and emphasizes on good understanding of basic concepts in modern digital system design. The course introduces computer aided design (CAD) tools including the use of hardware description language (HDL) for design entry. It also discusses the use of the latest available implementation technologies including CPLDs and FPGAs for mapping the design to modern technology. This course covers basic logic circuits, Boolean algebra, and implementation technology (from transistor to CPLDs and FPGAs). It also introduces logic functions optimization and implementation, number representation and arithmetic circuits, combinational circuits, synchronous and asynchronous sequential circuits as well as introduction to control unit data path and CPU operations. The Laboratory work requires the uses of CAD tools to design and simulate basic digital circuits. Implementation and testing of simple digital systems in LSI and CPLD will also be considered.
Academic Org	Biomedical Engineering
Components	Lecture: 4.00 / Laboratory: 3.00
Requisites	Prerequisites: CPS 188, ELE 202, MTH 240
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	2.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 406

Course ID	022888
Short Title	Biomechanics
Long Title	Biomechanics
Long Descr	An introduction to the application of mechanical engineering principles to biological materials and systems. Topics include ligament, tendon, bone, muscle; joints, gait analysis; exercise physiology. The basic concepts are directed toward an understanding of the science of orthopedic surgery and sports medicine.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: BME 323; Corequisite: BLG 601
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00

Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 423

Course ID 022889

Short Title Biomaterials

Long Title Biomaterials

Long Descr The principles of materials science and engineering with particular attention to topics most relevant to biomedical engineering. The structure-property relationships of metals, ceramics, polymers, and composites as well as skin, bone, cartilage, ligament, and vasculature; extensive treatment of the properties unique to materials' surfaces. Behaviour of materials in the physiological environment.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: BLG 143 and BME 323
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 434

Course ID	027056
Short Title	Circuits, Devices, and Sensors
Long Title	Circuits, Devices, and Sensors
Long Descr	Sensors (strain gauge, thermistors, photoresistors) and signals, op-amp basic circuits, signal conditioning circuits (Wheatstone bridge), second order circuits, differential equations and Laplace transform in circuit analysis, transfer function and frequency response and filters, mutual inductance and transformers; diodes and rectifier circuits, BJT, FETs, MOSFETs.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 202 and MTH 312
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 501

Course ID	022890
Short Title	Bioinformatics
Long Title	Bioinformatics
Long Descr	Introduction to analysis, management, and visualization of cellular information at the molecular level. The course includes an overview of mathematical modeling and simulation, pattern matching, methods for phylogenetics, gene recognition, distributed and parallel biological computing, designing and managing biological databases (both relational and object-oriented), linking disparate databases and data, data mining, reasoning by analogy, hypothesis formation and testing by machine.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00
Requisites	Prerequisite: BLG 601 and CEN 199 and MTH 312; Antirequisite: CPS 501
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 506

Course ID	022924
Short Title	Introduction to Software
Long Title	Introduction to Software
Long Descr	This course introduces Biomedical Engineers to the principles and processes governing software design and development. Software development processes are explored in the context of procedural and object-oriented paradigms (C/C++). Topics include requirements analysis/specifications, detailed design and implementation, testing, inspection and debugging. Decomposition into classes and modules is examined from the point of view of data-flow, entity-relationships, and the unified modeling language (UML). Students will learn how to leverage industry standard tools for design and development. Laboratory work will focus on applications relating to biomedical engineering.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: BME 328 and CEN 199; Antirequisite: COE 318
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 516

Course ID 022891

Short Title Fluid Mechanics

Long Title Fluid Mechanics

Long Descr Dimensions and units, continuum fluid mechanics. Properties of fluids. Fluid statics, the standard atmosphere. Manometry and pressure measurement. Forces on submerged planes. Flow characteristics: laminar and turbulent flow, steady and unsteady flow, streamlines. Flow analysis: control volume/control system and differential approaches for mass, momentum and energy conservation. Applications of the conservation equation, Euler and Bernoulli equations. Dimensional analysis, similitude and model testing. (2 hr. Lab every other week)

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: BME 229, BME 406, BME 423, CEN 199, MTH 312; Antirequisite: MEC 516

Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 532

Course ID 022892

Short Title Signals and Systems I

Long Title Signals and Systems I

Long Descr This course deals with the analysis of continuous-time and discrete-time signals and systems. Topics include: representations of linear time-invariant systems, representations of signals, Laplace transform, transfer function, impulse response, step response, the convolution integral and its interpretation, Fourier analysis for continuous-time signals and systems and an introduction to sampling.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, BME 434; Antirequisite: ELE 532

Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 538

Course ID	022893
Short Title	Microprocessor Systems
Long Title	Microprocessor Systems
Long Descr	This course introduces students to small microprocessor-based systems, with an emphasis on embedded system hardware and software design as applied to Biomedical Engineering. Topics will include microprocessor architecture and structure, with an overview of 8- 16- and 32-bit systems, assembly language programming and the use of high-level languages. Basic input/output including parallel communications with and without handshaking and serial protocols. Hardware and software timing using interrupts and exceptions. Overview of single-chip microprocessors and controllers with an emphasis on the PIC32 microcontroller. The internal structure and design of peripheral devices are examined; together with memory system design and analysis. Key software design concepts are reinforced through labs/project work; together with the use and structure of development tools such as (cross) assemblers or compilers, monitor programs, simulators, emulators, etc.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: BME 328 and CEN 199; Antirequisite: COE 538
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 632

Course ID 022894

Short Title Signals and Systems II

Long Title Signals and Systems II

Long Descr The topics covered in the course includes a general discussion on discrete signals (periodic signals, unit step, impulse, complex exponential), a general discussion on discrete systems, Discrete-Time Fourier Series (DTFS), Discrete-Time Fourier Transform (DTFT); analysis and synthesis, Fourier Spectra; continuous nature, periodicity, existence, Properties of the DTFT; linearity, conjugation, time/frequency reversal, time/frequency shifting, etc. LTI discrete time system analysis using DTFT, DTFT and Continuous-Time FT comparison and relation, DFT and FFT discussion and their relation to DTFT and CTFT, Discrete-Time Sampling, Z-Transform; generalization of the DTFT.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: BME 532, CEN 199; Antirequisite: ELE 632
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 634

Course ID 027057

Short Title Electrical Machines and Actuat

Long Title Electrical Machines and Actuators

Long Descr This course will cover essential concepts and design aspects of DC/AC motors, drives and actuators. Topics include, power electronic circuits, H bridges, PWM control, interfacing, power amplifiers, DC servo and stepper motors, Solenoids, AC synchronous and induction motors. In addition, methods of parameter identification of a loaded motor and its dynamic motion trajectory control will be covered for applications such as biomechanics or medical robotics.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: BME 434 and CEN 199
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

BME 639

Course ID	022895
Short Title	Control Systems Bio-Robotics
Long Title	Control Systems and Bio-Robotics
Long Descr	Introductory course for Biomedical Engineers: system modeling, simulation, analysis and classical-controller designs of linear, time-invariant, continuous time systems. System dynamic properties in time and frequency domains, performance specifications and basic properties of feedback are investigated. Stability analysis is reinforced through Routh-Hurwitz criterion, Root-Locus method, Bode plots, and Nyquist criteria. Concept of Bio-Robotics is introduced, and exposure to basics of state-space representation and feedback. Key control concepts are experienced through laboratory experiments using modular servo-system with open architecture, fully integrated with MATLab and Simulink; use of simulation tools; and solving design problems.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 1.50
Requisites	Prerequisite: BME 532, CEN 199; Antirequisite: ELE 639
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 674

Course ID	022896
Short Title	Biomedical Instrumentation
Long Title	Biomedical Instrumentation
Long Descr	This course deals with the application and design of medical instrumentation systems for which the source of the signals is living tissue or energy applied to living tissues. The major emphasis will be on, transduction principles, sensors, detectors, electronic signal conditioning and processing techniques, and electrical safety standards for medical instrumentation. Some of the major topics include: sensors and transducers - e.g. displacement, resistive, inductive, capacitive, piezoelectric, temperature, radiation thermometry, optical etc.; special-purpose amplification and signal processing techniques; ECG-EMG-EEG biopotential electrodes and amplifiers; non-invasive blood pressure, flow-rate and volume sensing and measurement techniques; respiratory plethysmography; electrochemical biosensors and laboratory instruments; medical imaging systems; and designs for electrical safety. Important instrumentation design concepts are illustrated through design labs, a final design project, and use of circuit simulation tools.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: BLG 601, BLG 701, BME 506, BME 538, CEN 199; Corequisite: BME 532
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 703

Course ID	022898
Short Title	Tissue Engineering
Long Title	Tissue Engineering
Long Descr	Tissue engineering approach for augmentation or replacement of compromised tissue function in nerve, microvessels, skin and cartilage. Integrative exploration of the use of three-dimensional polymeric scaffolds and drug delivery vehicles, and gene therapy and cellular engineering for functional repair of injured tissues.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 1.50 / Tutorial: 0.50
Requisites	Prerequisites: BLG 601 and BLG 701
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00

Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 704

Course ID 022899

Short Title Radiation Therapy Devices

Long Title Radiation Therapy Devices

Long Descr This course will cover radiation producing equipment, character of photon and electron radiation beams, radiation dose functions, computerized radiation treatment planning, brachytherapy, cone beam CT, 4D CT, MRI-Linac, image guided radiotherapy, special radiation treatment procedures, quality assurance, and radiation shielding of high energy facilities.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: BME 229 and BME 674 and MTH 410
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 705

Course ID 022900

Short Title Rehabilitation Engineering

Long Title Rehabilitation Engineering

Long Descr Engineering principles underlying the design and utilization of devices for persons with disabilities. Exposure to fabrication and design techniques. Overview of existing technology, including: limb and spinal orthoses, limb prostheses, devices aiding mobility, seating aids, reachers, robotic aids, functional electrical stimulation; sensory aids, uses of microcomputers, workplace/home modifications, devices for the aged. Effects of national policies, and challenges of technology transfer.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: BLG 601, BME 639, and BME 634
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 714

Course ID 027058

Short Title Medical Robotics

Long Title Medical Robotics

Long Descr This course provides students with fundamentals of medical robotics and their application. Students will learn concepts in robotics including: rigid motions, and homogeneous transformations, the Denavit-Hartenberg representation of linkages, forward kinematics, velocity kinematics and Jacobians, singularities, inverse kinematics, statics, joint control, tracking, and image-guided navigation.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: BME 634, BME 674, and BME 639
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 772

Course ID	022901
Short Title	Biomedical Signal Analysis
Long Title	Biomedical Signal Analysis
Long Descr	This course will focus on biomedical signals and related signal modeling and analysis techniques. Topics covered include an introduction to various physiological/biomedical signals such as the action potential, the electro-neurogram (ENG), the electromyogram (EMG), the electrocardiogram (ECG), the electroencephalogram (EEG), event-related potentials (ERPs), the electrogastrogram (EGG), the phonocardiogram (PCG), the carotid pulse (CP), signals from catheter-tip sensors, speech and oto-acoustic emission signals. The biomedical signal analysis portion of the course will deal with the analysis of concurrent, coupled and correlated processes, filtering for removal of artifact from biomedical signals, event detection techniques, analysis of wave-shape and waveform complexity associated with biomedical signals, mathematical modeling of biomedical systems, and medical decision support systems.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: BLG 601 and BLG 701 and BME 632 and BME 639; Antirequisite: ELE 772
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 777

Course ID 025933

Short Title Emerging Topics in BME

Long Title Emerging Topics in Biomedical Engineering

Long Descr This course will introduce students to emerging areas in biomedical engineering with specific topics geared towards current trends. The course is structured to be a technical elective i.e., the content may change from year to year depending on the specific topics covered in the course and may be taught by one or more instructors. Students may be required to undertake a major project.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: BLG 601, BLG 701, BME 406, BME 423, BME 501, BME 506, BME 516, BME 632, BME 639, BME 674, BME 634, and MTH 410

Equivalencies

Attributes Lab Work, Research Project
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 802

Course ID 022903

Short Title Human-Computer Interaction

Long Title Human-Computer Interaction

Long Descr Principles underlying the design, evaluation and implementation of interactive computing systems as well as the major research topics associated with such systems. Technical breakdown of interfaces that are multi-media based front-ends to complex networks. Graphical user interfaces will be introduced along with the related physiological and human factors issues. Design of interfaces using virtual reality, the Internet, and other advanced development tools. Commonly integrated media such as video, graphics, and audio capabilities will be examined. User-centered technology will be a primary theme using the design of web pages and medical device design as hands-on applications.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: BME 506, BME 639, BME 674 and BME 634

Equivalencies

Attributes Lab Work, Research Project
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

BME 803

Course ID	027059
Short Title	Cardiovascular Biomechanics
Long Title	Cardiovascular Biomechanics
Long Descr	The course will provide students with a fundamental understanding of cardiovascular biomechanics. Basic principle of cardiovascular fluid and solid mechanics and modelling techniques will be covered. Analytic and simulations approaches will be used to solve problems in cardiovascular biomechanics. Concepts include Womersley profile solution, constitutive laws for biological materials, lumped parameter modeling of heart and systemic circulation, and Newtonian and non-Newtonian blood properties.
Academic Org	Biomedical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: BME 516, BME 406, BME 639 and BME 634
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

BME 804

Course ID 022904

Short Title Design of Bio-MEMS

Long Title Design of Bio-MEMS

Long Descr Biophysical and chemical principles of biomedical microelectromechanical systems (bioMEMS) for the measurement of biological phenomena and clinical applications. micro-and nano-scale devices for the manipulation of cells and biomolecules. Topics include solid-state transducers, optical transducers, electrochemical transducers, biomedical microelectronics, microfluidics, and hybrid integration of microfabrication technology.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisites: BME 423 and BME 674 and BME 634
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 808

Course ID 022905

Short Title Computations in Genetic Eng

Long Title Computations in Genetic Engineering

Long Descr Discusses the theory and practice of molecular database searching and sequence alignment in genetic engineering. Covers databases and Internet access, sequence homology searching, and multiple alignment and sequence motif analysis, and protein structure and function.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisite: BME 501 and BME 532 and MTH 410
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 809

Course ID 022906

Short Title Biomedical Systems Modelling

Long Title Biomedical Systems Modelling

Long Descr Mathematical modeling of biomedical systems. Lumped and distributed models of electrical, mechanical, and chemical processes applied to cells, tissues, and organ systems.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisites: BLG 601 and BLG 701 and BME 229 and BME 639
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

BME 872

Course ID 022907

Short Title Biomedical Image Analysis

Long Title Biomedical Image Analysis

Long Descr Introduces the fundamental principles of medical imaging, analysis, and visualization. Focuses on the processing and analysis of ultrasound, MR, and X-Ray images for the purpose of quantification and visualization to increase the usefulness of modern medical image data. Includes image perception and enhancement, 2-D Fourier Transform, spatial filters, segmentation, and pattern recognition.

Academic Org Biomedical Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisites: BME 229 and BME 772
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 119

Course ID 027084

Short Title Work Term I - Biomedical Eng

Long Title Work Term I - Biomedical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Biomedical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 219

Course ID 027085

Short Title Work Term II Biomedical Eng

Long Title Work Term II - Biomedical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Biomedical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 299

Course ID 027373

Short Title Double Work Term - Biomedical

Long Title Double Work Term - Biomedical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Biomedical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 319

Course ID 027086

Short Title Work Term III Biomedical Eng

Long Title Work Term III - Biomedical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Biomedical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 419

Course ID 027087

Short Title Work Term IV Biomedical Eng

Long Title Work Term IV - Biomedical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Biomedical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 44A

Course ID 020354

Short Title Plant Design-A

Long Title Plant Design-A

Long Descr Chemical engineering design of industrially relevant process plants by student groups under the supervision of the course instructors; intensive application of the core disciplines such as thermodynamics, chemical reactor engineering, fluid mechanics, heat transfer, mass transfer, process modeling and simulation, process control, and optimization; inclusion of the principles of process safety, loss prevention, engineering economics, cost analysis, and prudent environmental practices; adherence to environmental-friendly process design, and conformation to environmental regulations and policies; utilization of relevant engineering software; preparation of written project reports, and formal public delivery of oral presentations at different stages; individual and group evaluation of students who are expected to exhibit the cooperative, ethical, and discipline traits of an effective Professional Engineer.

Academic Org Chemical Engineering (Co-op)

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisites: CHE 617; Corequisites: CHE 413 and CHE 415
Equivalencies

Attributes Capstone, Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N

Total Completions 1
Course Topics

CHE 44B

Course ID 020355

Short Title Plant Design-B

Long Title Plant Design-B

Long Descr Chemical engineering design of industrially relevant process plants by student groups under the supervision of the course instructors; intensive application of the core disciplines such as thermodynamics, chemical reactor engineering, fluid mechanics, heat transfer, mass transfer, process modeling and simulation, process control, and optimization; inclusion of the principles of process safety, loss prevention, engineering economics, cost analysis, and prudent environmental practices; adherence to environmental-friendly process design, and conformation to environmental regulations and policies; utilization of relevant engineering software; preparation of written project reports, and formal public delivery of oral presentations at different stages; individual and group evaluation of students who are expected to exhibit the cooperative, ethical, and discipline traits of an effective Professional Engineer.

Academic Org Chemical Engineering (Co-op)

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisite: CHE 44A
Equivalencies CHE44B/CHE44

Attributes Capstone, Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 200

Course ID	022957
Short Title	Chemical Eng Fundamentals
Long Title	Chemical Engineering Fundamentals
Long Descr	Fundamentals and principles of chemical engineering; analysis and synthesis of chemical and biochemical processes; material and energy balances for reacting and non-reacting systems; recycle and by-pass systems; phase equilibrium; and combustion.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 4.00 / Tutorial: 2.00
Requisites	Prerequisite: CHY 102
Equivalencies	CHE200/CHE222
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 204

Course ID	004584
Short Title	Thermodynamics I
Long Title	Thermodynamics I
Long Descr	Properties of pure substances; equations of state; heat and work conversions; internal energy and enthalpy; the first law of thermodynamics; entropy; the second law of thermodynamics; applications of the first and second laws to open systems and control volumes; irreversibility and availability; power cycles and refrigeration systems; gas turbines and compressors.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Tutorial: 1.00
Requisites	Prerequisites: CHE 200, CHY 211, MTH 141, MTH 240
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 214

Course ID 000026

Short Title Thermodynamics II

Long Title Thermodynamics II

Long Descr Maxwell relations; Clapeyron equation; residual properties; phase rule and Gibbs law; phase equilibrium and its criteria; real gas solubility; chemical potential; fugacity and fugacity coefficients; ideal and nonideal mixtures; excess properties; activity coefficients; azeotropes; Van Laar equation; application of the first and second laws for reacting systems; chemical reaction equilibria.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Laboratory: 1.50 / Tutorial: 1.00

Requisites Prerequisite: CHE 204
Equivalencies CHE214/CHE317

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 215

Course ID 000609

Short Title Process Measurements

Long Title Process Measurements

Long Descr Principal methods of measuring temperature, pressure, humidity, fluid flow rate, viscosity, liquid level, density and specific gravity, diffusion coefficient, and thermal conductivity; fundamentals of operation of each measurement method.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CHE 217, EES 512, PCS 125
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 217

Course ID	000550
Short Title	Fluid Mechanics
Long Title	Fluid Mechanics
Long Descr	Introduction to fluid mechanics; fluid properties; fluid statics; types of flow; Bernoulli equation; energy equation; head losses; design of piping systems; linear momentum balance equation; dimensional analysis; boundary layer theory; differential analysis of fluid flow; flow through porous media.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: CHE 200, MTH 141, MTH 240, PCS 211
Equivalencies	CHE217/CHE311
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 220

Course ID	001260
Short Title	Heat Transfer
Long Title	Heat Transfer
Long Descr	Steady-state conduction; transient conduction; lumped and distributed systems; thermal and hydrodynamic boundary layer concepts; forced convection (external and internal); free convection; heat exchanger design; radiation properties; radiation heat transfer.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Tutorial: 1.00
Requisites	Prerequisites: CHE 217, MTH 425
Equivalencies	CHE220/CHE320
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 307

Course ID 001955

Short Title Chemical Engineering Materials

Long Title Chemical Engineering Materials

Long Descr Relations between the structure of crystalline and amorphous materials and their properties; measurement of mechanical properties; processing of metals, ceramics, and plastics; applications; electrochemical reactions and corrosion.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CEN 199 and CHY 224
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 308

Course ID 005116

Short Title Mass Transfer

Long Title Mass Transfer

Long Descr Mass transfer fundamentals including molecular and convective mass transfer; molecular diffusion in fluids and solids; mass transfer coefficients and their applications; concentration distribution and mass transfer rates by using both shell mass balances and equations of change; interphase mass transfer; mass transfer applications including binary and multicomponent distillation.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisites: CEN 199 and CHE 214 and CHE 220
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 309

Course ID	022958
Short Title	Introductory Bioengineering
Long Title	Introductory Bioengineering
Long Descr	Biological systems for the production of commercial goods and services such as agriculture and foods, pharmaceuticals, chemicals, fuels, equipment, diagnostics, water treatment, and waste treatment; properties of microorganisms, plant and animal cells, and enzymes used in bioprocess applications; basic biochemistry, cell biology, cell metabolism, and cell physiology; cell nutrition and growth; properties and functions of biopolymers; overview of genetics, recombinant DNA technology, and protein expression with a focus on biotechnologically relevant examples.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Prerequisites: CEN 199 and CHE 200 and CHY 224
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 312

Course ID	022959
Short Title	Chemical Reaction Engineering
Long Title	Chemical Reaction Engineering
Long Descr	Chemical kinetics; differential and integral rate laws; rate equations for elementary, complex and multiple reactions; kinetics in batch and flow systems; determination of reaction kinetics from experimental data; reaction mechanisms and ideal reactors; design for single reactions, continuous stirred tank and tubular reactors; reactor networks; design for multiple reactions, non-isothermal reactors, and catalytic reactors; diffusion and heterogeneous catalytic reactions; residence time distribution for chemical reactors; non-ideal reactors.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisite: CHE 308 or CHE 318
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N

Total Completions 1
Course Topics

CHE 315

Course ID 003138

Short Title Unit Operations Laboratory I

Long Title Unit Operations Laboratory I

Long Descr Operation and analysis of pilot plant type equipment for various industrial operations with emphasis on mechanical separations, filtration, evaporation, pump and piping, and drying; diffusivity measurement in gases and liquids.

Academic Org Chemical Engineering (Co-op)

Components Laboratory: 3.00

Requisites Prerequisites: (CHE 215 and CHE 308) or (CHE 318 and CHE 331)
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 318

Course ID	004819
Short Title	Separation Processes
Long Title	Separation Processes
Long Descr	Separation processes involving single and multiple staged, and continuous contacting operations for gas-liquid, and solid-fluid systems; process design and equipment for gas absorption packed columns, drying, membrane separation, liquid-liquid extraction, leaching, and adsorption processes.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Tutorial: 1.00
Requisites	Corequisites: CHE 308
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 319

Course ID	003621
Short Title	Process Modeling/Simulation
Long Title	Process Modeling and Simulation
Long Descr	Definitions and classifications of mathematical models; macroscopic and microscopic conservation equations for mass, energy and momentum; solution techniques for models with ordinary and partial differential equations; Laplace transforms; transfer functions; dynamic behaviours of first-order and second-order systems; block diagrams; use of computer software to simulate process dynamics.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisite: CHE 308 or (CHE 318 and CHE 338); Corequisite: CHE 312
Equivalencies	CHE310/CHE319
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 331

Course ID 003921

Short Title Eng. Statistics/Probabilities

Long Title Engineering Statistics and Probabilities

Long Descr Probability; binomial, normal and Poisson distributions; sampling distributions; confidence intervals and tests of significance; multiple linear regression; applications of these concepts to engineering processes.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Tutorial: 1.00

Requisites Prerequisites: CEN 199 and CPS 125 and MTH 425
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 338

Course ID 002725

Short Title Chemical Eng Computations

Long Title Chemical Engineering Computations

Long Descr Introduction to numerical methods with applications to chemical engineering problems; analysis of numerical errors; roots of an equation; development of computational algorithms and computer programs to (i) find roots of equations, (ii) solve linear and nonlinear algebraic equations, (iii) approximate functions for interpolation, (iv) perform least-squares fitting, (v) evaluate integrals and derivatives, and (vi) solve ordinary and partial differential equations; introduction to computing and engineering software.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisite: CEN 199, CHE 200, CHE 214, CHE 220, CPS 125
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 404

Course ID 024945

Short Title Enhanced Oil Recovery

Long Title Enhanced Oil Recovery

Long Descr Provenance and properties of heavy oil; basic concepts regarding its enhanced recovery; geological factors and residual oil saturation; injection of gases and supercritical solvents; injection of chemical solutions; polymer flooding; microbial injection; hydrocarbon displacement; thermal methods including steam injection and combustion; modelling aspects; economic consideration and environmental impact.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 413

Course ID 022960

Short Title Equipment Design

Long Title Chemical Engineering Equipment Design

Long Descr The overall objective of this course is to introduce the selection, sizing and detailed design of important equipment used in full-scale chemical engineering processes. Students will learn equipment design procedures, which will include computation of materials and energy requirements; consideration of manufacturing, operational and environmental aspects; adherence to relevant design codes and practices; process safety; and handling of imprecise or incomplete data. Computer software for equipment design will be introduced.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CHE 307, ECN 801; Corequisites: CHE 415, CHE 430
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 414

Course ID	025875
Short Title	Rate Processes in Chemical Eng
Long Title	Rate Processes in Chemical Engineering
Long Descr	Principles, design and applications in industrial processes, including liquid-liquid extraction, gas separation by zeolite and molecular sieve, ion exchange/adsorption, leaching in mining industries, evaporation and crystallization; separation of bio-materials.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Prerequisites: CHE 318
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 415

Course ID 004342

Short Title Unit Operations Laboratory II

Long Title Unit Operations Laboratory II

Long Descr Sequel to CHE 315 with emphasis on transport, mixing and separation processes; students learn to (i) design feasible objectives subject to the limitations of time, safety and equipment capability, (ii) understand and apply the underlying theory, (iii) decipher manufacturer's instruction manual, (iv) accurately visualize process flow diagrams of equipment, (v) validate engineering principles themselves instead of relying on recipes, (vi) evaluate safety and environmental issues for similar industrial equipment, and (vii) effectively communicate and substantiate their reasoning verbally and in written reports.

Academic Org Chemical Engineering (Co-op)

Components Laboratory: 3.00

Requisites Prerequisites: CHE 315, CHE 318; Corequisite: CHE 430
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 420

Course ID 002924

Short Title Particulate Engineering

Long Title Particulate Engineering

Long Descr Characterization of particulate solids; rheological properties and behaviour of powders; sampling techniques; experimental methods for particle size measurements; statistical analysis of data; structural properties of particles in assemblage; interparticle and surface forces; agglomeration phenomenon and its application in granulation, pelletization and tableting; storage and flow of bulk solids in bins and hoppers; dust explosion.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CHE 217; Corequisite: CHE 331
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 422

Course ID	000695
Short Title	Biochemical Engineering
Long Title	Biochemical Engineering
Long Descr	Brief review of basic microbiology and basic biochemistry; enzyme kinetics; growth kinetics; stoichiometry of microbial growth and product formation; operation considerations for bioreactors for suspension and immobilized cultures; recovery and purification of products; mixed cultures including biological wastewater treatment.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Prerequisites: CHE 220; Corequisites: CHE 312, CHE 309
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 424

Course ID 004783

Short Title Food Process Engineering

Long Title Food Process Engineering

Long Descr Physical properties of food materials; flow of particulate solids; steady and unsteady state heat and mass transfer operations (thermal and aseptic processing, cooking, frying, extrusion); microwave and ohmic heating; nonthermal preservation techniques; influence of processing on the nutritional quality of foods.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisites: CHE 220 and CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 425

Course ID 002829

Short Title Process and Eng Optimization

Long Title Process and Engineering Optimization

Long Descr Theory of optimization methods; practical implementation issues; formulation of optimization problems, selection of solution techniques, and interpretation of results; use of modern optimization software to solve chemical engineering problems of industrial relevance; optimization of process design.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Corequisites: CHE 319
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 426

Course ID	001405
Short Title	Transport Phenomena
Long Title	Transport Phenomena
Long Descr	Mechanisms of the transport of mass, momentum and energy; similarities and differences between the three transport processes; analysis of transport phenomena in chemical engineering processes; solution methodologies for the engineering transport problems; design and analysis of systems involving the transfer of mass, momentum and energy.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Corequisite: CHE 318
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 427

Course ID	004549
Short Title	Fluidization Engineering
Long Title	Fluidization Engineering
Long Descr	Fluidization phenomenon and its industrial relevance; determination of involved variables; intervals and their effect; two-phase and three-phase fluid beds; entrainment, elutriation and TDH; pneumatic transport; gas-solid separators; chemical reactors; combustion in fluid beds; circulating and pressurized fluid beds; heat and mass transfer in fluidized beds; design of fluidized bed processes and their components.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Prerequisite: CHE 217; Corequisite: CHE 318
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 430

Course ID	002361
Short Title	Process Control
Long Title	Process Control
Long Descr	General introduction to process control; brief overview of process modeling; model building by identification schemes using step responses; control valves and sensors; closed transfer functions; system stability analysis; design of single-loop classical controllers using quarter decay ratio, and other empirical tuning methods; frequency domain analysis with bode plots; design of feed-forward, cascade and IMC controllers; PID tuning using IMC; applications in chemical engineering units operations (such as heat-exchangers and distillation columns), and processes (chemical and biochemical reactors).
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CHE 312, CHE 318, CHE 319
Equivalencies	CHE416/CHE430
Attributes	Case Studies
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 435

Course ID	027485
Short Title	Hydrogen and Fuel Cell Tech
Long Title	Hydrogen and Fuel Cell Technologies
Long Descr	Clean energy infrastructure; types and components of fuel cells and electrolyzers; electrochemical principles and diagnostic methods; thermodynamics and transport phenomena; fuel cells and electrolyzer design and operation strategies; hydrogen storage and distribution.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Corequisite: CHE 312
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 450

Course ID	027486
Short Title	Introduction to AI in Chem Eng
Long Title	Introduction to AI in Chem Eng
Long Descr	This course will introduce Artificial Intelligence (AI) and its applications to chemical engineering. The AI topics will include artificial neural networks, clustering, support vector machines, evolutionary optimization, and reinforcement learning. Essential AI applications will be covered in the modeling, simulation, optimization, control, and safe operation of process systems.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Corequisite: CHE 319
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 451

Course ID 002113

Short Title Plastics Technology

Long Title Plastics Technology

Long Descr Classification and general properties of plastics, thermosets, thermoplastics, commodity plastics, engineering plastics, fillers and reinforcements; design of polymer manufacturing processes; study of injection molding, compression molding, extrusion, blow molding, wire and cable coating, and thermoforming.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CHY 224; Corequisite: CHE 312
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 454

Course ID 005718

Short Title Polymer Science

Long Title Polymer Science

Long Descr Classifications of polymers; molecular weight measurements and distributions; step growth polymerization; radical chain polymerization; ionic polymerization; coordination polymerization; physical and mechanical properties of polymers.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisites: CHE 331 and CHY 224
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 460

Course ID 027493

Short Title Design Charact Mixing in Pharm

Long Title Design and Charact of Mixing in Pharma Ind

Long Descr This course covers the design and characterization of various mixing operations essential to the pharmaceutical industry. Mixing is a critical operation that involves combining different materials to produce antibiotics, vaccines, emulsions, tablets, suspensions, syrups, and creams/ointments. The course introduces the principles and applications of gas-liquid, solid-liquid, miscible liquid-liquid, immiscible liquid-liquid, and non-Newtonian mixing operations, as well as powder blending. The course compares the advantages and disadvantages of batch mixing and continuous mixing operations and discusses strategies for scaling up mixing processes in the pharmaceutical industry.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisites: CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 462

Course ID 022961

Short Title Computer Process Control

Long Title Computer Process Control

Long Descr Discrete-time models; discrete models of sampled-data systems; analysis of sampled data systems; sampling and hold; spectrum of a sampled signal and aliasing; analysis of sampled-data control systems; open-loop block diagram analysis; closed-loop transfer functions; stability; digital PID controllers; tuning of digital PID controllers; direct synthesis methods; digital feed-forward control; system identification.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CHE 430
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

CHE 471

Course ID	022962
Short Title	Thesis/Project
Long Title	Thesis/Research and Design Project
Long Descr	An in-depth study of a chemical engineering topic selected by the supervising Chemical Engineering faculty member and the student; the study may involve advanced design procedures or applied research; the student designs, assembles and evaluates a project appropriate to his or her interest; upon project completion, the student is required to deliver an oral presentation and a written report covering the project theory or background, design, construction and application; the student is encouraged to work with a minimum of direct supervision; the project must have a minimum of 25% Engineering Design content as defined by the Canadian Engineering Accreditation Board (CEAB), and approved by the thesis coordinator before the initiation and after the completion of the project; enrolment in and completion of this course are permitted only in the student's final semester of the program. Departmental consent is required.
Academic Org	Chemical Engineering (Co-op)
Components	Laboratory: 6.00
Requisites	
Equivalencies	
Attributes	Lab Work, Research Project
Dept Consent	Department Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 473

Course ID	022963
Short Title	Sustainable Energy Technology
Long Title	Sustainable Energy Technologies
Long Descr	Basic energy technology and design of energy generation systems; performance and efficiency of energy generation systems; energy conversions and economic considerations; sustainable energy generation in context of political, social, economic and environmental goals; non-combustion based, renewable power generation technologies.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Corequisite: CHE 312
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 474

Course ID	022964
Short Title	Nanotechnology
Long Title	Nanotechnology and Its Applications
Long Descr	Principles of nanotechnology and its relevance to chemical engineering; nanostructured materials and their applications; different types of engineering materials of metals, ceramics, polymers and composites; nanoscale details of the materials; their properties, characterizations, and manufacturing methods; unique applications in electronics, sporting, energy production, and other emerging technologies; study of the toxicological effects of the materials.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Prerequisites: CHE 307
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 480

Course ID 026842

Short Title Microfluidic Systems

Long Title Microfluidic Systems

Long Descr Microfluidics, the manipulation and control of fluids at microscales in confined geometries, have formed the basis for numerous emerging applications such as medical diagnostics, environmental sensing, particle synthesis, and biological analysis. This course offers the fundamentals of transport phenomena and derivation of constitutive balances at small scales relevant to microfluidic systems, such as low Reynolds number flow and surface tension flow. Various microfabrication methods and tools to create microfluidic systems are covered as well as applications that include chemical and biological sensing and analysis, called “Lab-on-a-chip”, namely micromixing, separation, particle synthesis,microreactors, and cell cultures. Recent developments in the field are also explored through literature reviews to date.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 490

Course ID 027490

Short Title Resource Recovery from Waste

Long Title Resource Recovery from Waste and Circ Econ

Long Descr This course focuses on the municipal and industrial solid waste and wastewater as valuable sources for recovery of materials and energy. The principles of circular economy (reduce, reuse, recycle) will be the backbone of the emerging processes involved in resource recovery from various types of waste to make value-added products.The recovery of materials, energy and water will be discussed in detail.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Corequisites: CHE 309
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

CHE 615

Course ID 001501

Short Title Air Pollution and Control

Long Title Air Pollution and Control

Long Descr Air pollution, and its control methods; air pollution measurements, and emission estimates; fixed-box and diffusion models for air pollutant concentration; design of typical air pollution control equipment for volatile organic compounds, sulphur dioxide, and nitrogen oxides; control of particulate pollutants.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Prerequisite: CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 616

Course ID 000823

Short Title Water and Wastewater Treatment

Long Title Water and Wastewater Treatment

Long Descr Introduction to water and wastewater engineering with special emphasis on drinking water, and municipal and industrial wastewaters; fundamental chemical, physical, biological and engineering concepts including unit operations and reactors used in water and wastewater treatment; water quality, water pollution, and its domestic and industrial sources; the best known water and wastewater treatment processes and technologies, and their comparative evaluation; description of the most effective sludge treatment methods, and processes dealing with water recycling and reuse.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Corequisite: CHE 312
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 617

Course ID 005070

Short Title Chem Process Sfty/Loss/Prvntn

Long Title Chemical Process Safety Loss Prevention

Long Descr Process safety and loss prevention for chemical industry; evaluation of sources of fire and explosion and prevention methods; techniques and equipment used in industry to detect, control and prevent hazardous conditions in chemical processes; risk assessment methods and process design to prevent chemical release, fire and explosion.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00 / Tutorial: 1.00

Requisites Prerequisite: (CHE 307 and CHE 308) or CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 618

Course ID	004938
Short Title	Solid Waste Treatment
Long Title	Solid Waste Treatment
Long Descr	Classification and generation of hazardous wastes; hazardous waste regulations; transport of contaminants; toxicology concepts; effective management practices including audits and pollution prevention; solid waste treatment techniques, and disposal methods; economics of hazardous waste management.
Academic Org	Chemical Engineering (Co-op)
Components	Lecture: 3.00
Requisites	Prerequisite: CHE 318; Corequisite: CHE 312
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CHE 714

Course ID 003092

Short Title Pharm Tech and Processing

Long Title Pharmaceutical Technology and Processing

Long Descr Basic pharmaceutical industry and major pharmaceutical manufacturing methods; design of unit operations such as powder mixing, coating and tableting for drug processing; drug chemistry, synthesis, metabolism and validation; principles of drug finding, formulation, and clinical studies; principles of Good Lab Practice (GLP), Good Manufacturing Practice (GMP), and the history and development of FDA regulations; quality and safety aspects.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Corequisites: CHE 309, CHE 315
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CHE 715

Course ID 005281

Short Title Membrane Technology

Long Title Membrane Technology

Long Descr Material transport in membranes, and the modes of operation; mass transfer modeling in membrane processes; design and applications of various industrial membrane processes such as membrane filtration, reverse osmosis, gas permeation, and pervaporation.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 3.00

Requisites Corequisite: CHE 318
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 401

Course ID 000588

Short Title Work Term I Chemical Eng

Long Title Work Term I - Chemical Engineering

Long Descr Co-op position must be engineering or science related. Routine type of positions are acceptable. All courses from 1st and 2nd Semester must be successfully completed before enrolling in WKT 401. This course is graded on a pass/fail basis.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 500

Course ID 003246

Short Title Work Term II Chemical Eng

Long Title Work Term II - Chemical Engineering

Long Descr Co-op position must be engineering or science related. Routine type of positions are acceptable. This course is graded on a pass/fail basis.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 501

Course ID 002749

Short Title Work Term III Chemical Eng

Long Title Work Term III - Chemical Engineering

Long Descr Co-op position must be discipline related. Position should involve project work but some routine work is acceptable. This course is graded on a pass/fail basis.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 601

Course ID 002695

Short Title Work Term IV Chemical Eng

Long Title Work Term IV - Chemical Engineering

Long Descr Co-op position must be discipline related and should involve project work. This course is graded on a pass/fail basis.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 602

Course ID 003800

Short Title Work Term V Chemical Eng

Long Title Work Term V - Chemical Engineering

Long Descr Co-op position must be discipline related and should involve project work. This course is graded on a pass/fail basis.

Academic Org Chemical Engineering (Co-op)

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 70A

Course ID 025316

Short Title Struct Capstone Design Proj-A

Long Title Structural Capstone Design Project-A

Long Descr A design project for all areas of Civil Engineering. Students complete a design for a real-life project from industry. Students work in teams of 4 - 6 per group or as instructor dictates. Teams submit at least two design alternatives and evaluate them based on economic, environmental, and other considerations. Typically, each team determines the best alternative in the fall and completes a detailed design in the winter, along with oral presentation and written report.

Academic Org Civil Engineering

Components Tutorial: 3.00 / Lecture: 1.00

Requisites Prerequisites: CVL 312, CVL 313, CVL 410, CVL 411, CVL 600, CVL 609
Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 70B

Course ID 025317

Short Title Struct Capstone Design Proj-B

Long Title Structural Capstone Design Project-B

Long Descr A design project for all areas of Civil Engineering. Students complete a design for a real-life project from industry. Students work in teams of 4 - 6 per group or as instructor dictates. Teams submit at least two design alternatives and evaluate them based on economic, environmental, and other considerations. Typically, each team determines the best alternative in the fall and completes a detailed design in the winter, along with oral presentation and written report.

Academic Org Civil Engineering

Components Tutorial: 3.00 / Lecture: 1.00

Requisites Prerequisite: CVL 70A
Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 71A

Course ID 025318

Short Title Env Capstone Design Project-A

Long Title Environmental Capstone Design Project-A

Long Descr A design project for all areas of Civil Engineering. Students complete a design for a real-life project from industry. Students work in teams of 4 - 6 per group or as instructor dictates. Teams submit at least two design alternatives and evaluate them based on economic, environmental, and other considerations. Typically, each team determines the best alternative in the fall and completes a detailed design in the winter, along with oral presentation and written report.

Academic Org Civil Engineering

Components Tutorial: 3.00 / Lecture: 1.00

Requisites Prerequisite: CVL 400 and CVL 602
Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 71B

Course ID 025319

Short Title Env Capstone Design Project-B

Long Title Environment Capstone Design Project-B

Long Descr A design project for all areas of Civil Engineering. Students complete a design for a real-life project from industry. Students work in teams of 4 - 6 per group or as instructor dictates. Teams submit at least two design alternatives and evaluate them based on economic, environmental, and other considerations. Typically, each team determines the best alternative in the fall and completes a detailed design in the winter, along with oral presentation and written report.

Academic Org Civil Engineering

Components Tutorial: 3.00 / Lecture: 1.00

Requisites Prerequisite: CVL 71A
Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 72A

Course ID 025320

Short Title Tran Capstone Design Project-A

Long Title Transportation Capstone Design Project-A

Long Descr A design project for all areas of Civil Engineering. Students complete a design for a real-life project from industry. Students work in teams of 4 - 6 per group or as instructor dictates. Teams submit at least two design alternatives and evaluate them based on economic, environmental, and other considerations. Typically, each team determines the best alternative in the fall and completes a detailed design in the winter, along with oral presentation and written report.

Academic Org Civil Engineering

Components Tutorial: 3.00 / Lecture: 1.00

Requisites Prerequisite: CVL 316 and CVL 735
Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 72B

Course ID 025321

Short Title Tran Capstone Design Project-B

Long Title Transportation Capstone Design Project-B

Long Descr A design project for all areas of Civil Engineering. Students complete a design for a real-life project from industry. Students work in teams of 4 - 6 per group or as instructor dictates. Teams submit at least two design alternatives and evaluate them based on economic, environmental, and other considerations. Typically, each team determines the best alternative in the fall and completes a detailed design in the winter, along with oral presentation and written report.

Academic Org Civil Engineering

Components Tutorial: 3.00 / Lecture: 1.00

Requisites Prerequisite: CVL 72A
Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 207

Course ID	002485
Short Title	Graphics
Long Title	Graphics
Long Descr	Principles of traditional descriptive geometry of points, lines, planes and solids, done with modern tools. Selections, auxiliary views, intersections and developments, pictorial drawings. Principles of 2D and 3D computer-aided drafting (AutoCAD) used in areas of civil engineering. Structural drafting pertaining to steel, concrete and timber construction, standards and conventions. Drafting room and computer lab exercises are assigned. Constructed solutions with vector diagram projection; comparison with equivalent vector algebraic methods. Graphical statistics, concurrent force problems including pure axial force plane structures.
Academic Org	Civil Engineering
Components	Lecture: 2.00 / Laboratory: 2.00
Requisites	
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 207E

Course ID	002485
Short Title	Graphics
Long Title	Graphics
Long Descr	Principles of traditional descriptive geometry of points, lines, planes and solids, done with modern tools. Selections, auxiliary views, intersections and developments, pictorial drawings. Principles of 2D and 3D computer-aided drafting (AutoCAD) used in areas of civil engineering. Structural drafting pertaining to steel, concrete and timber construction, standards and conventions. Drafting room and computer lab exercises are assigned. Constructed solutions with vector diagram projection; comparison with equivalent vector algebraic methods. Graphical statistics, concurrent force problems including pure axial force plane structures.
Academic Org	Civil Engineering
Components	Lecture: 2.00 / Laboratory: 2.00
Requisites	
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 300

Course ID	025030
Short Title	Enviro Science and Impact
Long Title	Environmental Science and Impact Assess
Long Descr	This course overviews the environmental disturbances and the roles of civil engineers in environmental protection. Concepts of sustainability and pollution prevention are reviewed. In order to achieve sustainable development, it introduces the concepts and methods of environmental impact assessment in Ontario and Canada. It examines the biological, economic, and social impacts that are commonly associated with development activities and the means used to predict, evaluate, and mitigate impacts in human and natural environments. It includes a review of the history of environmental assessment and its relation to environmental planning principles. The course concludes with a review of current practice in impact assessment and the major controversies in the field.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 1.00
Requisites	Prerequisites: CEN 100 and CHY 102
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00

Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 312

Course ID 003137

Short Title Computer Aided Struct Analysis

Long Title Computer Aided Structural Analysis

Long Descr Flexibility and stiffness methods, applications to trusses, beams and frames; computer analysis of structures; structural analysis programs; formulation of plane stress and plane strain problems; introduction to the finite element method of analysis.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, CVL 313 and MTH 510
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 313

Course ID 000213

Short Title Structural Analysis

Long Title Structural Analysis

Long Descr Deflections of structures: moment-area theorems, conjugate-beam method, virtual work and Castigliano's theorem. Approximate analysis of statically, indeterminate structures. Analysis of continuous beams and frames using the force and slope-deflection methods. Analysis of statically indeterminate structures using the moment-distribution method. Influence Lines for statically determinate structures.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisite: CEN 199 and CVL 420
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 316

Course ID 003372

Short Title Transportation Engineering

Long Title Transportation Engineering

Long Descr Introductory level course on transportation engineering, including transportation system characteristics, classification, mathematical models, and modes; transportation planning (trip generation, trip distribution, mode choice, and traffic assignment); highway geometric design; traffic flow characteristics; capacity and level of service; queuing and simulation models; and evaluation of transportation impacts.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 1.00

Requisites Prerequisite: MTH 425
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 316E

Course ID	003372
Short Title	Transportation Engineering
Long Title	Transportation Engineering
Long Descr	Introductory level course on transportation engineering, including transportation system characteristics, classification, mathematical models, and modes; transportation planning (trip generation, trip distribution, mode choice, and traffic assignment); highway geometric design; traffic flow characteristics; capacity and level of service; queuing and simulation models; and evaluation of transportation impacts.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 1.00
Requisites	Prerequisite: MTH 425
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 320

Course ID 003919

Short Title Strength of Materials I

Long Title Strength of Materials I

Long Descr Analysis of trusses, frames, beams, arches and cables. Analysis and diagrams of reactions, shear forces and bending moments. Review of moments of inertia. Normal, shearing, and bearing stresses. Deformation and strains. Temperature effects. Stress-strain relationship and the generalized Hooke's law. Axial loading applications and pressure vessels. Stress concentrations. Stress transformation equations and Mohr's circle for plane stress analysis. Analysis of plane stresses and strains. Strain measurement and rosette analysis. Laboratory work for experimental learning.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 3.00

Requisites Prerequisites: CEN 100, MTH 141, MTH 240, MTL 200, PCS 125, PCS 211
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 320E

Course ID 003919

Short Title Strength of Materials I

Long Title Strength of Materials I

Long Descr Analysis of trusses, frames, beams, arches and cables. Analysis and diagrams of reactions, shear forces and bending moments. Review of moments of inertia. Normal, shearing, and bearing stresses. Deformation and strains. Temperature effects. Stress-strain relationship and the generalized Hooke's law. Axial loading applications and pressure vessels. Stress concentrations. Stress transformation equations and Mohr's circle for plane stress analysis. Analysis of plane stresses and strains. Strain measurement and rosette analysis. Laboratory work for experimental learning.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 3.00

Requisites Prerequisites: CEN 100, MTH 141, MTH 240, MTL 200, PCS 125, PCS 211
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

CVL 323

Course ID	001129
Short Title	Fundamentals of Surveying
Long Title	Fundamentals of Surveying
Long Descr	Introduction to surveying theory and techniques; distance, angular and height measurement methods; traversing and traverse adjustments; field calibration of instruments; topographic mapping; coordinate geometry; geometry of horizontal and vertical curves; curves and construction layout; use of surveying software.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CVL 207 and MTH 240 and PCS 125
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 323E

Course ID 001129

Short Title Fundamentals of Surveying

Long Title Fundamentals of Surveying

Long Descr Introduction to surveying theory and techniques; distance, angular and height measurement methods; traversing and traverse adjustments; field calibration of instruments; topographic mapping; coordinate geometry; geometry of horizontal and vertical curves; curves and construction layout; use of surveying software.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CVL 207 and MTH 240 and PCS 125
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 352

Course ID 004455

Short Title Geomatics Measurement Tech

Long Title Geomatics Measurement Techniques

Long Descr Introduction to photogrammetry, remote sensing, satellite positioning and geographic information systems; Introduction to the use of various sensors and techniques for the acquisition of precise metric and attribute data. Applications in the field of geomatics and civil engineering .

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CEN 199 and CVL 323
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 354

Course ID 001309

Short Title Remote Sensing and Image Analy

Long Title Remote Sensing and Image Analysis

Long Descr The course covers an overview of the principles of remote sensing and image analysis from a Geomatics Engineering perspective. Topics include: basic characteristics of electromagnetic radiation, radiation interactions with terrestrial materials and atmospheric effects, remote sensing platforms, active and passive sensors, geometric and radiometric corrections, visual image interpretation, image enhancement and transformation, thematic classification, applications of change detection, environmental monitoring and mapping.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, CVL 405, PCS 125
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 400

Course ID 025031

Short Title Hydrology and Water Resources

Long Title Hydrology and Water Resources

Long Descr Introduction to hydrologic principles. Components of the hydrologic cycle: Precipitation, interception, abstraction, infiltration, evapotranspiration, overland runoff, streamflow. Hydrological data measurement and monitoring. Rainfall-runoff relationships and analyses: unit hydrograph theory, synthetic hydrographs, flow routing. Flow through porous media: saturated and unsaturated groundwater flow, well hydraulics and pumping tests. Urban hydrology: The Rational Method, sewer system hydraulics, detention basin design. Use of computer simulation models for urban and rural watersheds.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisites: CEN 199, CVL 405, CVL 502, MTL 200, PCS 125
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

CVL 405

Course ID	025032
Short Title	Probability and Statistics
Long Title	Probability and Statistics for Engineers
Long Descr	Description of statistical samples in civil engineering. Measurement errors. Elements of probability theory. Discrete probability distribution. Continuous probability distributions: uniform on an interval, Normal distribution, t-distribution, Exponential distribution, x^2 distribution. Confidence interval and hypothesis testing concerning mean, variance and population. F-distribution. Correlation and covariance. Covariance propagation. Multi-dimensional Normal distribution. Error ellipse and error ellipsoid. Principles of least-squares estimation.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisites: CPS 125 and MTH 141 and MTH 240
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 405E

Course ID 025032

Short Title Probability and Statistics

Long Title Probability and Statistics for Engineers

Long Descr Description of statistical samples in civil engineering. Measurement errors. Elements of probability theory. Discrete probability distribution. Continuous probability distributions: uniform on an interval, Normal distribution, t-distribution, Exponential distribution, x^2 distribution. Confidence interval and hypothesis testing concerning mean, variance and population. F-distribution. Correlation and covariance. Covariance propagation. Multi-dimensional Normal distribution. Error ellipse and error ellipsoid. Principles of least-squares estimation.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisites: CPS 125 and MTH 141 and MTH 240
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 407

Course ID 022371

Short Title Structures III

Long Title Structures III

Long Descr This course considers structural systems, commencing with the design of individual members discussed in Structures II and moving to the design of the whole building. The course develops the concept of a building comprised of horizontal and vertical systems that are organized strategically. Alternative arrangements of structural systems are considered based on their structural behaviour and their relationship to materials of construction. Building lateral loads and load transfer mechanisms are explored. The course concludes with a discussion on connections and detailing of components of complex systems, exploring examples for specific materials.

Academic Org Civil Engineering

Components Lecture: 3.00

Requisites Prerequisite: ASC 303
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

CVL 410

Course ID	000644
Short Title	Structural Concrete Design I
Long Title	Structural Concrete Design I
Long Descr	Limit state design of continuous beams and one-way slabs for flexure, shear and serviceability; shear friction and horizontal shear transfer; development, anchorage, and splicing of reinforcement; bar cut-offs for tension and compression reinforcement; design of short column for combined bending and axial compression; design of slender columns; types of footings; design of strip, isolated and combined footings.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisite: CEN 199 and CVL 500
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 411

Course ID	000165
Short Title	Structural Steel Design
Long Title	Structural Steel Design
Long Descr	Design of continuous beams and Plate girder; Composite floor system; Beam-column design; overall column stability; tension members; welded and bolted connections; base plates under axial load and bending; fatigue design of structural steel; crane girder design; Beams with web openings; Complete design of Gerber girder system.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisites: CEN 199, CVL 313 and CVL 500
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 420

Course ID	000266
Short Title	Strength of Materials II
Long Title	Strength of Materials II
Long Descr	Torsion and angle of twist. Beam bending. Flexural and shear equations. Compound stresses. Theories of failure. Deflection of beams. Euler's formula for columns and its modification for codes. Inelastic behaviour of members. Experimental laboratory work involving flexural stress, deflection of beams and buckling load of columns.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: CVL 320
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 420E

Course ID	000266
Short Title	Strength of Materials II
Long Title	Strength of Materials II
Long Descr	Torsion and angle of twist. Beam bending. Flexural and shear equations. Compound stresses. Theories of failure. Deflection of beams. Euler's formula for columns and its modification for codes. Inelastic behaviour of members. Experimental laboratory work involving flexural stress, deflection of beams and buckling load of columns.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: CVL 320
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 423

Course ID	004235
Short Title	Geology for Engineers
Long Title	Geology for Engineers
Long Descr	This course provides Civil Engineering students with an understanding of the physical world in which they work and live. The course deals with the following topics: structure of the earth, plate tectonic theory and continental drift, minerals, rocks and their mode of formation, erosion and weathering, soil formation, folding and fracturing of rocks, earthquakes, volcanoes, glacial landforms and permafrost, ground and surface water, rock mass stability, mass wasting, and the physiography of Canada. The engineering significance of each topic is illustrated by practical examples. Laboratory activities include mineral and rock identification and interpretation of topographic and geological maps.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CHY 102 and PCS 125 and PCS 211
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1

Course Topics

CVL 423E

Course ID	004235
Short Title	Geology for Engineers
Long Title	Geology for Engineers
Long Descr	This course provides Civil Engineering students with an understanding of the physical world in which they work and live. The course deals with the following topics: structure of the earth, plate tectonic theory and continental drift, minerals, rocks and their mode of formation, erosion and weathering, soil formation, folding and fracturing of rocks, earthquakes, volcanoes, glacial landforms and permafrost, ground and surface water, rock mass stability, mass wasting, and the physiography of Canada. The engineering significance of each topic is illustrated by practical examples. Laboratory activities include mineral and rock identification and interpretation of topographic and geological maps.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CHY 102 and PCS 125 and PCS 211
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 434

Course ID 022873

Short Title Geotech Properties of Soils

Long Title Geotechnical Properties of Soils

Long Descr Introduction of structural and glacial geology; rock cycle; mineral and soil identification and classification; clay soil structure; weight-volume relationship; Atterberg limits; relative density; seepage theory; hydraulic conductivity measurements in the field and in the lab; flow nets; and principle of effective stress. Mohr-Coulomb failure criterion; shearing strength of saturated soils; consolidation theory, settlement prediction and computer assisted processing of laboratory test results.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CVL 320
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 434E

Course ID 022873

Short Title Geotech Properties of Soils

Long Title Geotechnical Properties of Soils

Long Descr Introduction of structural and glacial geology; rock cycle; mineral and soil identification and classification; clay soil structure; weight-volume relationship; Atterberg limits; relative density; seepage theory; hydraulic conductivity measurements in the field and in the lab; flow nets; and principle of effective stress. Mohr-Coulomb failure criterion; shearing strength of saturated soils; consolidation theory, settlement prediction and computer assisted processing of laboratory test results.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CVL 320
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 500

Course ID	025033
Short Title	Intro to Structural Design
Long Title	Introduction to Structural Design
Long Descr	Types of structures; Loads, load factors and load transfer; Properties of structural steel, Behaviour and design of steel compression members and statically-determinate steel beams; Properties of concrete and reinforcing steel; Behaviour of uncracked and cracked reinforced concrete beams; Design of statically-determinate one-way slabs and rectangular, T and L beams for ultimate and serviceability limit states; Design of reinforced concrete short columns. Behaviour and design of timber members subjected to bending, axial compression and combined bending and compression.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisite: CEN 199, CVL 420
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 501

Course ID	025034
Short Title	Fluid Mechanics and Hydraulics
Long Title	Fluid Mechanics and Hydraulics
Long Descr	Fluid mechanics. Fluid properties. Fluid statics. Forces on submerged bodies and planes. Fluid motion: flow path, velocity, acceleration. Continuity, energy and momentum equations. Dimensional analysis and model similitude. Hydraulic applications in conduit flows: flow classification, shear stress and velocity distribution, pipe friction formula, energy equations, pump/pipeline systems. Open channel flow: application of the energy, momentum and continuity equations, channel bed friction, steady and uniform flow, specific energy, hydraulic jump, gradually varied flow, natural channel designs. Appropriate experimental laboratory work related to the area of hydraulic engineering.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: CEN 199 and CVL 400
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 502

Course ID	026881
Short Title	Hydraulic Engineering
Long Title	Hydraulic Engineering
Long Descr	Hydraulic applications in conduit flows: flow classification, shear stress and velocity distribution, pipe friction formula, energy equations, pump/pipeline systems. Open channel flow: application of the energy, momentum and continuity equations, channel bed friction, steady and uniform flow, specific energy, hydraulic jump, gradually varied flow, natural channel designs. Hydraulic structures and analysis of looped pipe systems. Appropriate experimental laboratory work related to the area of hydraulic engineering.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 522
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N

Total Completions 1
Course Topics

CVL 502E

Course ID	026881
Short Title	Hydraulic Engineering
Long Title	Hydraulic Engineering
Long Descr	Hydraulic applications in conduit flows: flow classification, shear stress and velocity distribution, pipe friction formula, energy equations, pump/pipeline systems. Open channel flow: application of the energy, momentum and continuity equations, channel bed friction, steady and uniform flow, specific energy, hydraulic jump, gradually varied flow, natural channel designs. Hydraulic structures and analysis of looped pipe systems. Appropriate experimental laboratory work related to the area of hydraulic engineering.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 522
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 533

Course ID 002809

Short Title Concrete Materials

Long Title Concrete Materials

Long Descr Introduction to concrete as a construction material: performance requirements, strength, and durability. Aggregates: types, processing, beneficiation, testing, and quality control. Reclaimed concrete aggregates: uses and properties. Portland cement of different types: raw materials, manufacturing, composition, physical properties, testing, blended cement, hydration, and porosity. Supplementary Cementing materials: types, properties, hydration, and effects on concrete. Design of concrete mixtures for different applications. Chemical admixtures: types and uses. Mixing, placing, finishing, fresh and hardened properties and quality control testing of concrete. Concrete durability: freezing and thawing, reinforcement corrosion and chemical attacks. Volume change in concrete: shrinkage of different types, deformation and creep.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CEN 199 and CVL 320
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 600

Course ID 004633

Short Title Foundation Engineering

Long Title Foundation Engineering

Long Descr Soil exploration, Active and Passive earth pressure calculations. Slope stability, Design of earth retaining structures, open and supported excavations, Design of shallow foundation, Soil bearing capacity and settlement. Design of pile foundation and drilled caissons.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CEN 199 and CVL 434
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

CVL 601

Course ID	025035
Short Title	Wastewater Engineering
Long Title	Wastewater Engineering
Long Descr	Wastewater collection: sewer system components, design of sanitary sewers, system layout and flow hydraulics. Sewage treatment: primary, secondary, tertiary processes. Wastewater microbiology: microorganism classification, population dynamics, kinetics of decomposition. Unit processes of secondary treatment: trickling filters, activated sludge, rotating biological contactors. Sludge management, treatment, and ultimate disposal. Experimental laboratory work involving sedimentation model, chemical treatment: coagulation and flocculation, nutrients, biochemical oxygen demand, and microscopic analyses of sludge.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: CEN 199, CVL 400, CVL 501
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 602

Course ID 026882

Short Title Municipal Engineering

Long Title Municipal Engineering

Long Descr The course introduces aspects of planning, design, operation and maintenance of municipal infrastructure systems. An overview of regulations relevant to land development, urbanization and design of municipal infrastructure are covered. Topics on water distribution systems, and wastewater and stormwater collection systems are addressed through design exercises, including: pumping, distribution and storage of drinking water; collection and management of sanitary and combined sewage; stormwater management and low impact development; and deterioration and rehabilitation of buried infrastructure.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisites: CEN199, CVL400, CVL502
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 609

Course ID 023506

Short Title Civil Engineering Systems

Long Title Civil Engineering Systems

Long Descr This course provides an introduction to systems analysis tools that facilitate decision-making in engineering design and management. Particular emphasis is placed on fundamentals of systems approach, linear programming, integer programming, multi-objective programming, dynamic programming, sensitivity analysis, Monte Carlo simulation, and decision-making under uncertainty. Applications of these tools are tailored to design and management of various civil engineering systems depending on whether a student is enrolled in the Civil Engineering program or the Structural Engineering option.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, CVL 405, ECN 801, MTH 510
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

CVL 633

Course ID	005363
Short Title	Highway Materials
Long Title	Highway Materials
Long Descr	Pavements types: flexible, rigid and composite. Properties, testing and selection of aggregates for highway purposes. Subgrade preparation and testing. Effects of environment on highways: water infiltration, ice lenses, frost heave and spring breakup. Highway drainage and design of soil filters. Use of geotextiles in highway construction. Soil stabilization for highways: types and applications. Performance-Graded Asphalt Binder: development, testing, and short and long-term performance. Design of asphalt mixtures using Marshall and SUPERPAVE methods. Construction and quality control: plant mix, types of asphalt plants, hot and cold recycling, and end-result specification for pavement works.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CEN 199, CVL 320 and CVL 434
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 650

Course ID 001380

Short Title Satellite Positioning CE

Long Title Satellite Positioning for Civil Engineers

Long Descr Basic concepts of satellite positioning and applications; datums and coordinate systems; orbital determination; GNSS signal structure, pseudorange and carrier-phase measurements; GNSS errors and biases; linear combinations of GNSS observables; GNSS positioning modes, absolute and relative positioning, static, kinematic and real-time kinematic (RTK) GNSS positioning; Communication links; GNSS data and correction services.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisite: CVL 352 and CVL 405
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 735

Course ID 002581

Short Title Highway Design

Long Title Highway Design

Long Descr The selection of design elements by explicitly considering design controls, human factors, and the safety, operational, environmental and other consequences of design decisions is the underlying philosophy adopted for the following major topics: design of horizontal and vertical alignment and cross-section elements; alignment coordination; intersection and interchange design; and roadside design, including barriers and guiderail. Hydraulic design of urban and rural highway drainage facilities is also covered.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CEN 199 and CVL 323
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 736

Course ID	022875
Short Title	Geospatial Information Systems
Long Title	Geospatial Information Systems
Long Descr	Introduction to geographical information systems (GIS) and science; hardware and software components; geo-referencing of geospatial data; vector and raster data representation and topological relationships; GIS databases; vector and raster data exploration, analysis and processing; data display and visualization; spatial analytical modeling; data quality, integration, and standards; concepts of web GIS and mapping services; GIS project design and implementation.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: CVL 352
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 742

Course ID 003993

Short Title Project Management

Long Title Project Management

Long Descr Aims to develop a body of knowledge, methods, skills and techniques that are essential for students to successfully manage future engineering projects within budget, deadline and resource limits. Topics discussed include: introduction to project management body of knowledge (PMBOK); project delivery systems and contracting methods; budget estimate and bid cost estimate; project planning, work breakdown structure; project scheduling: critical path method (CPM) and network diagram, resource allocation and leveling, line of balance (LOB), integration of CPM and TLOB; project control and earned value analysis; project risk management, impact of uncertainty on schedule and cost, PERT; general principles of construction quality, health and safety management. Computer software for cost estimation and scheduling will be practised in laboratory sessions.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: ECN 801; Antirequisites: EMS 304 and IND 713
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 900

Course ID 000968

Short Title Pavement Design and Management

Long Title Pavement Design and Management

Long Descr Introduction to pavement: pavement types and properties. Pavement performance and distress. Stress analysis of flexible and rigid pavements. Properties and characterization of paving materials. Design of flexible and rigid pavement using AASHTO and MTO methods. Design of overlays. The mechanistic-empirical approach of pavement design. Advances in pavement construction and rehabilitation. Pavement management systems. Review of highway and rehabilitation projects.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CVL 633; Antirequisite: CV8405
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00

Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 901

Course ID 003485

Short Title Municipal Solid Waste Mgmt

Long Title Municipal Solid Waste Management

Long Descr Introduction to legislation and authority; integrated solid waste management planning; solid waste generation, characterization, and collection; collection and processing; reduction, reuse, and recycle; landfilling of municipal waste, site selection, development, hydrological factors, leachate and gas collection and control, closure; solid waste incineration.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: CVL 602
Equivalencies CVL901/CVL412

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 902

Course ID 002353

Short Title Traffic Operations and Mgmt

Long Title Traffic Operations and Management

Long Descr Introductory topics related to the management of traffic on urban and rural road networks, including bicycle and pedestrian facilities. Topics include: capacity analysis for interrupted and uninterrupted flow facilities; deterministic and stochastic models for traffic flow; traffic simulation principles; freeway traffic management; signal timing for isolated intersections, networks and arterials; adaptive traffic control; safety of traffic management and engineering principles and techniques.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: CVL 316; Antirequisite: CV8401
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 903

Course ID 003759

Short Title Water Resources Engineering

Long Title Water Resources Engineering

Long Descr Development of water resources systems; statistical analysis of hydrologic data; drainage and runoff analysis; flood control and management; water pollution prevention and control planning; storage and conveyance system design and management; natural channel design and rehabilitation; comprehensive water resources development.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: CVL 400 and CVL 502
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 904

Course ID	000416
Short Title	Structural Concrete Design II
Long Title	Structural Concrete Design II
Long Descr	Truss model and compression field theory for beams failing in shear and torsion; design of deep beams and corbels; design of two way slab systems using direct design method with beams and drop panels; design of two-way slab floor using elastic frame method. Introduction to prestressed concrete: pretensioning vs. post-tensioning technology; prestressing material properties; behaviour and design of statically-determined prestressed concrete beams in flexure, shear and serviceability; design of precast concrete hollow-core slabs and double-tee beams for building construction.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: CVL 410; Antirequisite: CV8307
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 905

Course ID	001186
Short Title	Bridge Design and Construction
Long Title	Bridge Design and Construction
Long Descr	Types of bridges; bridge loads; load distribution in bridge superstructures; simplified methods of analysis, with reference to the Canadian Highway Bridge Design Code; design of slab bridges; design of slab-beam bridges; Acceleration bridge construction; Bridge evaluation; Bridge Testing; student presentations on selected topics.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisite: CVL 411; Antirequisite: CV8308
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 906

Course ID	010174
Short Title	Renovation Repair Structures
Long Title	Renovation/Repair of Existing Structures
Long Descr	Rehabilitation of civil infrastructure systems including aspects of deterioration science, nondestructive assessment, maintenance, renovation, rehabilitation and preservation of infrastructure; mechanisms of mechanical, chemical and biological infrastructure degradation; corrosion of steel condition surveys and evaluation of buildings and bridges repair and preservation materials, techniques and strategies; renewal engineering, construction planning, management, public policy, codes and guidelines; case studies.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CVL 410 and CVL 533; Antirequisite: CV8303
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 908

Course ID	022928
Short Title	Structural Building Systems
Long Title	Structural Building Systems
Long Descr	Loads and loading cases in multi-storey building. Shear wall-frame interaction. Determination of forces using torsion analysis of buildings with randomly distributed concrete shear walls or steel bracings. Concrete and steel column stability. Design details of low rise concrete and steel buildings. Analysis and design using computer software. Mat foundation, pile caps, retaining walls, tanks, swimming pool, pump stations. Masonry materials, stress analysis and flexural design. Axial load and bending design for masonry walls and columns.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Tutorial: 2.00
Requisites	Prerequisites: CVL 312, CVL 410, CVL 411; Corequisite: CVL 904
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 910

Course ID 022880

Short Title Transportation Planning

Long Title Transportation Planning

Long Descr Treatment of the process and techniques of transportation planning, with emphasis on urban and regional applications. Topics include: historical development of transportation planning in North America; transportation planning framework; surveys and data collection; transportation-land use interaction; analysis and models of transportation demand; analysis and models of transportation performance; development and evaluation of transportation planning options.

Academic Org Civil Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: CVL 316
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 913

Course ID 025036

Short Title Water Supply Engineering

Long Title Water Supply Engineering

Long Descr Water quality parameters; Drinking water sources, quantity and quality requirements; Water chemistry; Unit processes of water treatment: screening; solids separation; coagulation; flocculation; sedimentation; filtration; softening; disinfection. Treated water distribution: flow in looped pipe network systems; monitoring; applications of computer modelling. Experimental laboratory work involving water quality determination: solids, alkalinity, hardness, disinfection, coliform and bacterial analyses.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisites: CVL 601
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CVL 914

Course ID	026568
Short Title	Pavement Materials and Design
Long Title	Pavement Materials and Design
Long Descr	Pavement types: flexible, rigid and composite. Properties, testing and selection of aggregates for pavement purposes. Subgrade types and testing. Effects of environment on highways: water infiltration, ice lenses, frost heave and spring breakup. Design of soil filters and subsurface drainage. Introduction to the use of geotextiles in highway construction. Design of asphalt mixtures using Marshall and SUPERPAVE methods. Design of flexible and rigid pavement using AASHTO and MTO methods. Introduction to the mechanistic-empirical approach of pavement design.
Academic Org	Civil Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: CVL 434
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CVL 920

Course ID 026915

Short Title Water and Wastewater Treatment

Long Title Water and Wastewater Treatment Engineering

Long Descr The course will introduce students to the composition of water and wastewater, and address methodologies relevant to the engineering design and analysis of processes used in water and wastewater treatment. The topics covered in the course include physical, chemical and biological processes, as well as sludge handling and management. The course includes a laboratory component, where the students will perform hands-on experiments related to the above processes.

Academic Org Civil Engineering

Components Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00

Requisites Prerequisite: CVL 602
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 90A

Course ID 021704

Short Title Co-operative Internship-A

Long Title Co-operative Internship Program-A

Long Descr An optional 12-16 month Work Term assignment for students in the Civil Engineering program. The selected students will have completed all the academic curricular requirements of the third year of the program, and achieved a clear standing. Course enrolment is conditional on the student obtaining and accepting an internship placement offer from an approved corporate partner. Interns will be visited as required by the course co-ordinator to assess their progress. This course is graded on a pass/fail basis. Grade achieved at the successful completion of the assignment and the submission of an acceptable Work Term report is PSD.

Academic Org Civil Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 0.0
Repeat for Credit N
Total Completions 1

Course Topics

WKT 90B

Course ID	021705
Short Title	Co-operative Internship-B
Long Title	Co-operative Internship Program-B
Long Descr	An optional 12-16 month Work Term assignment for students in the Civil Engineering program. The selected students will have completed all the academic curricular requirements of the third year of the program, and achieved a clear standing. Course enrolment is conditional on the student obtaining and accepting an internship placement offer from an approved corporate partner. Interns will be visited as required by the course co-ordinator to assess their progress. This course is graded on a pass/fail basis. Grade achieved at the successful completion of the assignment and the submission of an acceptable Work Term report is PSD.
Academic Org	Civil Engineering
Components	Lecture: 1.00
Requisites	Prerequisite: WKT 90A
Equivalencies	
Attributes	Co-operative Internship
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Pass/Fail
Hegis Code	
GPA Weight	0.00/0.00
Billing Units	0.0
Course Count	2.0
Repeat for Credit	N
Total Completions	1
Course Topics	

WKT 121

Course ID 027088

Short Title Work Term I Civil Engineer

Long Title Work Term I - Civil Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Civil Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 221

Course ID 027089

Short Title Work Term II Civil Engineer

Long Title Work Term II - Civil Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Civil Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 291

Course ID 027374

Short Title Double Work Term - Civil Eng

Long Title Double Work Term - Civil Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Civil Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 321

Course ID 027090

Short Title Work Term III Civil Engineer

Long Title Work Term III - Civil Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Civil Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 421

Course ID 027091

Short Title Work Term IV Civil Engineer

Long Title Work Term IV - Civil Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Civil Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 70A

Course ID 026613

Short Title COE Engineering Capstone Des-A

Long Title Computer Engineering Capstone Design-A

Long Descr This two-term course provides a training platform for systematic open-ended design process and project management. Student groups apply their acquired knowledge and engineering skills to develop and build a design project from concept to working prototype. The lecture component provides advice and information on the design process, project management, reliability, system components, documentation, safety, and program specific aspects. In the laboratory component, once a project topic is assigned, student groups plan, design, source components, build, test/debug, and analyze, under the supervision of a faculty lab coordinator and submit a final design project report.

Academic Org Computer Engineering

Components Lecture: 1.00 / Laboratory: 1.00

Requisites Prerequisites: COE 528, COE 608, COE 628, MEC 511, MTH 514 and [(COE 501, ELE 632, ELE 635, and ELE 639) or (COE 501, CPS 688, ELE 632, and ELE 635) or (COE 501, ELE 632, ELE 639, and CPS 688) or (COE 691, COE 692, CPS 688, and ELE 532)]
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N

Total Completions 1
Course Topics

COE 70B

Course ID 026614

Short Title COE Engineering Capstone Des-B

Long Title Computer Engineering Capstone Design-B

Long Descr This two-term course provides a training platform for systematic open-ended design process and project management. Student groups apply their acquired knowledge and engineering skills to develop and build a design project from concept to working prototype. The lecture component provides advice and information on the design process, project management, reliability, system components, documentation, safety, and program specific aspects. In the laboratory component, once a project topic is assigned, student groups plan, design, source components, build, test/debug, and analyze, under the supervision of a faculty lab coordinator and submit a final design project report.

Academic Org Computer Engineering

Components Laboratory: 5.00

Requisites Prerequisite: COE 70A
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 318

Course ID	000268
Short Title	Software Systems
Long Title	Software Systems
Long Descr	The course introduces the software development cycle including requirements analysis and specifications, implementation, and testing, inspection and debugging techniques. An object-oriented programming language is used. Decomposition in to classes and modules is examined. The integration of independent modules is explored.
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CHY 102, CPS 188, ELE 202, MTH 240, PCS 211
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 318E

Course ID	000268
Short Title	Software Systems
Long Title	Software Systems
Long Descr	The course introduces the software development cycle including requirements analysis and specifications, implementation, and testing, inspection and debugging techniques. An object-oriented programming language is used. Decomposition in to classes and modules is examined. The integration of independent modules is explored.
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CHY 102, CPS 188, ELE 202, MTH 240, PCS 211
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 328

Course ID 003069

Short Title Digital Systems

Long Title Digital Systems

Long Descr This course covers the basics digital logic circuits and emphasizes on good understanding of basic concepts in modern digital system design. The course introduces computer aided design (CAD) tools including the use of hardware description language (HDL) for design entry. It also discusses the use of the latest available implementation technologies including CPLDs and FPGAs for mapping the design to modern technology. This course covers basic logic circuits, Boolean algebra, and implementation technology (from transistor to CPLDs and FPGAs). It also introduces logic functions optimization and implementation, number representation and arithmetic circuits, combinational circuits, synchronous and asynchronous sequential circuits as well as introduction to control unit data path and CPU operations. The Laboratory work requires the uses of CAD tools to design and simulate basic digital circuits. Implementation and testing of simple digital systems in LSI and CPLD will also be considered. (Formerly ELE 328.)

Academic Org Computer Engineering

Components Lecture: 4.00 / Laboratory: 3.00

Requisites Prerequisites: CPS 188, ELE 202, MTH 240
Equivalencies COE328/ELE328

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 328E

Course ID 003069

Short Title Digital Systems

Long Title Digital Systems

Long Descr This course covers the basics digital logic circuits and emphasizes on good understanding of basic concepts in modern digital system design. The course introduces computer aided design (CAD) tools including the use of hardware description language (HDL) for design entry. It also discusses the use of the latest available implementation technologies including CPLDs and FPGAs for mapping the design to modern technology. This course covers basic logic circuits, Boolean algebra, and implementation technology (from transistor to CPLDs and FPGAs). It also introduces logic functions optimization and implementation, number representation and arithmetic circuits, combinational circuits, synchronous and asynchronous sequential circuits as well as introduction to control unit data path and CPU operations. The Laboratory work requires the uses of CAD tools to design and simulate basic digital circuits. Implementation and testing of simple digital systems in LSI and CPLD will also be considered. (Formerly ELE 328.)

Academic Org Computer Engineering

Components Lecture: 4.00 / Laboratory: 3.00

Requisites Prerequisites: CPS 188, ELE 202, MTH 240

Equivalencies	COE328/ELE328
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	2.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 428

Course ID	005702
Short Title	Algorithms and Data Structures
Long Title	Engineering Algorithms and Data Structures
Long Descr	The main topics covered in this course include basic data structures (arrays, pointers), abstract data structures (trees, lists, heaps), searching, sorting, hashing, recursive algorithms, parsing, space-time complexity, NP-complete problems, software engineering and project management, object-oriented data structures. Case studies and lab exercises will be implemented using a high level programming language. (Formerly ELE 428.)
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: COE 318; Corequisite: MTH 314
Equivalencies	COE428/ELE428
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 428E

Course ID 005702

Short Title Algorithms and Data Structures

Long Title Engineering Algorithms and Data Structures

Long Descr The main topics covered in this course include basic data structures (arrays, pointers), abstract data structures (trees, lists, heaps), searching, sorting, hashing, recursive algorithms, parsing, space-time complexity, NP-complete problems, software engineering and project management, object-oriented data structures. Case studies and lab exercises will be implemented using a high level programming language. (Formerly ELE 428.)

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: COE 318; Corequisite: MTH 314
Equivalencies COE428/ELE428

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 501

Course ID 026389

Short Title Electromagnetism Theory Effect

Long Title Electromagnetism: Theory and Effects

Long Descr Coulomb's law and electric field intensity. Gauss's law and electric flux density, the electric potential and potential gradient, electric fields in material space, capacitance, magnetic field intensity, Ampere's circuital law and magnetic flux density, Magnetic forces, Faraday's Law, Self and mutual inductance, time-varying fields, Maxwell's equations, electromagnetic effects on circuits, grounding, shielding and electrical termination.

Academic Org Computer Engineering

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisite: MTH 312; Antirequisite: ELE 401
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 528

Course ID	004434
Short Title	Object Orientd Analysis Design
Long Title	Object Oriented Eng Analysis and Design
Long Descr	This course deals with the analysis and design of complex engineering systems. In particular, students will be asked to create requirement specifications prior to the design and implementation of such engineering systems. Case studies from software development projects will be used to illustrate the design process. Development of expertise in analyzing, designing, implementing, and testing industrial-quality, reusable software systems. Project work include practice with an object-oriented programming language. (Formerly COE 618)
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: COE 318
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 528E

Course ID	004434
Short Title	Object Orientd Analysis Design
Long Title	Object Oriented Eng Analysis and Design
Long Descr	This course deals with the analysis and design of complex engineering systems. In particular, students will be asked to create requirement specifications prior to the design and implementation of such engineering systems. Case studies from software development projects will be used to illustrate the design process. Development of expertise in analyzing, designing, implementing, and testing industrial-quality, reusable software systems. Project work include practice with an object-oriented programming language. (Formerly COE 618)
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: COE 318
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 538

Course ID	001332
Short Title	Microprocessor Systems
Long Title	Microprocessor Systems
Long Descr	This course introduces students to small microprocessor-based systems, with an emphasis on embedded system hardware and software design. Topics will include microprocessor architecture and structure, with an overview of 8- 16- and 32-bit systems, assembly language programming and the use of high-level languages. Basic input/output including parallel communications with and without handshaking and serial protocols. Hardware and software timing. Using interrupts and exceptions. Overview of single-chip microprocessors and controllers with an emphasis on the Freescale HCS12. The internal structure and design of peripheral devices. Memory system design and analysis. The use and structure of development tools such as (cross) assemblers or compilers, monitor programs, simulators, emulators, etc.
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CEN 199 and COE 328 and ELE 404 and MTH 314
Equivalencies	
Attributes	Case Studies
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0

Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 608

Course ID 005872

Short Title Computer Organization and Arch

Long Title Computer Organization and Architecture

Long Descr The main topics of the course include basic architecture of modern computers, interaction between computer hardware and software at various levels, and performance evaluation and metrics. Instruction set design, computer arithmetic is also discussed. Data path and control unit design for RISC Processors are covered in detail. The laboratory work includes the design and implementation of a 16-bit RISC CPU using an FPGA development system and VHDL.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199 and COE 328 and COE 538
Equivalencies COE608/ELE548

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 628

Course ID 004507

Short Title Operating Systems

Long Title Operating Systems

Long Descr Topics include: Operating systems basic concepts. Hardware and software features required for operating systems. Process management; scheduling, inter-process communication and synchronization, process starvation, deadlocks. Memory management, virtual memory, and file systems. The major lab project will involve developing operating system modules. (Formerly COE 518).

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199 and COE 318 and COE 428; This course previously coded as COE 518.

Equivalencies COE518/COE708

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 691

Course ID 026579

Short Title Software REQs Analysis SPEC

Long Title Software Requirements Analysis and SPEC

Long Descr Introduces students to the requirement definition phase of the software development cycle with an emphasis on the design and implementation of system-level software, large architectural models for System-On-Chip systems, electronic-Design-Automation tool flows, and embedded systems. Methodologies for the analysis of system specification, the creation of appropriate descriptions of desired system behaviour and qualities along with relevant constraints and assumptions will be discussed.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: COE 428, COE 528, CPS 510

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 692

Course ID	026578
Short Title	Software Design Architecture
Long Title	Software Design and Architecture
Long Descr	Introduces students to issues, techniques, strategies, representations, and patterns used to implement software systems with an emphasis on the design and implementation of system-level software, large architectural models for System-On-Chip systems, Electronic-Design-Automation tool flows, and embedded systems.
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: COE 428, COE 528, CPS 510
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 718

Course ID 004679

Short Title Embedded Systems Design

Long Title Embedded Systems Design

Long Descr This course will cover the basics of embedded system organization, system on programmable-chip technologies and real-time systems. It provides the advance knowledge required for embedded computer design and development as well as real-time operating systems. Students are introduced to software development concepts applicable to real-time and embedded systems. Particularly ARM Cortex M3 will be studied as a representative embedded processor and embedded software development is carried out for ARM Cortex CPUs. The students will be able to grasp the main principles of embedded system design and understand the concept of hardware-software codesign, system on programmable chip (SoPC), real-time operating systems and scheduling techniques. Embedded system co-specification and partitioning is also introduced in the course. SystemC or other languages (e.g. UML, C, etc.) can be employed to present a unified view of the embedded systems. SystemC is introduced as a representative Co-specification language. Embedded hardware-software design and development tools (such as Altera Quartus II and SOPC builder) will be introduced.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: COE 538
Equivalencies COE718/ELE718

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 758

Course ID 003367

Short Title Digital Systems Engineering

Long Title Digital Systems Engineering

Long Descr The emphasis of this course is an understanding of the system architecture around the processor. Course covers all types of modern semiconductor memory, cache and virtual memory organization, hard disk drives and video-output subsystem. Course gives classification of buses and description of concepts of bus organization, bus protocols, arbitration mechanisms and the concept of Direct Memory Access (DMA). The laboratory projects include design of Cache Controller and VGA-signal generator using VHDL in Xilinx CAD environment.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: (COE 538 or ELE 538) and COE 608
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION

Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 768

Course ID 005488

Short Title Computer Networks

Long Title Computer Networks

Long Descr This is an introductory course in computer networks. In particular, it concentrates on the Internet technology. It first introduces the OSI and TCP/IP network architecture models. It then studies the implementation principles and design issues at each layer of these models. Lecture topics include: OSI and TCP/IP models, data transmission basics, data-link protocols, local area networks, wide-area networks, Internet structures, TCP/IP protocol suite, and application Layer protocols. Laboratory work focuses on the implementation of stop-and-wait protocol based on the BSD socket. In addition, students will gain practical experience by building and studying a physical network using network devices such as switches and routers.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: (COE 538 or ELE 538) and ELE 532
Equivalencies COE768/ELE735

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 817

Course ID 025404

Short Title Network Security

Long Title Network Security

Long Descr This course provides an introduction to the theory and application of security in computer network environments. Students will develop the skills necessary to formulate and address the security needs of wired and wireless network environments. The course will begin by an overview of network security and cryptography. Latter topics will cover transport level security, IP security, e-mail security, WiFi security, malicious code, firewall, and intrusion detection systems.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: COE 768
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 818

Course ID 005214

Short Title Advanced Computer Architecture

Long Title Advanced Computer Architecture

Long Descr The main topics include: instruction set architecture for advanced processor, advanced pipelining, including branch predication, instruction level parallelism. It also covers advanced architecture including superscalar VLIW, speculative, vector processors, multithreading and multi-processors. It discusses the performance limitations and scalability issues and introduces real-world examples including MMX technology, and Pentium architectures. The laboratory work includes performance evaluation of advanced architectures.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: COE 758
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 838

Course ID	024942
Short Title	Systems-on-Chip Design
Long Title	Systems-on-Chip Design
Long Descr	This course will cover the basics of system-on-chip (SoC) design, hardware-software co- specification, co-synthesis and network-on-chip (NoC) systems. It provides the advance knowledge required for system-on-chip design, multi-core architectures and embedded systems on a chip. Students will also be introduced to the main principles of SoC modeling and design using SystemC. Various soft processor cores such as Nios-II and other IPs will be explored. Interconnection structures such as AMBA, Avalon and IBM Core-connect for SoC design will be covered in detail. Various SoC development tools will be utilized in the labs and projects.
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: COE 718 or ELE 734
Equivalencies	
Attributes	Lab Work, Research Project
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 848

Course ID 025449

Short Title Fund. of Data Engineering

Long Title Fundamentals of Data Engineering

Long Descr Data engineering is core to the effective development of scalable software applications. Rich data management schemes are needed to handle the sizeable Big Data that is available for processing. This course will cover related topics such as entity-relation diagrams, relational databases, data definition and manipulation languages, structured data representations formats, development of novel vocabularies and semi-structured data and also novel concepts in NoSQL databases.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: COE 528
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 865

Course ID 005847

Short Title Advanced Computer Networks

Long Title Advanced Computer Networks

Long Descr This is an advanced level undergraduate course in computer networking. The course is designed to include materials relevant to the industry, for example IP routing and traffic engineering. The course deals with the principles, architectures, algorithms, and protocols related to the Internet, with emphasis on routing, transport protocol design, flow control and congestion control, quality of service, traffic engineering and MPLS. It also introduces network virtualization and software-defined networking (SDN). (Formerly ELE 865.)

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: COE 768
Equivalencies COE865/ELE865

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

COE 891

Course ID	026580
Short Title	Software Testing and QA
Long Title	Software Testing and Quality Assurance
Long Descr	Introduces students to various techniques to verify and validate software and software-hardware co-design systems with an emphasis on the design and implementation of system-level software, System-On-Chip systems, Electronic-Design-Automation tool flows, and embedded systems.
Academic Org	Computer Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: COE 692
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

COE 892

Course ID 026612

Short Title Distributed Cloud Computing

Long Title Distributed and Cloud Computing

Long Descr This course will introduce students to concepts in the design and implementation of large-scale distributed/cloud computing systems. The topics will range from cloud technology to cluster and multi-core systems. The course will specifically cover the topics of cloud infrastructures, virtualization, software defined networks and storage, distributed storage systems, and programming models.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: COE 768
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EES 508

Course ID 022865

Short Title Digital Systems

Long Title Digital Systems

Long Descr Number systems, codes and coding, minimization techniques applied to design of logic systems. Component specifications. Discussion of microprocessors, memory and I/O logic elements. Microcomputer structure and operation. I/O modes and interfacing. Machine language and Assembler programming. Design and application of digital systems for data collection and control of pneumatic hydraulic and machine systems. Laboratory work includes the use of microcomputers.

Academic Org Computer Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: EES 512 and CEN 199
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 122

Course ID 027092

Short Title Work Term I Computer Eng

Long Title Work Term I - Computer Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Computer Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 222

Course ID 027093

Short Title Work Term II Computer Eng

Long Title Work Term II - Computer Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Computer Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 292

Course ID 027375

Short Title Double Work Term Computer Eng

Long Title Double Work Term - Computer Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Computer Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 322

Course ID 027094

Short Title Work Term III Computer Eng

Long Title Work Term III - Computer Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Computer Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 422

Course ID 027095

Short Title Work Term IV Computer Eng

Long Title Work Term IV - Computer Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Computer Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EES 512

Course ID 000532

Short Title Electric Circuits

Long Title Electric Circuits

Long Descr This one-semester lecture/lab course covers general electric circuit parameters and laws. Topics include: basic electric circuits, voltage and current sources, resistance, analysis of DC circuits, power considerations. Concepts of capacitance, inductance, and their transient behaviour. Introduction of AC sources, phasors, reactance and impedance, AC analysis of RC, RL, and RCL circuits, the effect of resonance, real and complex power in reactive loads.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisites: MTH 140 and MTH 141
Equivalencies EES170/EES512

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EES 512E

Course ID 000532

Short Title Electric Circuits

Long Title Electric Circuits

Long Descr This one-semester lecture/lab course covers general electric circuit parameters and laws. Topics include: basic electric circuits, voltage and current sources, resistance, analysis of DC circuits, power considerations. Concepts of capacitance, inductance, and their transient behaviour. Introduction of AC sources, phasors, reactance and impedance, AC analysis of RC, RL, and RCL circuits, the effect of resonance, real and complex power in reactive loads.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Tutorial: 2.00

Requisites Prerequisites: MTH 140 and MTH 141
Equivalencies EES170/EES512

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EES 612

Course ID 000345

Short Title Elec Machines and Actuators

Long Title Electric Machines and Actuators

Long Descr The single-phase transformer and its applications. DC and AC motor characteristics, and their application in mechanical drives. Power electronic circuits, H bridges, PWM control, interfacing, power amplifiers. DC servo and stepper motors, AC synchronous and induction motors. Transformers. Introduction to typical speed and torque control techniques of motors.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199 and (EES 512 or MTE 401)
Equivalencies CKEL317CKEL324/EES612/624/640

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 70A

Course ID	026574
Short Title	ELE Eng Capstone Design-A
Long Title	Electrical Engineering Capstone Design-A
Long Descr	This two-term course provides a training platform for systematic open-ended design process and project management. Student groups apply their acquired knowledge and engineering skills to develop and build a design project from concept to working prototype. The lecture component provides advice and information on the design process, project management, reliability, system components, documentation, safety, and program specific aspects. In the laboratory component, once a project topic is assigned, student groups plan, design, source components, build, test/debug, and analyze, under the supervision of a faculty lab coordinator and submit a final design project report.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: COE 538, ELE 504, ELE 632, ELE 635, ELE 637, ELE 639, MEC 511
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Multi-Term Course: Not Graded
Hegis Code	
GPA Weight	0.00/0.00
Billing Units	1.0
Course Count	0.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 70B

Course ID	026575
Short Title	ELE Engin Capstone Design-B
Long Title	Electrical Engineering Capstone Design-B
Long Descr	This two-term course provides a training platform for systematic open-ended design process and project management. Student groups apply their acquired knowledge and engineering skills to develop and build a design project from concept to working prototype. The lecture component provides advice and information on the design process, project management, reliability, system components, documentation, safety, and program specific aspects. In the laboratory component, once a project topic is assigned, student groups plan, design, source components, build, test/debug, and analyze, under the supervision of a faculty lab coordinator and submit a final design project report.
Academic Org	Electric, Comp and Biomed Eng
Components	Laboratory: 5.00
Requisites	Prerequisite: ELE 70A
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	2.00/2.00
Billing Units	1.0

Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 202

Course ID 002014

Short Title Electric Circuit Analysis

Long Title Electric Circuit Analysis

Long Descr This course is a one semester introductory course in electric circuit analysis. The topics covered include the following: circuit variables and elements, resistive circuits, methods of circuit analysis, circuit theorems, energy storage elements, transient responses of RL and RC circuits, sinusoidal steady state analysis, and AC steady state power concepts. (1 hr. Tutorial and 3 hr. Lab every other week)

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 4.00 / Laboratory: 1.50 / Tutorial: 0.50

Requisites Prerequisites: MTH 140 and MTH 141
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 202E

Course ID 002014

Short Title Electric Circuit Analysis

Long Title Electric Circuit Analysis

Long Descr This course is a one semester introductory course in electric circuit analysis. The topics covered include the following: circuit variables and elements, resistive circuits, methods of circuit analysis, circuit theorems, energy storage elements, transient responses of RL and RC circuits, sinusoidal steady state analysis, and AC steady state power concepts. (1 hr. Tutorial and 3 hr. Lab every other week)

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 4.00 / Laboratory: 1.50 / Tutorial: 0.50

Requisites Prerequisites: MTH 140 and MTH 141

Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 302

Course ID 003158

Short Title Electric Networks

Long Title Electric Networks

Long Descr This course builds on the introductory course ELE202 in electric circuit analysis. The course topics include a brief overview of circuit variables, elements, laws and theorems; mutual inductance and the ideal transformer model; 3-phase circuits; the operational amplifier as an active circuit element. Also, simple opamp circuits, the Laplace transform with applications to differential equations and electric circuits, frequency responses, Bode plots, resonant circuits, Fourier series; two port networks, and network parameters for interconnection of two-port networks; use of PSpice simulation software to solve circuit problems.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 4.00 / Laboratory: 3.00

Requisites Prerequisites: CHY 102, MTH 140, MTH 141, PCS 125, PCS 211, CPS 188, ELE 202, MTH 240; Corequisite: MTH 312

Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 2.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

ELE 302E

Course ID	003158
Short Title	Electric Networks
Long Title	Electric Networks
Long Descr	This course builds on the introductory course ELE202 in electric circuit analysis. The course topics include a brief overview of circuit variables, elements, laws and theorems; mutual inductance and the ideal transformer model; 3-phase circuits; the operational amplifier as an active circuit element. Also, simple opamp circuits, the Laplace transform with applications to differential equations and electric circuits, frequency responses, Bode plots, resonant circuits, Fourier series; two port networks, and network parameters for interconnection of two-port networks; use of PSpice simulation software to solve circuit problems.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 4.00 / Laboratory: 3.00
Requisites	Prerequisites: CHY 102, MTH 140, MTH 141, PCS 125, PCS 211, CPS 188, ELE 202, MTH 240; Corequisite: MTH 312
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	2.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 401

Course ID 000025

Short Title Electric and Magnetic Fields

Long Title Electric and Magnetic Fields

Long Descr Review of vector analysis and coordinate systems. Coulomb's law and electric field intensity. Gauss's law and electric flux density. The electric potential and potential gradient. Electric fields in material space. Poisson's and Laplace's equations. Capacitance. Biot-Savart's Law and magnetic field intensity. Ampere's circuital law and the magnetic flux density. Magnetic forces. Self and mutual inductances. Time-varying fields and Maxwell's equations.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 4.00 / Tutorial: 2.00

Requisites Prerequisite: MTH 312
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 401E

Course ID 000025

Short Title Electric and Magnetic Fields

Long Title Electric and Magnetic Fields

Long Descr Review of vector analysis and coordinate systems. Coulomb's law and electric field intensity. Gauss's law and electric flux density. The electric potential and potential gradient. Electric fields in material space. Poisson's and Laplace's equations. Capacitance. Biot-Savart's Law and magnetic field intensity. Ampere's circuital law and the magnetic flux density. Magnetic forces. Self and mutual inductances. Time-varying fields and Maxwell's equations.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 4.00 / Tutorial: 2.00

Requisites Prerequisite: MTH 312
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 404

Course ID	004560
Short Title	Electronic Circuits I
Long Title	Electronic Circuits I
Long Descr	Introduction to electronics, diodes, linear and non-linear circuit applications. Bipolar junction and field-effect transistors: physical structures and modes of operation. DC analysis of transistor circuits. The CMOS inverter. The transistor as an amplifier and as a switch. Transistor amplifiers: small signal models, biasing of discrete circuits, and single-stage amplifier circuits. Biasing of BJT integrated circuits. Multi-stage and differential amplifiers. Current sources and current mirrors. Important concepts are illustrated with structured lab experiments and through the use of Electronic workbench circuit simulations.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 4.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 302 and MTH 312 and PCS 224
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 404E

Course ID 004560

Short Title Electronic Circuits I

Long Title Electronic Circuits I

Long Descr Introduction to electronics, diodes, linear and non-linear circuit applications. Bipolar junction and field-effect transistors: physical structures and modes of operation. DC analysis of transistor circuits. The CMOS inverter. The transistor as an amplifier and as a switch. Transistor amplifiers: small signal models, biasing of discrete circuits, and single-stage amplifier circuits. Biasing of BJT integrated circuits. Multi-stage and differential amplifiers. Current sources and current mirrors. Important concepts are illustrated with structured lab experiments and through the use of Electronic workbench circuit simulations.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 4.00 / Laboratory: 2.00

Requisites Prerequisites: ELE 302 and MTH 312 and PCS 224
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 504

Course ID 002257

Short Title Electronic Circuits II

Long Title Electronic Circuits II

Long Descr Advanced course on the analysis and design of electronic circuits. Topics include non-ideal Op-Amp amplifier characteristics, practical amplifier designs, linear/non-linear Op-Amp circuits, filters and tuned amplifiers, oscillators, signal generators, power output stages, etc. Circuit applications to such areas as instrumentation, signal processing and conditioning, and control are considered. Key design concepts are experienced through laboratory work and a major design project, use of electronic circuit simulation tools, and solving design problems.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: ELE 404 and CEN 199
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

ELE 531

Course ID	003234
Short Title	Electromagnetics
Long Title	Electromagnetics
Long Descr	Time-varying fields and Maxwell's equations, boundary conditions, retarded potentials. The wave equation. The uniform plane wave, wave polarization, wave reflection. Transmission lines, Smith chart. Rectangular waveguides. Radiation from short dipoles, half- and quarter-wavelength antennas, the radiation resistance. Basic microwave measurements.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisite: ELE 401 and CEN 199
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 532

Course ID 002540

Short Title Signals and Systems I

Long Title Signals and Systems I

Long Descr This course deals with the analysis of continuous-time signals and systems both in the time domain and frequency domain. Topics include: representation of signals and linear time-invariant systems, impulse response, convolution, Fourier Series, Fourier Transform, Laplace Transform and an introduction to sampling.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, COE 428, ELE 404, MTH 314
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 632

Course ID 022190

Short Title Signals and Systems II

Long Title Signals and Systems II

Long Descr The topics covered in the course includes a general discussion on discrete signals (periodic signals, unit step, impulse, complex exponential), a general discussion on discrete systems, Discrete-Time Fourier Series (DTFS), Discrete-Time Fourier Transform (DTFT); analysis and synthesis, Fourier Spectra; continuous nature, periodicity, existence, Properties of the DTFT; linearity, conjugation, time/frequency reversal, time/frequency shifting, etc. LTI discrete time system analysis using DTFT, DTFT and Continuous-Time FT comparison and relation, DFT and FFT discussion and their relation to DTFT and CTFT, Discrete-Time Sampling, Z-Transform; generalization of the DTFT.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: ELE 532
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 635

Course ID	004355
Short Title	Communication Systems
Long Title	Communication Systems
Long Descr	This course studies basic principles of communication theory as applied to the transmission of information. The course topics include: baseband signal transmission, amplitude, phase and frequency modulation, modulated waveform generation and detection techniques, effects of noise in analog communication systems, frequency division multiplexing. Digital Signals: sampling, aliasing, quantization and introduction to pulse code modulation. (3 hr. Lab every other week)
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.50
Requisites	Prerequisites: ELE 532 and MTH 514 and CEN 199
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 637

Course ID 001821

Short Title Energy Conversion

Long Title Energy Conversion

Long Descr Basic principles of operation of different types of machines and their control; magnetic circuit analysis, single-phase, and three-phase transformers, principles of electromechanical energy conversion, DC machines, three-phase induction motors, synchronous machines, introduction to solid-state motor controls and devices, transients and dynamics of machines, introduction to programmable logic controller (PLC), control of electric motors by PLC.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: ELE 302 and ELE 531
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 639

Course ID 002070

Short Title Control Systems

Long Title Control Systems

Long Descr Introductory course in control theory: system modeling, simulation, analysis and controller design. Description of linear, time-invariant, continuous time systems, differential equations, transfer function representation, block diagrams and signal flows. System dynamic properties in time and frequency domains, performance specifications. Basic properties of feedback. Stability analysis: Routh-Hurwitz criterion, Root Locus method, Bode gain and phase margins, Nyquist criterion. Classical controller design in time and frequency domain: lead, lag, lead-lag compensation, rate feedback, PID controller. Laboratory work consists of experiments with a DSP-based, computer-controlled servomotor positioning system, and MATLAB and Simulink assignments, reinforcing analytical concepts and design procedures.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.50

Requisites Prerequisite: ELE 532 and CEN 199
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

ELE 707

Course ID 022189

Short Title Sensors and Measurement

Long Title Sensors and Measurement

Long Descr The course will cover the theory and principles of sensors and transducers (electrical, chemical and mechanical). The topics covered include transduction techniques, linear/non-linear signal processing, low noise amplifiers, instrumentation amplifiers, data converters. There will be small design projects for the labs to reinforce sensor/transducer interfacing. (Formerly ELE 604.)

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisite: ELE 504 and COE 538; Antirequisite: ELE 604 (ELE 707 was formerly offered as ELE 604)

Equivalencies

Attributes Lab Work, Research Project
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 709

Course ID 004404

Short Title Real-Time Computer Ctrl Sys

Long Title Real-Time Computer Control Systems

Long Descr This course deals with practical techniques for the specification, design and implementation of real-time computer control systems. Topics include: overview of computer control strategies; introduction to real-time systems; hardware and software requirements; implementation of digital control algorithms; design of real-time computer control systems; design analysis; considerations for fault detection and fault tolerance. The lab work and project require solid background in C programming.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: ELE 639 or MEC 830
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 714

Course ID 025041

Short Title Digital System Testing and Des

Long Title System Testing and Design-for-Testability

Long Descr This course deals with the detection and correction of faults and errors in digital circuits and systems. Major topics include digital circuit test methodologies from algorithms to gate/transistor-level designs, faults in combinational and sequential circuits including test-generation algorithms, measurement and calibration, error classification at the circuit level and solutions to detect and remove errors, digital system design and testing, identification of the sources of faults at the system level including power lines, memory testing, and input / output testing, built-in self-test techniques, and design-for-testability methods at system level design.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: ELE 504 and ELE 635 and ELE 639
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

ELE 719

Course ID	025636
Short Title	Fundamentals of Robotics
Long Title	Fundamentals of Robotics
Long Descr	This course provides a comprehensive treatment on the fundamentals of robotic manipulators and mobile robots. Topics include: homogeneous transformations, the Denavit-Hartenberg representation of linkages, solution of the forward kinematics problem. Closed-form and numerical solutions of the inverse kinematics problem. Differential kinematics and motion, Jacobian matrix, singularities. Kinematic and dynamic model of mobile robots. Path planning, trajectory planning and motion control for mobile robots.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 639 or MEC 709
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 727

Course ID	027053
Short Title	CMOS Analog Integrated Circuit
Long Title	CMOS Analog Integrated Circuits
Long Descr	Fundamentals of IC design: MOS device physics, IV characteristics, regions of operation, small-signal model, single-transistor amplifiers, cascodes, differential voltage amplifier, frequency response of amplifiers, noise, feedback, CMOS op amps, systematic design of op amps, bandgap references, biasing circuits, voltage regulators, filter implementation in CMOS.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 504 and ELE 639
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 734

Course ID	000506
Short Title	Low Pwr Dgtl Integrated Circts
Long Title	Low Power Digital Integrated Circuits
Long Descr	This course deals with the design of Digital CMOS integrated circuits. The course consists of three essential components: Theory, Laboratory, and project. Variety of design techniques, such as Static CMOS, Dynamic CMOS, and Transmission Gate are discussed in theory. These designs are studied on basic logic gates as well as combinational and sequential circuits. The lessons learned are applied to arithmetic building blocks such as adders and decoders. A MOS transistor is studied using I-V equations, and the different areas of operations are modeled. The static (DC) are dynamic (transient) behaviours for an important building block, a CMOS inverter, are studied in depth.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: COE 538
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 745

Course ID	005213
Short Title	Digital Communication Systems
Long Title	Digital Communication Systems
Long Descr	This course provides a comprehensive introduction to basic principles and techniques of digital communication. Lecture topics include: Analog to digital conversion, PCM, baseband transmission, power spectrum density analysis, intersymbol interference, matched filters, noise analysis, digital modulation, coherent and non-coherent detections. Laboratory work is based on simulations in Matlab.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: ELE 635
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 746

Course ID	004144
Short Title	Power Systems Analysis
Long Title	Power Systems Analysis
Long Descr	Overview of the power system; Generator and transformer models and operation; Per-unit system of calculations; Transmission line parameters; Steady-state operation of short, medium-length, and long transmission lines; Load Flow problem and Gauss-Seidel and Newton-Raphson iterative methods of solution; Symmetrical fault analysis; Simulation of power systems using software packages.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 637 and ELE 639
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 747

Course ID	025448
Short Title	Advanced Electric Drives
Long Title	Advanced Electric Drives
Long Descr	A course on modeling, analysis and design of electric drive systems. The main topics include: modelling of dc/ac motors, dynamic and steady performance, reference frame, small signal (linearized) analysis, solid-state converters, motor speed/position control schemes, simulation and digital control techniques. The modeling, simulation and digital controller will be developed in this course to analysis and design advanced electric drive systems. Important concepts are illustrated with laboratory experiments.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: (ELE 637 and ELE 639) or ELE 654
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 754

Course ID	002104
Short Title	Power Electronics
Long Title	Power Electronics
Long Descr	A course in power electronics and solid-state converters. Major topics include switching devices (SCR, MOSFET, IGBT, GTO, etc.), non-isolated and isolated DC-DC switched-mode converters, diode and thyristor bridges, voltage-sourced converters (inverters and rectifiers), and industry applications of power electronics. Typical digital and analog control schemes for power electronic converters will also be discussed. Important concepts are illustrated through computer and/or hardware labs.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisite: ELE 504; Not available to students who have completed ELE 654 - Power Electronics.
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 792

Course ID	005585
Short Title	Digital Signal Processing
Long Title	Digital Signal Processing
Long Descr	The topics covered in this course include fast algorithms for the computation of DFT, fast Fourier transform (FFT), finite length discrete transforms, Discrete Cosine transform (DCT), estimation of spectra from finite-duration observations of signals, implementation of discrete-time systems, floating-point and fixed-point representations, multi-rate signal processing, adaptive filters and applications.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 632 and (COE 538 or ELE 538)
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 801

Course ID	025442
Short Title	Electric Vehicles
Long Title	Electric Vehicles
Long Descr	This course introduces architectures and technologies associated with electric, hybrid electric, and plug-in hybrid electric vehicles, including their constituent components. Specific topics include electric and hybrid electric drive trains, energy storage, electromechanical energy conversion and power-electronic drives, vehicle-level modeling and control, and optimization.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: ELE 637 or EES 612
Equivalencies	
Attributes	Case Studies
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 804

Course ID	004441
Short Title	Radio-Frequency Circ and Sys
Long Title	Radio-Frequency Circuits and Systems
Long Descr	This course deals with design of CMOS circuits for wireless communications. The theoretical component consists of: introduction to wireless communications, modulation schemes for wireless communications, characterization of RF circuits, architecture of RF transceivers, building block of RF transceivers (LNAs, mixers, RF filters, VCOs, frequency synthesizers, and power amplifiers), and electromagnetic compatibility. Students are required to complete a design project with a professionally prepared project report.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: ELE 724 or ELE 734
Equivalencies	
Attributes	Lab Work, Research Project
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 806

Course ID	022194
Short Title	Alternative Energy Systems
Long Title	Alternative Energy Systems
Long Descr	The topics include introduction to alternative energy systems, power converters for renewable energies, wind energy system fundamentals, wind generators, doubly fed induction generator based wind turbines, synchronous generator based wind generation systems, control schemes, transient and steady-state analysis, solar energy systems, photovoltaic arrays, and maximum power point tracking schemes. Other alternative energy systems will also be introduced.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisite: ELE 747
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 809

Course ID 000782

Short Title Digital Control System Design

Long Title Digital Control System Design

Long Descr This course deals with the theory on the design of digital control systems and their implementation. Major topics include: State-space system model. Discrete-time signals and systems; z-transform. Sampling: the ideal sampler, data reconstruction, quantization effects. Discrete equivalents to continuous-time transfer functions. Stability analysis: Jury's stability test; root locus; Nyquist stability criterion. Design of digital control systems: transform techniques; stat-space techniques. Hardware and software aspects in implementation. Laboratory work will include experiments on PID controller, and sate feedback controller design of an electro-mechanical system.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: ELE 639
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 815

Course ID 002306

Short Title Wireless Communications

Long Title Wireless Communications

Long Descr This course provides a comprehensive introduction to basic principles and techniques in cellular mobile communications. The topics include: communication overview and frequency reuse, the cellular concept, radio propagation environments, techniques of modulation and equalization, multiple access wireless systems: TDMA/FDMA systems, CDMA systems, etc.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ELE 745
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 819

Course ID 025650

Short Title Control Robotic Manipulators

Long Title Control of Robotic Manipulators

Long Descr This course deals with motion and force control and visual servoing of robotic manipulators. Topics include: Dynamics: Euler-Lagrange and Newton-Euler formulations. Path and trajectory planning. Motion and interaction control of robotic manipulators. Visual servoing for robotic manipulators.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ELE 719
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 827

Course ID 027055

Short Title CMOS Mixed-Signal Crcts and Sy

Long Title CMOS Mixed-Signal Circuits and Systems

Long Descr This course deals with CMOS mixed-signal circuits and systems. Key topics include Delay-Locked Loops (DLLs) and Phase-Locked Loops (PLLs), Analog-to-Digital converters (ADCs), Nyquist-rate ADCs (flash, pipelined, and successive approximation), over-sampled noise-shaping ADCs, Nyquist and noise-shaping time-to-digital converters (TDCs), All-Digital Phase-Locked Loops (ADPLLs), Finite Impulse Response (FIR), and Infinite Impulse Response (IIR) digital filters in ADPLLs and noise-shaping ADCs, simultaneous switching noise and analog/digital grounding.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: ELE 727 or ELE 734
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 829

Course ID 003782

Short Title Sys Models and Identification

Long Title System Models and Identification

Long Descr Introduction to modern methods of linear system identification. Different types of models. Review of classic time- and frequency-based approach to empirical, 'black-box' system modeling. Non-parametric identification: impulse and step weights, spectral analysis. Parametric, discrete transfer function models from I/O data using Least Squares. Data-collection procedures, model structure selection, use of auto- and cross-correlation functions for diagnostics and model validation, overview of different estimation algorithms.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: ELE 639
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

ELE 846

Course ID	001232
Short Title	Power Systems Protection Ctrl
Long Title	Power Systems Protection and Control
Long Descr	Overview of power system operation and control; Generator Voltage Control; Turbine-Governor Control, Load-Frequency Control, Economic Dispatch and Optimal Power Flow; Transient Operation of Transmission lines, power system over-voltages and Insulation coordination; Transient stability study, swing equation, equal-area criteria and methods of improving transient stability; ETAP to study transient stability.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: ELE 746
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 861

Course ID 001898

Short Title Microwave Engineering

Long Title Microwave Engineering

Long Descr Introduction to microwave technology, transmission line theory and applications, standing waves and voltage standing wave ratio (VSWR), examples of practical transmission lines, the Smith chart, power flow, transmission-line impedance matching networks, L-section lumped-element matching networks, Z, Y, S and ABCD parameters, passive microwave devices: power dividers and directional couplers, introduction to Computer Aided Design (CAD) techniques, theory and design of microwave amplifiers: FETs, BJTs, 2-port power gains, amplifier stability, design for maximum gain, specified gain, and minimum noise figure.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ELE 531
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

ELE 863

Course ID 000389

Short Title VLSI Systems

Long Title VLSI Circuits for Data Communications

Long Descr An advanced course on design of VLSI circuits for data communications over wire channels. The theoretical component consists of: switching noise and grounding of mixed analog-digital circuits, modeling of wire channels, clock generation and distribution, power distribution on chip, ESD protection, channel equalization, clock and data recovery. The laboratory component consists of design of clock and data recovery circuits using state-of-the-art CMOS technology and CAD tools.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisite: ELE 724 or ELE 734
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

ELE 882

Course ID	022195
Short Title	Intro to Digital Image Process
Long Title	Intro to Digital Image Processing
Long Descr	The course will cover basic theory and principles of digital image processing. The topics covered include: Image Capture and Display, Digital Image Storage and formats, 2-D Sampling and Quantization of Images, Grey-level image processing, 2-D image filtering operations (spatial and frequency domain), colour and trichromacy, planar colour image processing, image compression, and the extension of concepts to video.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisite: ELE 632
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 884

Course ID	003648
Short Title	Photonics
Long Title	Photonics
Long Descr	This course offers a comprehensive overview of the properties and behaviour of light. It begins with the light transmission including ray optics and wave optics; followed by the generation of light by lasers and light-emitting diodes. Examples on various lasers will be given. Further topics include electro-optical devices for optical modulation, switching and scanning. The last chapter is the light detection, mainly by semiconductor photo-detectors. Numerous applications and engineering examples are presented throughout the course.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: ELE 531 and ELE 635
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 885

Course ID	003814
Short Title	Optical Communication Systems
Long Title	Optical Communication Systems
Long Descr	This course provides a good understanding of the fundamentals of optical communications; both fiber optics and emerging optical wireless systems will be covered. Some of the topics are: high speed single mode and low speed multimode fibers, step and graded refractive index profiles, different dispersion mechanisms and their effect on high-speed links, advantage of coherent (LASER) light source over incoherent (LED) sources for long haul, high-speed links, photo detectors and their role in bit error rate (BER). Students will do design calculations for point to point and star type fiber optic networks, and they will also be introduced to Synchronous Optical Networks (SONET) and wavelength division multiplexing scenarios. Signal processing performance improvements will also be discussed.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisite: ELE 635
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0

Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 888

Course ID	000945
Short Title	Intelligent Systems
Long Title	Intelligent Systems
Long Descr	Machine learning and pattern classification are fundamental blocks in the design of an intelligent system. This course will introduce fundamentals of machine learning and pattern classification concepts, theories, and algorithms. Topics covered include: Bayesian decision theory, linear discriminant functions, multilayer neural networks, classifier evaluation, and an introduction to unsupervised clustering/grouping, and other state-of-the-art machine learning and AI algorithms.
Academic Org	Electric, Comp and Biomed Eng
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisite: ELE 532 or MEC 733
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

ELE 900

Course ID 027505

Short Title AI: Sociotechnical Perspective

Long Title AI: Sociotechnical Perspective

Long Descr This course provides a critical introduction to Artificial Intelligence (AI) and its various applications in the real world. The course starts with introducing students to the historical and philosophical background of AI, including key figures and ideas that have influenced the development of the field over the past few decades as well as its most recent advances. The course provides students with frameworks to understand and appraise the social, cultural, and scientific context of AI and enables students to critically evaluate the pros and cons of AI applications.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 3.00

Requisites
Equivalencies Not available to Engineering students and Computer Science students.

Attributes Upper Level Liberal Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 99A

Course ID 020284

Short Title Co-op Internship Program-A

Long Title Co-op Internship Program-A

Long Descr Work Term, mandatory for Electrical Engineering students who have opted to participate in the program and have been placed with an industrial partner. The duration of the work term is not less than 12 months and not more than 16 months, normally commencing in May and concluding no later than August 31st of the following year. To be eligible to participate in the IIP, the student must have completed three years of the four year program of studies and be in good standing at the end of their third year. Students will be required to file a brief report by March 31st of their year in industry. The Department publishes the criteria to be met by the report. The program coordinator will attempt to visit the student at their place of work to ensure that the student is gaining significant industrial and professional experience during the work term. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code

GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 99B

Course ID 020285

Short Title Co-op Internship Program-B

Long Title Co-op Internship Program-B

Long Descr Work Term, mandatory for Electrical Engineering students who have opted to participate in the program and have been placed with an industrial partner. The duration of the work term is not less than 12 months and not more than 16 months, normally commencing in May and concluding no later than August 31st of the following year. To be eligible to participate in the IIP, the student must have completed three years of the four year program of studies and be in good standing at the end of their third year. Students will be required to file a brief report by March 31st of their year in industry. The Department publishes the criteria to be met by the report. The program coordinator will attempt to visit the student at their place of work to ensure that the student is gaining significant industrial and professional experience during the work term. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies WKT99B/WKT99

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 123

Course ID 027096

Short Title Work Term I Electrical Eng

Long Title Work Term I - Electrical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 223

Course ID 027097

Short Title Work Term II Electrical Eng

Long Title Work Term II - Electrical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 293

Course ID 027376

Short Title Double Work Term - Electrical

Long Title Double Work Term - Electrical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 323

Course ID 027098

Short Title Work Term III Electrical Eng

Long Title Work Term III - Electrical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 423

Course ID 027099

Short Title Work Term IV Electrical Eng

Long Title Work Term IV - Electrical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Electric, Comp and Biomed Eng

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CEN 100

Course ID 022920

Short Title Introduction to Engineering

Long Title Introduction to Engineering

Long Descr This course is aimed at familiarizing the first year students with the basic information of the academic structure and expectations. Exposure to public and worker safety and the impact of engineering activities on health as well as safety standards and safety codes will be covered. The course also stresses integration with other first year courses. The principal objectives of the course are to provide a general introduction to the field of engineering; to convey the social, professional, and ethical responsibilities of engineers and why they are important to an engineering education; to introduce the undergraduate engineering programs available at Toronto Metropolitan University; and to provide a general description of the skills needed to become a practising engineer. Case studies in engineering are used to illustrate engineering fields and scientific principles.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 2.00 / Tutorial: 1.00

Requisites Available only to Engineering and Engineering Special students.
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

CEN 100E

Course ID	022920
Short Title	Introduction to Engineering
Long Title	Introduction to Engineering
Long Descr	This course is aimed at familiarizing the first year students with the basic information of the academic structure and expectations. Exposure to public and worker safety and the impact of engineering activities on health as well as safety standards and safety codes will be covered. The course also stresses integration with other first year courses. The principal objectives of the course are to provide a general introduction to the field of engineering; to convey the social, professional, and ethical responsibilities of engineers and why they are important to an engineering education; to introduce the undergraduate engineering programs available at Toronto Metropolitan University; and to provide a general description of the skills needed to become a practising engineer. Case studies in engineering are used to illustrate engineering fields and scientific principles.
Academic Org	Faculty of Eng and Arch Sci
Components	Lecture: 2.00 / Tutorial: 1.00
Requisites	Available only to Engineering and Engineering Special students.
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

CEN 199

Course ID 024744

Short Title Writing Skills

Long Title Writing Skills

Long Descr All engineering students are required to write a mandatory Writing Skills Test (WST) administered during Orientation Week before the beginning of the first semester. Students who pass the WST (grade of 'B' or higher) may enrol in their chosen breadth elective (liberal studies) courses. Those students who do not pass the WST will be required to enrol in LNG 111, LNG 112, LNG 113, or LNG 121 as a breadth elective (lower level liberal studies) course. Students who do not pass the WST will have three additional chances to write the WST. The second test will be scheduled in May following the completion of the first year Engineering curriculum. The third and fourth WST will be administered during the next academic year Orientation Week, and again, in May. This course must be successfully completed prior to enrolling in third-year engineering courses. This course is graded on a pass/fail basis.

Academic Org Faculty of Eng and Arch Sci

Components Laboratory: 1.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent Department Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CEN 199E

Course ID 024744

Short Title Writing Skills

Long Title Writing Skills

Long Descr All engineering students are required to write a mandatory Writing Skills Test (WST) administered during Orientation Week before the beginning of the first semester. Students who pass the WST (grade of 'B' or higher) may enrol in their chosen breadth elective (liberal studies) courses. Those students who do not pass the WST will be required to enrol in LNG 111, LNG 112, LNG 113, or LNG 121 as a breadth elective (lower level liberal studies) course. Students who do not pass the WST will have three additional chances to write the WST. The second test will be scheduled in May following the completion of the first year Engineering curriculum. The third and fourth WST will be administered during the next academic year Orientation Week, and again, in May. This course must be successfully completed prior to enrolling in third-year engineering courses. This course is graded on a pass/fail basis.

Academic Org Faculty of Eng and Arch Sci

Components Laboratory: 1.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required

Drop Consent Department Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CEN 699

Course ID 024826

Short Title Research Placement

Long Title Research Placement

Long Descr Students carry out research projects under the supervision of faculty members in Engineering. Research projects can be theoretical or experimental studies. Students are required to complete written reports. This course is graded on a Pass/Fail basis. Permission by Dean's Office.

Academic Org Faculty of Eng and Arch Sci

Components Laboratory: 3.00

Requisites
Equivalencies

Attributes Practicum/Placement, Research Project
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CEN 800

Course ID 005157

Short Title Law and Ethics in Eng Practice

Long Title Law and Ethics in Engineering Practice

Long Descr Study of the legal and ethical aspects of engineering practice, including Canadian legal system and business organizations, tort liability, business contract law, intellectual and industrial property, principles of arbitration and alternative dispute resolutions, the practice of engineering, occupational health and safety, ethical aspects of engineering practice, ethical dilemmas in project management, sustainable development and ethical behaviour, and globalization and international standards for ethical and social responsibility.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

CEN 810

Course ID 027060

Short Title Selected Topics in Engineering

Long Title Selected Topics in Engineering

Long Descr Provides advanced study and application of selected multidisciplinary topics in Engineering. This course will be offered from time to time by the Faculty of Engineering and Architectural Science. See teaching department for consent criteria.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00 / Tutorial: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics 1. Interdisciplinary Sustainability and Innovation

EIE 201

Course ID 025023

Short Title Start-up of Tech. Ventures

Long Title Start-up of Technology Ventures

Long Descr The course is designed to introduce the students to the process of establishing technology based venture. It is designed to familiarize them with the kind of opportunities and challenges likely to be encountered by entrepreneurs. The course will provide the practical knowledge and technical skills required to pursue an entrepreneurial career. Students will learn how to identify, and validate value creating business opportunities. The course will facilitates student market research and intellectual property assessments for their business idea and preparation of a market feasibility study report. The course will deal with all the practical aspects of technology feasibility of the proposed solution for the customer problems they intend to solve and the generation of commercialization and business plans.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EIE 301

Course ID 025024

Short Title Practicum I:New Venture Ident.

Long Title Practicum I: New Venture Identification

Long Descr In this practicum the students are required to identify and validate a market based new business opportunity without investing significant time or resources. Starting by understanding of real customers problems to be solved, students explore the nature of potential solutions and the customer groups that can benefit. In addition to using secondary market research data, students are expected to talk to industry experts to better understand the market niche or the industry they are targeting. The preliminary work in this phase will also focus on market competition, the business model and value proposition. EIE students will develop a preliminary technical plan that should include analysis of intellectual property issues associated with the solution and sketch out the plan for achieving a technology proof-of-concept. Finally, students prepare a new venture concept identification report and an investor oral presentation.

Academic Org Faculty of Eng and Arch Sci

Components Laboratory: 4.00 / Lecture: 1.00

Requisites Prerequisites: ECN 801, EMS 201 and EIE 201
Equivalencies

Attributes Practicum/Placement
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required

Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

EIE 401

Course ID	025025
Short Title	Practicum II: Market Tech Dev
Long Title	Practicum II: Market and Tech Development
Long Descr	Practicum II will allow students to conduct both technical and market feasibility analyses. The main objective is to validate that there are customers willing to pay for the product and/or service. Students are required to demonstrate that their proposed engineering solution would serve identified customers. They must also prove that the underlying technology for the solution can deliver the required essential characteristics that satisfy customer needs. From the market development side, it is expected that thorough market research will be carried out to explore different customer groups. Moreover, using the voice of customer, a clear understanding of the relationship between customer needs and technical characteristics of the product/service has to be developed. The market development and the engineering technical proof-of-concept activities are the key deliverables from this practicum.
Academic Org	Faculty of Eng and Arch Sci
Components	Laboratory: 4.00 / Lecture: 1.00
Requisites	Prerequisites: ECN 801, EMS 201, EIE 201 and EIE 301
Equivalencies	
Attributes	Practicum/Placement
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

EIE 501

Course ID 025026

Short Title Prac III:Bus Dev/Mkt Readiness

Long Title Practicum III: Bus Dev and Mkt Readiness

Long Descr Practicum III is the 3rd and final phase of three-stage process the EIE students will go through to develop their entrepreneurial skills and leadership in new venture creation. Students will build on the knowledge accumulated in the previous phases in order to analyse potential business models, select a business start-up strategy, complete a full business plan and formulate tactical go-to-market approaches. The expectation is that the business is either ready to enter the market and raise funds, or the venture is pivoted to pursue more promising market opportunity. At the conclusion of this phase, the student goes through a Market Readiness Review and is evaluated on their ability to convince investors to invest in their new venture.

Academic Org Faculty of Eng and Arch Sci

Components Laboratory: 4.00 / Lecture: 1.00

Requisites Prerequisites: ECN 801, EMS 201, EIE 201, EIE 301 and EIE 401
Equivalencies

Attributes Practicum/Placement
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EMS 201

Course ID 007412

Short Title Entrepreneurship/Innovation

Long Title Entrepreneurship and Innovation Management

Long Descr This course is designed to illustrate how successful managers implement innovation in their areas of responsibility. Students will learn the importance of leadership, entrepreneurial thinking and creativity in dealing with the changing and complex issues facing today's business enterprises. The courses will attempt to develop the individual's creative instincts and improve their capacity as agents of change within careers as independent business owners or managers within large corporations.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0

Repeat for Credit N
Total Completions 1
Course Topics

EMS 202

Course ID 009402

Short Title Operations Management

Long Title Operations Management

Long Descr Topics include: productivity; competitiveness and strategy; quality management; product and service design; process selection; design of work systems; learning curves; inventory management; materials requirements planning (MRP), Just In Time (JIT); maintenance and reliability. Issues in supply chain management will also be introduced such as: distribution strategies, location analysis, customer service, outsourcing decisions, buyer-supplier relationships, and information exchange, with an emphasis on emerging technology and its impact on Supply Chain Management (SCM).

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EMS 203

Course ID 009570

Short Title Investment Analysis

Long Title Investment Analysis

Long Descr This course is designed to give students an overview of both security analysis and portfolio management. The course covers the valuation of common stock, treasury bills and bonds, the trade-off between risk and return, the efficient market hypothesis, modern portfolio theory, equilibrium pricing relationships, and the evaluation of portfolio performance. Playing an investment challenge game is a requirement of the course.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites Prerequisite: EMS 303
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EMS 204

Course ID 006139

Short Title Organization Design/Dynamics

Long Title Organization Design and Dynamics

Long Descr This course is designed to help students develop a theoretical understanding of organizational behaviour, and to help them improve their interpersonal skills and their ability to work productively in a team. Topics include: employee motivation, job design, perception and diversity, interpersonal and organizational communication, team dynamics, leadership, industrial relations and legislation, power and organizational culture, stress, organizational commitment and job.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EMS 301

Course ID	009897
Short Title	Management Information Systems
Long Title	Management Information Systems
Long Descr	Topics include algorithm analysis and design, data structures, basic algorithms for searching and sorting, recursion, and list processing. Database systems from a systems analyst perspective will give students some foundations in design and analysis of information systems (IS). In addition, the concepts, structure, benefits and problems of Enterprise Resource Planning (ERP) solutions are examined from a business perspective, as well as from a technical Information Technology perspective. This course is not available to Computer Science students.
Academic Org	Faculty of Eng and Arch Sci
Components	Lecture: 3.00
Requisites	Prerequisite: EMS 201
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

EMS 302

Course ID 009087

Short Title Operations Research

Long Title Operations Research

Long Descr Topics include: the linear programming model and simplex method of solution, duality, and sensitivity analysis; transportation and assignment problems; and shortest path and maximal flow problems. In addition, probability review, Markov decision process, queuing theory, inventory models, and simulation will be covered.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites Prerequisite: EMS 202
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EMS 303

Course ID 006661

Short Title Managerial Accounting

Long Title Managerial Accounting

Long Descr In this course, students will gain a quick review of the principles of accounting and reporting to various users that are external to the organization. Topics covered provide a good balance between the concepts and procedures used in the accumulation and use of data by management accountants to facilitate planning and decision-making. Management Control is studied through the use of budgets, standards, and variance analysis, return on investment and residual income expectations.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites Prerequisite: CHE 411 or ECN 801
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

EMS 304

Course ID	009419
Short Title	Project Management
Long Title	Project Management
Long Descr	The objective of this course is to examine the fundamentals of project management within a life-cycle approach. This course will cover topics such as: project screening and selection, evaluation methods of projects, project structures, management and control, project scheduling, resource management, life-cycle costing, research and development projects, computer support for project management, and project termination. This course is not available to Civil Engineering students.
Academic Org	Faculty of Eng and Arch Sci
Components	Lecture: 3.00
Requisites	Prerequisite: EMS 204; Antirequisites: CVL 742, IND 713, MEC 713
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

TEC 210

Course ID 025920

Short Title Fundamentals of Project Mgnt

Long Title Fundamentals of Project Management

Long Descr This course will familiarize the student with the concepts and basic functions of the project management body of knowledge, including scope, quality, time, cost, risk, procurement, human resource, and communication management. The integration of these functions into a project management system, and the role of the project manager and project support staff, will be examined. This course provides a basic knowledge of project management as preparation for other courses in the program. (39 PDUs)

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

TEC 241

Course ID 025921

Short Title Energy Innovation

Long Title Energy Innovation

Long Descr This course focuses on the drivers for innovation in Ontario's energy sector, the opportunities for new business, and the challenges of moving from the idea stage to the marketplace. Barriers to innovation and commercialization - technological, financial, and regulatory - will be explored through case studies, including lessons learned from guest lectures by business leaders in the Ontario energy sector.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

TEC 264

Course ID	025922
Short Title	Trends in Smart Grid
Long Title	Trends in Smart Grid
Long Descr	This course will examine the challenges of modernizing and digitizing the electrical grid in Ontario. It will explore the engineering and technological challenges of the smart grid; the issues of privacy and security; third party access to smart grid data; technologies which allow customers to manage their consumption of electricity; and the innovation and economic opportunities of the smart grid.
Academic Org	Faculty of Eng and Arch Sci
Components	Lecture: 3.00
Requisites	
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

TEC 269

Course ID 025923

Short Title Trends in Energy Conservation

Long Title Trends in Energy Conservation

Long Descr This course is designed to allow students to explore the technical and policy dimensions of energy conservation, energy efficiency, and demand response, with particular focus on potential contributions to sustainability of urban energy systems in a Canadian and, more particularly, an Ontario-based context. A key element of this course will be guest speakers from the energy industry, many of whom are potential employers.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

TEC 282

Course ID 025924

Short Title Public Policy in Energy

Long Title Public Policy in Energy

Long Descr This course introduces students to the wide range of factors that influence the implementation of energy policy in Canada. The course will review the social, political, geographic, and other pressures that make the energy debate so highly charged in our very regionalized country. Students will appreciate how many non-technical issues impinge upon energy policy and why certain policy outcomes seem to be decided by these social and political considerations.

Academic Org Faculty of Eng and Arch Sci

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 70A

Course ID 020712

Short Title Industrial Systems Design-A

Long Title Industrial Systems Design-A

Long Descr This course, conducted in the graduating year, brings together the knowledge gained in many previous courses. The engineering design process and the impact of design on society and the environment are presented. Working in small teams, students will complete major team projects in which they will be expected to integrate the knowledge and skills acquired on various aspects of industrial engineering. Each student will complete a series of individual design projects as well. Students will be required to submit final reports and conduct oral presentations.

Academic Org Industrial Engineering

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisites: CMN 432, EES 512 IND 300, IND 400, IND 405, IND 600, IND 604, IND 605, IND 712, MEC 323, MEC 309, MEC 516, PSY 209

Equivalencies

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 70B

Course ID 020713

Short Title Industrial Systems Design-B

Long Title Industrial Systems Design-B

Long Descr This course, conducted in the graduating year, brings together the knowledge gained in many previous courses. The engineering design process and the impact of design on society and the environment are presented. Working in small teams, students will complete major team projects in which they will be expected to integrate the knowledge and skills acquired on various aspects of industrial engineering. Each student will complete a series of individual design projects as well. Students will be required to submit final reports and conduct oral presentations.

Academic Org Industrial Engineering

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisites: CMN 432, EES 512 IND 300, IND 400, IND 405, IND 600, IND 604, IND 605, IND 712, MEC 323, MEC 309, MEC 516, PSY 209

Equivalencies IND70B/IND70

Attributes Capstone
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 108

Course ID 025637

Short Title Data Analytics Non Analysts

Long Title Data Analytics for Non-Data Analysts

Long Descr This course is designed to give non-data analysts an overview of big data, the status of practice in analytics, the role of the data scientists, big data analytics in industry verticals, and data analytics lifecycle as an end-to-end process. This course aims at providing the ability to make effective decisions in a data-driven manner.

Academic Org Industrial Engineering

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 110

Course ID	025665
Short Title	Data Org. for Data Analysts
Long Title	Data Organization for Data Analysts
Long Descr	This course provides a foundation in data management for data analysts. Topics include database architectures, formation of queries, queries themselves, data warehousing, relational database systems, NoSQL, and responsibilities of data management professionals.
Academic Org	Industrial Engineering
Components	Lecture: 3.00
Requisites	
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 119

Course ID 025638

Short Title Introduction to Big Data

Long Title Introduction to Big Data

Long Descr This course is designed to give students an overview of big data, state of the practice in analytics, the role of the data scientist, big data analytics in industry verticals, and analytics life-cycle as an end-to-end process. It focuses on key roles for a successful analytic project, main phases of the life-cycle, developing core deliverables for stakeholders, team work skills, and problem solving skills.

Academic Org Industrial Engineering

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 123

Course ID 025639

Short Title Data Analytics: Basic Methods

Long Title Data Analytics: Basic Methods

Long Descr This course is an introduction to R, analyzing and exploring data with R, and using R with a database. It focuses on statistics for model building and evaluation. Topics cover experimental research, correlation analysis, regression, confidence intervals, and group comparisons, and parametric and non-parametric models.

Academic Org Industrial Engineering

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 300

Course ID 000665

Short Title Introduction to Management

Long Title Introduction to Management

Long Descr The study of theories and practices of management will be introduced with an understanding of the environment in which they operate. The task of the worker, industrial organizations and their culture, the formation and operation of a union and the Canadian industrial relations will be discussed; the dominant North American management theories and applications will be examined, and the Japanese industrial organization and the new role of management will be studied.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MTH 141, MTH 240, CPS 188, CMN 432, CEN 199
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 303

Course ID 001461

Short Title Work Msrmnt Analys and Design

Long Title Work Measurement, Analysis and Design

Long Descr General IE functions are introduced. Operation process chart, flow process chart, flow diagram, worker and machine process chart, and gang process chart are considered as recording and analysis tools. Principles of motion economy and motion study are discussed for manual work design. Work measurement tools covered include predetermined time systems: MTM-1, MTM-2, MTM-3, Maynard Operation Sequence Technique (MOST) and introduction to computer-based MOST; time-study systems: fundamentals of continuous and snap-back techniques for stop-watch, datamyte and palm-pilots; and analytical systems: work sampling and standard data development. Student teams undertake an open-ended work-system design project that requires the integration and analysis of the topics covered.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, CMN 432, CPS 188, ECN 801, MTH 410, PCS 211
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

IND 400

Course ID	002453
Short Title	Facilities Design
Long Title	Facilities Design
Long Descr	Principles and practices in layout and material handling for design of industrial and service facilities. Analytical treatment of facilities location, physical layout, material flow and handling. Integration of product, process and functional design of facilities. Fundamental concepts applied through a sequence of design projects.
Academic Org	Industrial Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CEN 199, CMN 432, ECN 801, IND 303, MEC 322, MTH 425
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 405

Course ID 003676

Short Title Data Science and Analytics

Long Title Introduction to Data Science and Analytics

Long Descr Overview of big data, data science and analytics, the role of the data scientist, analytics lifecycle as an end-to-end process. The course focuses on the main phases of the lifecycle, developing core deliverables for stakeholders, teamwork skills, and problem solving skills. The course aims to provide a strong foundation in Analytics, Tools, and Statistics involving in-class lectures, individual assignments, and team projects to solve a problem, and design a solution.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CEN 199, CMN 432, CPS 188, MTH 410
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 508

Course ID 004183

Short Title Operations Research I

Long Title Operations Research I

Long Descr This course will introduce students to the basic principles of Operations Research with special emphasis on the paradigms associated with linear programming and simplex method. These include generic modelling; mathematical modelling; the "max", "min", and "mixed case" simplex algorithms; sensitivity analysis; duality; dual simplex algorithm; the revised simplex method; and "assignment", "transportation" and "transhipment" models. These subjects will be studied from both theoretical and practical perspectives.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, CPS 188, ECN 801, MTH 410
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 600

Course ID	002618
Short Title	Systems Modeling/Simulation
Long Title	Systems Modeling and Simulation
Long Descr	Simulation models of systems in terms of procedural behaviours, both discrete and continuous, deterministic and stochastic, with an emphasis on stochastic, dynamic simulation models will be studied. These include formulating and implementing simulation models, verification and validation of models, analysis of input and output data, statistical techniques for comparing alternative systems. Computer simulation languages and simulators will be introduced.
Academic Org	Industrial Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: MEC 325 and IND 508
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 604

Course ID 005203

Short Title Operations Research II

Long Title Operations Research II

Long Descr This course will build upon the principles learned in IND 508. Topics covered in this course include integer programming, dynamic programming, queuing theory, and stochastic processes with practical applications to operational research problems. Non-linear optimality concepts will also be introduced in this course.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 325, IND 508, MTH 510
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 605

Course ID 005273

Short Title Experimental Dsgn/Qual Assur

Long Title Experimental Design and Quality Assurance

Long Descr The objective of this course is to introduce students to the design of experiments as well as statistical quality control. Topics on experimental design include single-factor experiments, block designs, factorial designs, 2-factor experiments and Taguchi's approach to parameter design. Topics on quality control include product flow chart, cause-effect diagram, Pareto Analysis, statistical process control, acceptance sampling and Taguchi's approach to quality.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, CPS 188, PCS 211, MTH 410
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 708

Course ID 004343

Short Title Information Systems

Long Title Information Systems

Long Descr Introduction to information systems covering essential new technologies, information systems applications, and their impact on business models and managerial decision making. Students will learn how new technologies and innovations enable firms to create new products and services, develop new business models, and transform the day-to-day conduct of the business. The Information Systems development life cycle (i.e. requirements analysis, systems design, and implementation) will be reviewed. Students learn concepts through lectures, hands-on assignments, and case studies.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, IND 300, IND 400, IND 405, PSY 209
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 710

Course ID 001520

Short Title Production and Inventory Sys

Long Title Production and Inventory Systems

Long Descr The first part will deal with features of production/service systems, methods of modelling their operation and their control system. Topics include aggregate planning, forecasting techniques, work-force and operations scheduling and material requirement planning. The second part will cover the models and techniques for managing inventory systems. The deterministic and stochastic inventory models and lot sizing in continuous and periodic review systems will be included. Emphasis will be placed on the modelling aspect as well as the use of analytical approaches in the solution of system problems.

Academic Org Industrial Engineering

Components Lecture: 4.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, IND 400, IND 604, IND 300, PSY 209
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

IND 712

Course ID	002666
Short Title	Industrial Ergonomics
Long Title	Industrial Ergonomics
Long Descr	The course deals with anatomical and physiological factors of the human operator for the design and use of machines, and work facilities. Work physiology and biomechanical aspects of industrial workload, shift work, fatigue, cumulative trauma are analyzed. Techniques for optimizing human/machine system availability, and organization of workstations are considered. The reduction of factors such as visual problems, noise, and heat and cold stress are studied for workplace environmental design. Postural analysis techniques are introduced for making ergonomic work designs. Projects in industrial ergonomics are carried out by students in groups.
Academic Org	Industrial Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CMN 432, ECN 801, MEC 325, PCS 211
Equivalencies	
Attributes	External Project, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 713

Course ID 000473

Short Title Project Management

Long Title Project Management

Long Descr The objective of this course is to examine the fundamentals of project management within a life-cycle approach, i.e., from idea generation to termination/close phase. It treats human, mathematical, engineering and managerial issues surrounding project management to equip students with tools to effectively manage engineering projects. This course will cover topics such as: project screening and selection, evaluation methods of projects, project structures, management and control, project scheduling, resource management, life-cycle costing, research and development projects, computer support for project management, and project termination. (Equivalent to MEC 713)

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, ECN 801, MTH 510
Equivalencies MEC713/IND713

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 719

Course ID 025469

Short Title Big Data Analytics Tools

Long Title Big Data Analytics Tools

Long Descr This course is an introduction to learning big data tools with a focus on the Hadoop Ecosystem. Students will gain a clear understanding of Hadoop concepts, technology landscapes, and market trends. They will learn how to construct queries of moderate to high complexity using Pig/Hive to work with big data. Students will get hands-on experience working with interesting real-world datasets as geo-tagged social media posts, check-in datasets, and business tracking platform review data. Various use cases will be utilized such that students can apply what they learned in their daily work. See teaching department for consent criteria.

Academic Org Industrial Engineering

Components Lecture: 3.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0

Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 810

Course ID 005044

Short Title Flexible Manufacturing Systems

Long Title Flexible Manufacturing Systems

Long Descr This course provides students with an overview of the planning, design, implementation, and control of flexible manufacturing systems. It discusses the concept of flexible manufacturing and types of manufacturing systems such as cellular manufacturing and the application of various artificial intelligence techniques to the design of cellular manufacturing systems. It also includes an overview of the basic components of flexible manufacturing systems: selection of automated material handling systems, part type selection and tool allocation models, workpieces and tools routing, capacity planning, and scheduling for flexible manufacturing systems. (Equivalent to MEC 813)

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, ECN 801, MEC 322, MTH 510
Equivalencies MEC813 and IND810

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 816

Course ID 010147

Short Title Service Operations Management

Long Title Service Operations Management

Long Descr The objective of this course is to develop an understanding of the elements of service organizations and relations among the operations, human resources, information system and marketing functions in a service industry. The course explores the challenges faced by managers in various types of service organizations with a focus on operational issues in such organizations. Topics include the nature of services, the role of services in economy, designing service organizations, service quality, E-service, managing service operations, quality and productivity improvement in service organizations, and growth and globalization of services.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CMN 432, IND 300, IND 400, IND 405, IND 600, IND 604, IND 605, PSY 209

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 820

Course ID 026526

Short Title Big Data Analytics Project

Long Title Big Data Analytics Project

Long Descr This course is intended to engage students in hands-on applications of big data analytics methods and techniques in a project setting. Working with a faculty supervisor, students will apply big data analytics in respect to their real-world area of interest by using open source data.

Academic Org Industrial Engineering

Components Lecture: 3.00

Requisites Prerequisite: IND 405 or MTH 642
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 830

Course ID	026527
Short Title	Python Programming Data Sci
Long Title	Python Programming Data Science
Long Descr	This course is an introduction to Python, analysing and exploring data and doing machine learning with Python. Topics cover basics in Python programming language as well as visualization and exploratory data analysis in Python. Python libraries such as NumPy, Pandas, Matplotlib and Seaborn which are essential for data science will be introduced.
Academic Org	Industrial Engineering
Components	Lecture: 3.00
Requisites	
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 832

Course ID 022882

Short Title Reliability/Decision Analysis

Long Title Reliability and Decision Analysis

Long Descr The purpose of this course is to present analytical approaches to reliability engineering, decision analysis and risk assessment. In the first part of the course, students will be introduced to reliability functions, reliability distributions, analysis of failure data, reliability of systems, design for reliability, maintenance, reliability testing. The focus of the second part of the course is placed on the methodology to model, construct, solve and interpret various decision problems. Decision tree, value of information, risk assessment, utility theory, and multiple objective decision-making will be presented.

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 325, MTH 410, MTH 510
Equivalencies MEC832/IND832

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 833

Course ID 022883

Short Title Financial Engineering

Long Title Financial Engineering

Long Descr This course explores concepts and methods of financial engineering and its applications with special emphasis on fixed income mathematics, introduction to derivatives, valuation of forward contracts and future contracts, hedging strategies using futures, properties of stock options, no-arbitrage pricing, continuous models (the Black-Scholes theory), and discrete models (lattice approach, Monte Carlo simulation, and finite difference method).

Academic Org Industrial Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ECN 801, IND 604, MTH 410, MTH 425, MTH 510
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

IND 840

Course ID	026528
Short Title	Practical Machine Learning
Long Title	Practical Approaches in Machine Learning
Long Descr	This course covers the major ideas and principles underlying current practices of data mining. It starts with what machine learning is, where it can be used and different kinds of knowledge representations that are involved. Then, the course spans advanced techniques of data mining, at the lowest and most detailed levels. Finally, the course is wrapped up by covering techniques of “ensemble learning,” which combine the output from different learning techniques. On each topic, examples in Python are provided as lab materials.
Academic Org	Industrial Engineering
Components	Lecture: 3.00
Requisites	Prerequisite: MTH 642
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 850

Course ID	026529
Short Title	Practical Deep Learning
Long Title	Practical Deep Learning
Long Descr	This course covers an introduction to deep learning, building foundations of neural networks and doing practical deep learning with AI Platform. Topics cover supervised and unsupervised machine learning as well as basics in neural networks, convolutional and recurrent neural networks. It focuses on building deep learning applications with AI Platform.
Academic Org	Industrial Engineering
Components	Lecture: 3.00
Requisites	Prerequisite: IND 840
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

IND 860

Course ID	026530
Short Title	Adv Data Analytics Project
Long Title	Advanced Data Analytics Project
Long Descr	This course will be based on a hands-on application of data mining and deep learning techniques in a project setting. The advanced capstone course is intended to bring advanced data analytics methods, techniques and approaches and apply them to a real-world area of interest. Working with a faculty supervisor, participants will apply what they have learned in the two courses and implement their analysis through Python and AI Platform.
Academic Org	Industrial Engineering
Components	Lecture: 3.00
Requisites	Prerequisite: IND 850
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

WKT 126

Course ID 027100

Short Title Work Term I Industrial Eng

Long Title Work Term I - Industrial Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Industrial Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 226

Course ID 027101

Short Title Work Term II Industrial Eng

Long Title Work Term II - Industrial Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Industrial Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 296

Course ID 027377

Short Title Double Work Term - Industrial

Long Title Double Work Term - Industrial Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Industrial Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 326

Course ID 027102

Short Title Work Term III Industrial Eng

Long Title Work Term III - Industrial Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Industrial Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 426

Course ID 027103

Short Title Work Term IV Industrial Eng

Long Title Work Term IV - Industrial Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Industrial Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 70A

Course ID 027315

Short Title Mechatronics Capstone Design-A

Long Title Mechatronics Capstone Design-A

Long Descr Mechatronic systems case studies are used to cover topics such as modelling, simulation, model validation, and control of mechatronic systems. Students have individual design projects and also work in teams to develop design solutions to applied problems. Part A focuses on design and simulation-based verification of design while prototyping and implementation are the focus of Part B. A technical report will be submitted at the end of each term in addition to an oral presentation.

Academic Org Mechatronics

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisites: MTE 601, MTE 751, MTE 604, MTE 603
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 1.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 70B

Course ID 027316

Short Title Mechatronics Capstone Design-B

Long Title Mechatronics Capstone Design-B

Long Descr Mechatronic systems case studies are used to cover topics such as modelling, simulation, model validation, and control of mechatronic systems. Students have individual design projects and also work in teams to develop design solutions to applied problems. Part A focuses on design and simulation-based verification of design while prototyping and implementation are the focus of Part B. A technical report will be submitted at the end of each term in addition to an oral presentation.

Academic Org Mechatronics

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisites: MTE 70A
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 2.00/2.00
Billing Units 1.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 301

Course ID 027317

Short Title Programming for Mechatronics

Long Title Programming for Mechatronics Engineering

Long Descr Topics covered include programming for digital computation; introduction to C/C++, Matlab/Simulink, and Python programming for mechatronics systems; program structure; design and organization; object-oriented programming; graphical user interfaces; algorithm analysis (asymptotic complexity, big "O" notation), recursion; data structures ; and graph algorithms. A high-level programming language is used for case studies and lab exercises.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CPS 188
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 401

Course ID	027318
Short Title	Analysis of Electric Circuits
Long Title	Analysis of Electric Circuits
Long Descr	The topics covered in this introductory course in electric circuit analysis include: circuit variables and elements, voltage and current sources, resistive circuits, concepts of capacitance, inductance, and their transient behaviour. Introduction of AC sources, phasors, reactance and impedance, the effect of resonance, real and complex power in reactive loads, methods of circuit analysis, circuit theorems, energy storage elements, transient responses of RL and RC circuits, sinusoidal steady state analysis, analysis of DC circuits.
Academic Org	Mechatronics
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: MTH 140 and MTH 141
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTE 501

Course ID 027319

Short Title Signals and Sys Mechatronics

Long Title Signals and Systems for Mechatronics Eng

Long Descr This course deals with the analysis of continuous-time and discrete-time signals and systems. Topics include: representations of linear time-invariant (LTI) systems, representations of signals, transfer function, impulse response, system response, the convolution integral and its interpretation; Fourier analysis for continuous-time and discrete-time signals and systems, analysis and synthesis, frequency domain analysis, sampling, Laplace transform, Z-transform.

Academic Org Mechatronics

Components Lecture: 4.00 / Laboratory: 2.00

Requisites Prerequisites: CEN 199, MTH 425, MTE 401, MTE 301

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 502

Course ID 027320

Short Title Microprocessor Systems

Long Title Microprocessor Systems

Long Descr This course introduces industrial microprocessor systems with emphasis on software and integration. Introduction to Microprocessor-based Systems. Introduction to Digital Systems: Digital Logic and design of logic networks. Microprocessor architecture and structure 8, 16, and 32-bit systems. Assembly language and high-level languages. Basic input/output serial and parallel communications overview of single-chip microprocessors and controllers. Memory design and analysis. The internal structure and design of peripheral devices. Hardware and software timing. Interrupts and exceptions. Use of compilers, assemblers, simulators. Case studies will include sample microprocessor system studies.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 325, MTE 301, MTH 425

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

MTE 601

Course ID	027321
Short Title	Machine Mechanics and Design
Long Title	Machine Mechanics and Design
Long Descr	Dynamics of complex, multi-component systems; gears, simple, compound and epicyclic gear trains; power screws and belt drives; flywheels and gyroscopes. Synthesis and analysis of mechanisms. Simple Design Factor approach; Introductory stress analysis. Variable loads and stresses with stress concentrations; bolts, bolted joints and springs; shaft and bearing design; brakes and brake systems; welded joints. Vibration analysis and isolation.
Academic Org	Mechatronics
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CMN 432, MEC 311, MEC 323, CEN 199
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTE 602

Course ID 027322

Short Title Introduction to Robotics

Long Title Introduction to Robotics

Long Descr This course provides a brief introduction to the field of Robotics with emphasis on its mechanics. Included will be: a brief review of selected topics from linear algebra, robot geometry, velocity Jacobians, an introduction to theoretical kinematics and dynamics, equations of motion, inertia and compliance analysis, optimization of kinematic redundancy, kinematic and dynamic manipulability, multi-robot coordination, robot calibration, performance testing and characterization, fundamentals of robot programming, robot selection.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MTH 141, MTH 240, MTH 425, MTH 510, MEC 311, MEC 323
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 603

Course ID 027323

Short Title Comp Struc and Rea-Time Sys

Long Title Computer Structures and Real-Time Systems

Long Descr Number systems, codes and coding, minimization techniques applied to design of logic systems. Component specifications. Introduction to electronic digital computers. Introduction to computer organization including hardware and software organization, basic real-time concepts, process management, inter-process communication and synchronization, memory management, resource management, interrupt handling, concurrent programming, file systems.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CPS 188, MTE 301 and MTE 502
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 604

Course ID 027324

Short Title Electromech Sys Modelling Dsgn

Long Title Electromech System Modelling and Design

Long Descr Electromechanical system modelling including state space formulation and solution, time and frequency domain solutions. Design of motion transmission systems. Sensing and measurement of mechanical motion. Sensor selection. Electromechanical actuator selection and specification. Control selection and implementation. A design project will be assigned which will typically include the construction of an electromechanical system prototype. Otherwise, a Gazebo-based realistic simulation of the design will be requested.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CMN 432, MEC 311, MEC 325, MEC 323, CEN 199, MTE 501, EES 612; Co-Requisites: MTE 601, MTE 751

Equivalencies

Attributes

Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1

Course Topics

MTE 701

Course ID 027325

Short Title Real-Time Digital Ctrl Sys Dsg

Long Title Real-Time Digital Control Systems Design

Long Descr This course deals with the design and implementation of real-time digital control systems. Topics include: Discrete equivalent of continuous-time system representations (transfer function and state-space models). Stability analysis.Design of digital controllers: transform and state-space methods. Real-time system concepts. Concurrent programming for real-time implementation of digital control algorithms. Scheduling algorithms. Laboratory work will include experiments on real-time programming concepts and implementations of various digital control algorithms on an embedded controller.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: MTE 301, MTE 502, MEC 709, MTE 603, MTE 501, MTE 604

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 711

Course ID 027326

Short Title Fundamentals of MEM Systems

Long Title Fundamentals of Microelectromechanical Systems

Long Descr The course is designed to provide students with fundamental knowledge of Microelectromechanical Systems (MEMS). Topics covered include: Introduction to MEMS; fabrication technology and commercial processes; analysis, modeling and design of MEMS actuators; analysis, modelling and design of MEMS sensors; optical MEMS design and applications; RF MEMS design and applications; BioMEMS devices; and introduction to MEMS design, modelling and simulation software.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: PCS 125, MEC 323, MEC 325, MEC 322, MTE 301, EES 612, MTE 502, MTE 751, MTE 604

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

MTE 712

Course ID	027327
Short Title	Sensor Fusion
Long Title	Sensor Fusion
Long Descr	Sensor data and information fusion systems. Sensor modelling, including characterization of uncertainty. Sensor fusion approaches for estimation and decisions including weighted least squares, extended Kalman Filter, Dempster-Shafer evidential reasoning, artificial neural networks; Outlier rejection; Spatial and temporal registration. Course project involving independent study of one aspect of sensor data fusion.
Academic Org	Mechatronics
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 410, MTH 510, MTE 751
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTE 751

Course ID	027335
Short Title	Measurements/Instruments/Senso
Long Title	Measurements, Sensors and Instruments
Long Descr	Application of modern instrumentation to experimental measurements of mechanical and thermal systems is covered in this course. Fundamental concepts of static and dynamic measurements are reviewed. Transducers, signal conditioning, data transmission, and digital data acquisition systems are discussed.
Academic Org	Mechatronics
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 511, MEC 322, EES 612
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTE 792

Course ID	027328
Short Title	Digital Signal Processing
Long Title	Digital Signal Processing
Long Descr	The topics covered in this course include fast algorithms for the computation of DFT, fast Fourier transform (FFT), finite length discrete transforms, Discrete Cosine transform (DCT), estimation of spectra from finite-duration observations of signals, implementation of discrete-time systems, floating-point and fixed-point representations, multirate signal processing, adaptive filters and applications.
Academic Org	Mechatronics
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: (ELE 632 or MTE 501) and (COE 538 or ELE 538 or MTE 502)
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTE 801

Course ID 027329

Short Title Hardware in the Loop and RCP

Long Title Hardware in the Loop and RCP

Long Descr A portable control hardware is assigned to each student for the duration of the course. Students learn how to interface the system to industry- standard software using a data-acquisition device, before developing their own simulation models of the hardware. These models are used to design a feedback controller and verified in simulations before being implemented upon the hardware. The designed controller is further refined in a cycle of rapid control prototyping.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: MTE 301, EES 612, MTE 501, MTE 502, MEC 709, MTE 751, MTE 604, MTE 603, MTE 701

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 811

Course ID 027330

Short Title Design of Modern Control Sys

Long Title Design of Modern Control Systems

Long Descr Overview of classical controls and introduction to modern control theory. Control system modeling and analysis in state space. System controllability and observability. Pole placement control design. State observers. Introduction to nonlinear control systems. Fundamentals of Lyapunov theory. Lyapunov’s direct method. System linearization. Adaptive control.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 709 and MTE 501

Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 812

Course ID	027331
Short Title	Autonomous Robots and Vehicles
Long Title	Autonomous Robots and Vehicles
Long Descr	Fundamentals of autonomous mobile robotics, including both perception and planning for autonomous operation, sensor modelling, vehicle state estimation using Bayes Filters, Kalman filters, and Particle filters as well as on-board localization and mapping. Topics in planning include vehicle motion modelling and control, as well as graph based and probabilistic motion planning. An introduction to aerial vehicles control and planning.
Academic Org	Mechatronics
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	MTE 502, MTE 751, (ELE 719 or MTE 602), (ELE 639 or MEC 709), MTE 604
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTE 819

Course ID 027332

Short Title Control of Robotic Manipulator

Long Title Control of Robotic Manipulators

Long Descr This course deals with motion and force control and visual servoing of robotic manipulators. Topics include: Dynamics: Euler-Lagrange and Newton-Euler formulations. Path and trajectory planning. Motion and interaction control of robotic manipulators. Visual servoing for robotic manipulators.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ELE 719 or MTE 602
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 829

Course ID 027333

Short Title Sys Models and Identification

Long Title System Models and Identification

Long Descr Introduction to modern methods of linear system identification. Different types of models. Review of classic time and frequency-based approach to empirical, 'black-box' system modelling. Non-parametric identification: impulse and step weights, spectral analysis. Parametric, discrete transfer function models from I/O data using Least Squares. Data-collection procedures, model structure selection, use of auto- and cross-correlation functions for diagnostics and model validation, overview of different estimation algorithms.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ELE 639 or MEC 709
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 882

Course ID 027334

Short Title Intro to Digital Image Process

Long Title Introduction to Digital Image Processing

Long Descr The course will cover basic theory and principles of digital image processing. The topics covered include: Image Capture and Display, Digital Image Storage and formats, 2-D Sampling and Quantization of Images, Grey-level image processing, 2-D image filtering operations (spatial and frequency domain), colour and trichromacy, planar colour image processing, image compression, and the extension of concepts to video.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: ELE 632 or MTE 501
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MTE 888

Course ID 027348

Short Title Intelligent Systems

Long Title Intelligent Systems

Long Descr Machine learning and pattern classification are fundamental blocks in the design of an intelligent system. This course will introduce fundamentals of machine learning and pattern classification concepts, theories, and algorithms. Topics covered include: Bayesian decision theory, linear discriminant functions, multi-layer neural networks, classifier evaluation, and an introduction to unsupervised clustering/grouping, and other state-of-the-art machine learning and AI algorithms.

Academic Org Mechatronics

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: (ELE 632 or MTE 501) and (MEC 733 or MTE 502)
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 128

Course ID	027379
Short Title	Work Term I Mechatronics Eng
Long Title	Work Term I - Mechatronics Engineering
Long Descr	Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.
Academic Org	Mechatronics
Components	Lecture: 4.00
Requisites	
Equivalencies	
Attributes	
Dept Consent	Department Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Pass/Fail
Hegis Code	
GPA Weight	0.00/0.00
Billing Units	0.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

WKT 228

Course ID 027380

Short Title Work Term II Mechatronics Eng

Long Title Work Term II - Mechatronics Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechatronics

Components Lecture: 4.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 238

Course ID 027381

Short Title Work Term III Mechatronics Eng

Long Title Work Term III - Mechatronics Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechatronics

Components Lecture: 4.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 248

Course ID 027382

Short Title Work Term IV Mechatronics Eng

Long Title Work Term IV - Mechatronics Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechatronics

Components Lecture: 4.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 294

Course ID 027383

Short Title Work Term V Mechatronics Eng

Long Title Work Term V - Mechatronics Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechatronics

Components Lecture: 4.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 110

Course ID 025205

Short Title Energy and the Environment

Long Title Energy and the Environment

Long Descr Energy shapes our culture and is at the centre of some of the greatest challenges faced by our technological society. This course describes energy usage patterns in Canada and worldwide, which remain dominated by fossil fuels. The environmental issues associated with energy for transportation, industrial processes and electrical power generation are discussed in detail. Methods to mitigate the environmental consequences of energy use and production, including an overview of sustainable alternatives, are presented. Some topics include energy-related calculations.

Academic Org Mechanical Engineering

Components Lecture: 3.00

Requisites Not available to students in the Faculty of Engineering and Architectural Science.

Equivalencies

Attributes Lower Level Liberal Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 222

Course ID 002561

Short Title Engineering Graphical Commun

Long Title Engineering Graphical Communication

Long Descr Introduction to technical drawing in compliance with Canadian and international standards: orthographic and auxiliary views, sections, dimensioning and tolerancing, assembly and detailed drawings. Dimensioning, standard notation symbols, drawings with off-the-shelf parts and parts lists will be covered. Labs will introduce both free-hand sketching and CAD-based methods.

Academic Org Mechanical Engineering

Components Lecture: 2.00 / Laboratory: 2.00

Requisites
Equivalencies

Attributes Lab Work, Studio
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 222E

Course ID	002561
Short Title	Engineering Graphical Commun
Long Title	Engineering Graphical Communication
Long Descr	Introduction to technical drawing in compliance with Canadian and international standards: orthographic and auxiliary views, sections, dimensioning and tolerancing, assembly and detailed drawings. Dimensioning, standard notation symbols, drawings with off-the-shelf parts and parts lists will be covered. Labs will introduce both free-hand sketching and CAD-based methods.
Academic Org	Mechanical Engineering
Components	Lecture: 2.00 / Laboratory: 2.00
Requisites	
Equivalencies	
Attributes	Lab Work, Studio
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 309

Course ID	003705
Short Title	Basic Thermodynamics
Long Title	Basic Thermodynamics
Long Descr	Introductory concepts and definitions: Thermo-dynamic systems, fluid properties. Energy, work, heat. First law. Cycles. Properties of a pure, simple compressible substance: substances that appear in different phases, ideal gas model. Control volume analysis: conservation of mass and energy. Second law: irreversible and reversible processes, Carnot cycle. Entropy: Clausius inequality, entropy change, entropy balance for closed and open systems, isentropic processes and efficiencies. Gas power systems; Air Standard Otto, Diesel, Dual and Brayton cycles. Engine testing.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 240, MTL 200 and PCS 211
Equivalencies	
Attributes	Field Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 309E

Course ID	003705
Short Title	Basic Thermodynamics
Long Title	Basic Thermodynamics
Long Descr	Introductory concepts and definitions: Thermo-dynamic systems, fluid properties. Energy, work, heat. First law. Cycles. Properties of a pure, simple compressible substance: substances that appear in different phases, ideal gas model. Control volume analysis: conservation of mass and energy. Second law: irreversible and reversible processes, Carnot cycle. Entropy: Clausius inequality, entropy change, entropy balance for closed and open systems, isentropic processes and efficiencies. Gas power systems; Air Standard Otto, Diesel, Dual and Brayton cycles. Engine testing.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 240, MTL 200 and PCS 211
Equivalencies	
Attributes	Field Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N

Total Completions 1
Course Topics

MEC 311

Course ID	005274
Short Title	Dynamics
Long Title	Dynamics
Long Descr	Particles in motion. Rigid bodies in motion. Work and Energy. Impulse and Momentum. Methods. Applications: clutch and brake systems. Vibrating systems.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: PCS 211, MTH 141, MTH 240
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 311E

Course ID	005274
Short Title	Dynamics
Long Title	Dynamics
Long Descr	Particles in motion. Rigid bodies in motion. Work and Energy. Impulse and Momentum. Methods. Applications: clutch and brake systems. Vibrating systems.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: PCS 211, MTH 141, MTH 240
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 322

Course ID	004317
Short Title	Manufacturing Fundamentals
Long Title	Manufacturing Fundamentals
Long Descr	An overview of manufacturing processes and methods with emphasis on understanding of the physical fundamentals of processes. The course will cover material removal processes, metal-casting processes forming and shaping processes and shaping processes for plastics. Students will also be introduced to areas of geometric dimensioning and tolerancing (GD and T), engineering metrology including coordinate measuring machines (CMM) and the principles of reverse engineering.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CEN 100, MTL 200, MEC 222, and CPS 188
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 322E

Course ID	004317
Short Title	Manufacturing Fundamentals
Long Title	Manufacturing Fundamentals
Long Descr	An overview of manufacturing processes and methods with emphasis on understanding of the physical fundamentals of processes. The course will cover material removal processes, metal-casting processes forming and shaping processes and shaping processes for plastics. Students will also be introduced to areas of geometric dimensioning and tolerancing (GD and T), engineering metrology including coordinate measuring machines (CMM) and the principles of reverse engineering.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: CEN 100, MTL 200, MEC 222, and CPS 188
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 323

Course ID	001518
Short Title	Statics and Mech of Materials
Long Title	Statics and Mechanics of Materials
Long Descr	Statics will cover rigid body equilibrium, including: two and three-force members, trusses, frames and machines. Mechanics of materials will cover introductory stress and strain, Hooke's Law, axial and torsional loading and statically indeterminate problems.
Academic Org	Mechanical Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: PCS 211, MTH 240, MTH 141
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 323E

Course ID	001518
Short Title	Statics and Mech of Materials
Long Title	Statics and Mechanics of Materials
Long Descr	Statics will cover rigid body equilibrium, including: two and three-force members, trusses, frames and machines. Mechanics of materials will cover introductory stress and strain, Hooke's Law, axial and torsional loading and statically indeterminate problems.
Academic Org	Mechanical Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: PCS 211, MTH 240, MTH 141
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 325

Course ID	022925
Short Title	Intro to Engineering Design
Long Title	Introduction to Engineering Design
Long Descr	The role of design in engineering; design process; conceptual design and evaluation; human factors in design; systems thinking; design for product life cycle; occupational safety; and environmental impact. A semester-long, team-based design project will be used to connect all material into an overview of real design situations.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: MEC 222, CEN 100, MTL 200
Equivalencies	
Attributes	Lab Work, Research Project
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 325E

Course ID	022925
Short Title	Intro to Engineering Design
Long Title	Introduction to Engineering Design
Long Descr	The role of design in engineering; design process; conceptual design and evaluation; human factors in design; systems thinking; design for product life cycle; occupational safety; and environmental impact. A semester-long, team-based design project will be used to connect all material into an overview of real design situations.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: MEC 222, CEN 100, MTL 200
Equivalencies	
Attributes	Lab Work, Research Project
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 411

Course ID	001683
Short Title	Mechanics of Machines
Long Title	Mechanics of Machines
Long Descr	Dynamics of complex, multi-component systems; gears, simple, compound and epicyclic gear trains; power screws and belt drives; flywheels and gyroscopes.
Academic Org	Mechanical Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 311, MEC 322, MEC 323, MEC 325, CEN 199
Equivalencies	
Attributes	Simulation
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 430

Course ID 005631

Short Title Solid Mechanics I

Long Title Solid Mechanics I

Long Descr Stresses and deflections; statically indeterminate problems. Stress transformation; principal stresses; Mohr's Circle; theories of failure. Flexural analysis; the method of superposition; design of beams and shafts for strength. Columns: Euler's formulae for buckling; various end attachments; transition slenderness ratio; the parabolic formulae; eccentric loading and the secant formulae.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.50

Requisites Prerequisites: CEN 199, MEC 323, MTL 200, MTH 425
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 431

Course ID 002854

Short Title Advanced Manufacturing

Long Title Advanced Manufacturing

Long Descr Computer Aided Manufacturing (CAM) and the fabrication of materials by various shaping processes. Fundamentals of CNC programming, from manual coding to computer integrated software for 4 and 5 axis machining. EDM, powder metallurgy, laser and chemical machining. Advanced manufacturing topics such as rapid prototyping/tooling and quality management techniques using statistical process control and other methods are introduced.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CMN 432, MEC 322, MEC 323, MEC 325, MTH 425
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 511

Course ID	000190
Short Title	Thermodynamics and Fluids
Long Title	Thermodynamics and Fluids
Long Descr	The scope and limitations of thermodynamics, macroscopic-approach heat, work, energy and first law. Properties and state of simple substances and fluids. Control-mass and control-volume energy analysis. The second law of thermodynamics, entropy limiting cycle efficiencies, criteria for equilibrium. Conservation equations for the flow of fluids. Application to one dimensional fluid flow.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CEN 199 and CHY 102 and PCS 211 and (CPS 125 or CPS 188) and (ELE 202 or MTE 301) and (PCS 224 or MEC 323) and (MTH 312 or MTH 425)
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 514

Course ID 004399

Short Title Applied Thermodynamics

Long Title Applied Thermodynamics

Long Descr Rankine cycle, steam turbine cycles, reheat and regenerative feed-water heating. Gas turbine cycles, regenerators. Combustion, stoichiometric, lean and rich mixtures. Nozzles. Convergent and convergent-divergent nozzles. Principles of vapour compression refrigeration cycles. Basic air-conditioning processes.

Academic Org Mechanical Engineering

Components Lecture: 4.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 309, MEC 311, CMN 432
Equivalencies

Attributes Research Project, Simulation
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 516

Course ID 003477

Short Title Fluid Mechanics I

Long Title Fluid Mechanics I

Long Descr Dimensions and units, continuum fluid mechanics. Properties of fluids. Fluid statics, the standard atmosphere. Manometry and pressure measurement. Forces on submerged planes. Flow characteristics: laminar and turbulent flow, steady and unsteady flow, streamlines. Flow analysis: control volume/control system and differential approaches for mass, momentum and energy conservation. Applications of the conservation equation, Euler and Bernoulli equations. Dimensional analysis, similitude and model testing. (2 hr. Lab every other week)

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: CEN 199, MEC 311, MTH 425, PCS 213
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 522

Course ID	002613
Short Title	Fluid Mechanics
Long Title	Fluid Mechanics
Long Descr	Fluid Mechanics. Fluid Properties. Fluid Statics. Manometry. Forces on submerged planes. Fluid motion: velocity, acceleration. Continuity, energy and momentum equations. One dimensional flow in conduits. Dimensional analysis. Model testing.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 141, PCS 211, CPS 125, CVL 207, MTH 240 and MTL 200
Equivalencies	AER410/316/MEC516/511/524
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 522E

Course ID	002613
Short Title	Fluid Mechanics
Long Title	Fluid Mechanics
Long Descr	Fluid Mechanics. Fluid Properties. Fluid Statics. Manometry. Forces on submerged planes. Fluid motion: velocity, acceleration. Continuity, energy and momentum equations. One dimensional flow in conduits. Dimensional analysis. Model testing.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MTH 141, PCS 211, CPS 125, CVL 207, MTH 240 and MTL 200
Equivalencies	AER410/316/MEC516/511/524
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 531

Course ID	000380
Short Title	Solid Mechanics II
Long Title	Solid Mechanics II
Long Descr	Stress Analysis. The stiffness method. Thick shell cylinders, interference fits; rotating discs and cylinders. Discussion of the moment-area method and its application to various complex beam problems. Strain energy; Castigliano's Theorem; application to truss and beam structures.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 430 and MTL 300
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 613

Course ID	002795
Short Title	Machine Design I
Long Title	Machine Design I
Long Descr	Review of stress analysis procedures; combined stresses; simple Design Factor approach; Variable loads and stresses with stress concentrations; bolts, bolted joints and springs; shaft and bearing design; brakes and brake systems; welded joints.
Academic Org	Mechanical Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 311, MEC 325, MEC 430, CMN 432, CEN 199
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 616

Course ID 002961

Short Title Fluid Mechanics II

Long Title Fluid Mechanics II

Long Descr Laminar and turbulent pipe flow. Friction and minor losses. Non-circular conduits. Pipes in series and in parallel. Relaxation techniques and numerical methods of solution. Boundary layers. Drag and lift. Flow measurements. Pumps and turbines. Cavitation. (2 hr. Lab every other week)

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 325, MEC 516, ECN 801, CMN 432
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 617

Course ID 000056

Short Title Manufacturing System Control

Long Title Manufacturing System Control

Long Descr This course introduces the fundamental elements of industrial automation control logic systems using fluid power and microprocessor based circuits, standard sensor technology and peripheral equipment. Industrial operation circuits are studied and designed using Boolean Algebra for the combinational and sequential logic requirements. These circuits are constructed and tested on pneumatic and electronic-pneumatic (i.e. Programmable Logic Controller) equipment. Circuits are documented using ANSI circuit symbology and PLC software.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 222, MEC 325, (EES 512 or MTE 401), MEC 709
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 626

Course ID 000092

Short Title Applied Finite Elements

Long Title Applied Finite Elements

Long Descr Fundamentals of finite elements method will be explained. Direct stiffness method. Application of finite elements to stress, heat transfer and fluid mechanics. Trusses, beams, frames and plate elements will be introduced. Applications using engineering software. (2 hr. Lab every other week)

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 325, MEC 411, MEC 701, and MTH 510
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 701

Course ID 003048

Short Title Heat Transfer

Long Title Heat Transfer

Long Descr A fundamental course in heat transfer including conduction, convection and radiation. Analytical, graphical and numerical solutions for conduction in the steady and unsteady state. Experimental and analytical techniques in convection. Basic ideas in black and gray surface radiation including the effect of geometry. Heat exchanger theory and design, including compact heat exchangers. (2 hr. Lab every other week)

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 309 and MEC 516
Equivalencies

Attributes Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 709

Course ID	004230
Short Title	Control Systems
Long Title	Control Systems
Long Descr	Mathematical model representation of physical control systems which involve mechanical, hydraulic, pneumatic and electrical components. Open and closed-loop control system analysis. Block diagram algebra. First, second and higher order system stability analysis using techniques such as: Bode diagrams, Routh-Horowitz analysis, Root Locus analysis. Introduction to system compensation such as Lead-Lag Compensators.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Tutorial: 1.00 / Laboratory: 1.00
Requisites	Prerequisites: EES 512, MEC 311, MEC 325, MTH 425
Equivalencies	
Attributes	Lab Work, Simulation
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 713

Course ID	022363
Short Title	Project Management
Long Title	Project Management
Long Descr	The objective of this course is to examine the fundamentals of project management within a life-cycle approach, i.e., from idea generation to termination/close phase. It treats human, mathematical, engineering and managerial issues surrounding project management to equip students with tools to effectively manage engineering projects. This course will cover topics such as: project screening and selection, evaluation methods of projects, project structures, management and control, project scheduling, resource management, life-cycle costing, research and development projects, computer support for project management, and project termination. (Equivalent to IND 713)
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: CMN 432 and ECN 801 and MTH 510; Antirequisites: EMS 304, CVL 742
Equivalencies	MEC713/IND713
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1

Course Topics

MEC 721

Course ID	002897
Short Title	Vibrations
Long Title	Vibrations
Long Descr	The dynamic behaviour of vibrating mechanical systems is studied. Topics include: Single degree of freedom systems in free and forced vibration, with and without damping. Instrumentation for vibration measurement. Vibration isolation. Vibration of multi-degree of freedom and continuous systems. Introduction to sound and acoustics, with emphasis on the prediction and abatement of industrial noise. Acoustics of enclosures and barriers. Noise control criteria.
Academic Org	Mechanical Engineering
Components	Lecture: 4.00 / Laboratory: 1.00
Requisites	Prerequisites: CMN 432, MEC 311, MEC 325, MTH 425
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 722

Course ID 002396

Short Title Thermal Systems Design

Long Title Thermal Systems Design

Long Descr The design problem. Systems selection for energy-based problems. Principles of fluid mechanics, thermodynamics and heat transfer integrated in a number of design projects. Equipment selection. Use of commercial catalogs. Piping and instrumentation design for energy efficiency. Environmental impact. Commercial software. Estimating. Economics. The bid process. Inspection requirements. Lab work entails individual and group design of 3 to 4 projects. Project management techniques and creative thinking are encouraged.

Academic Org Mechanical Engineering

Components Lecture: 2.00 / Laboratory: 2.00

Requisites Prerequisites: CMN 432, MTH 410, MEC 325, ECN 801, MEC 701, MEC 616, MTH 510
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 723

Course ID 003526

Short Title Mechanical Systems Design

Long Title Mechanical Systems Design

Long Descr The science of design, and the impact of design on society and the environment. Working in teams of 3 or 4, students will complete a series of projects in which they will be expected to integrate efficient production methods, cost effectiveness, modern materials and methods such as fibre composites and plastic deformation. Also, the 'best' solution will be chosen from a group of solutions presented to them, based on the above criteria.

Academic Org Mechanical Engineering

Components Lecture: 2.00 / Laboratory: 2.00

Requisites Prerequisites: CMN 432, MTH 410, ECN 801, MTH 510 and MEC 613
Equivalencies

Attributes Capstone, Studio
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 733

Course ID	005188
Short Title	Microprocessor Systems
Long Title	Microprocessor Systems
Long Descr	This course introduces industrial microprocessor systems with emphasis on software and integration. Introduction to Microprocessor-based Systems. Introduction to Digital Systems: Digital Logic and design of logic networks. Microprocessor architecture and structure 8, 16, and 32-bit systems. Assembly language and high-level languages. Basic input/output serial and parallel communications overview of single-chip microprocessors and controllers. Memory design and analysis. The internal structure and design of peripheral devices. Hardware and software timing. Interrupts and exceptions. Use of compilers, assemblers, simulators. Case studies will include sample microprocessor system studies.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 2.00
Requisites	Prerequisites: MEC 325, EES 612, EES 508, MTH 510, MTH 425
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 734

Course ID 004466

Short Title Design for Manufacturing

Long Title Design for Manufacturing

Long Descr This course introduces the student to concepts for successful product design in consideration of manufacturing processes. Principles of concurrent engineering, design for assembly, environmentally conscious design and manufacturing and the competitive aspects of manufacturing will be studied. Methods of assessment for engineering life cycles, manufacturing systems, assembly/disassembly processes in relation to rapid product manufacturing will be examined. Numerous case studies will be reviewed. Lab work will entail individual and group design of three to four projects.

Academic Org Mechanical Engineering

Components Lecture: 2.00 / Laboratory: 2.00

Requisites Prerequisites: CMN 432, MTH 410, MEC 325, ECN 801 and MEC 322
Equivalencies

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 740

Course ID 000108

Short Title Env Control in Buildings

Long Title Environmental Control in Buildings

Long Descr Heating, ventilating, and air conditioning. Psychometrics and psychometric processes. Sensible heating and cooling, cooling and dehumidification, mixing and humidification. Human comfort, ventilation and room air distribution. Design of air conditioning and heating systems. Equipment selection. Duct and fan design. Pump and piping design. Refrigeration and refrigeration systems. Energy management in buildings.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 701, MEC 325, MEC 323
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 751

Course ID	022926
Short Title	Measurements/Instruments/Senso
Long Title	Measurements, Sensors and Instruments
Long Descr	Application of modern instrumentation to experimental measurements of mechanical and thermal systems is covered in this course. Fundamental concepts of static and dynamic measurements are reviewed. Transducers, signal conditioning, data transmission, and digital data acquisition systems are discussed.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 309, MEC 322, MEC 709, EES 612
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 809

Course ID 005693

Short Title Integrated Manufacturing

Long Title Integrated Manufacturing

Long Descr This course covers integrated manufacturing from CAD to CAM. Topics to be covered include: Computer Aided Process Planning, Production Planning and Control, Material Handling, Manufacturing Databases, Quality Control, Information Flow and Networks. Robot topics such as, sensors, actuators, kinematics and dynamics, motion control, programming and advanced applications will be investigated. Course work will consist of assignments, projects and laboratories. (Equivalent to IND 715)

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 322, MEC 325, MEC 309, MEC 411, MEC 709
Equivalencies IND715/MEC809

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 810

Course ID 001288

Short Title Thermal Power Generation

Long Title Thermal Power Generation

Long Descr Electrical systems loads, peaks, reliability. Types of power plants and interconnectivity. Boilers and nuclear reactors. Steam turbine and gas turbine calculations. Auxiliary equipment: heat exchangers, fuel preparation, water treatment, cooling equipment. Combined-cycle power plants. Co-generation. Environmental impact of energy production. Pollution abatement devices. Economics.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 616, MEC 701, MTH 510
Equivalencies

Attributes
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 811

Course ID	004943
Short Title	Machine Design II
Long Title	Machine Design II
Long Descr	A second course in Machine Design, this course will emphasize the art and skill of actual design process. A number of small to medium size projects will be undertaken on an individual basis or as small group efforts. Reports submitted, must include all pertinent design information, including manufacturing, assembly. Strength and control considerations, as well as component deformation, vibrations, system operations and costs.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 613, MEC 721, MTH 510
Equivalencies	
Attributes	Case Studies, Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 813

Course ID 022364

Short Title Flexible Manufacturing Systems

Long Title Flexible Manufacturing Systems

Long Descr This course provides students with an overview of the planning, design, implementation, and control of flexible manufacturing systems. It discusses the concept of flexible manufacturing and types of manufacturing systems such as cellular manufacturing and the application of various artificial intelligence techniques to the design of cellular manufacturing systems. It also includes an overview of the basic components of flexible manufacturing systems: selection of automated material handling systems, part type selection and tool allocation models, workpieces and tools routing, capacity planning, and scheduling for flexible manufacturing systems. (Equivalent to IND 810)

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 322, MTH 510, CMN 432, ECN 801
Equivalencies MEC813 and IND810

Attributes Case Studies, Lab Work
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 816

Course ID 004976

Short Title Topics in Manufacturing Eng

Long Title Topics in Manufacturing Engineering

Long Descr This course exposes the student to relevant topics in Manufacturing Engineering. The topics include but are not limited to: the interpretation of design intent in engineering drawings, GD and T, dimensional metrology, concepts of process capability, statistical process control, and other quality control methods. Design of small tools, jigs, fixtures, and functional gages will also be presented.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: ECN 801, CMN 432, MEC 411, MEC 322
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1

Course Topics

MEC 817

Course ID	001651
Short Title	Combustion Engineering
Long Title	Combustion Engineering
Long Descr	This course will cover combustion fundamentals and their application to engineered combustion systems such as furnaces and fossil-fuelled engines, with an emphasis on maximizing combustion efficiency and minimizing pollutant formation. Topics covered will include flame stoichiometry, chemical kinetics, flame temperature, pre-mixed and diffusion flames, fuel properties, continuous and unsteady combustion systems, pollution reduction techniques and safety issues.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00
Requisites	Prerequisites: MEC 701, MEC 616
Equivalencies	
Attributes	
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 825

Course ID 010214

Short Title Mechanical Design

Long Title Mechanical Design

Long Descr Integrated design of mechanical or electromechanical products or systems. Working in teams, students will develop design solutions to applied problems. Methods of collaborative engineering will be emphasized. Design methods to address function, form, manufacturability, cost, environmental impact, safety, reliability, integrity and other factors will be treated. A formal technical report and oral presentation will be made at the end of the term.

Academic Org Mechanical Engineering

Components Laboratory: 3.00 / Lecture: 1.00

Requisites Prerequisites: MEC 411 and MEC 430 and (MEC 722 or MEC 723 or MEC 734 or MEC 830)

Equivalencies

Attributes Case Studies, Research Project
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

MEC 830

Course ID 002968

Short Title Mechatronics Systems Design

Long Title Mechatronics Systems Design

Long Descr This course provides a focused interdisciplinary theme for electromechanical systems design. Introduction to Mechatronic Systems. Modeling and simulation of physical systems. Review of Electrical and Computer Engineering fundamentals. Review of Analog signal processing using Amplifiers, Integrators, Differentiators, Comparators, Sample and Hold circuits. Review of Digital Circuits: binary logic, Karanaugh Maps, flip-flops, time, trigger, counter. Real-time interfacing: data acquisitions, A/D, D/A, I/O. Signal conditioning. Sensors and Traducers. Actuators. Microprocessor-based control. Mechatronic systems case studies.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 2.00

Requisites Prerequisites: CMN 432, MTH 410, MEC 325, ECN 801, MEC 411, MEC 733, MEC 709
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N

Total Completions 1
Course Topics

MEC 832

Course ID	022927
Short Title	Reliability/Decision Analysis
Long Title	Reliability and Decision Analysis
Long Descr	The purpose of this course is to present analytical approaches to reliability engineering, decision analysis and risk assessment. In the first part of the course, students will be introduced to reliability functions, reliability distributions, analysis of failure data, reliability of systems, design for reliability, maintenance, reliability testing. The focus of the second part of the course is placed on the methodology to model, construct, solve and interpret various decision problems. Decision tree, value of information, risk assessment, utility theory, and multiple objective decision-making will be presented.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MEC 325, MTH 410, MTH 510
Equivalencies	MEC832/IND832
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MEC 850

Course ID	003945
Short Title	Env Impact of Thermal Systems
Long Title	Environmental Impact of Thermal Systems
Long Descr	The course describes the environmental impact of thermal systems such as power generation, industrial processes and transportation. Air, soil and water pollution. Pollution prevention, pollution abatement devices and equipment. Legislation. Sustainable development solutions.
Academic Org	Mechanical Engineering
Components	Lecture: 3.00
Requisites	Prerequisites: MEC 514, MEC 616
Equivalencies	
Attributes	Case Studies, Field Studies
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTL 200

Course ID	002756
Short Title	Materials Science Fundamentals
Long Title	Materials Science Fundamentals
Long Descr	Atomic structure, atomic bonding in materials, crystallinity, lattice structure. Crystal systems, x-ray diffraction, amorphous materials. Imperfections and diffusion in solids. Phase diagrams and phase transformations. Structures of metals, polymers and ceramics. Corrosion and degradation. Thermal and electrical properties of materials. (2 hr. Lab every other week)
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisite: CHY 102
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTL 200E

Course ID	002756
Short Title	Materials Science Fundamentals
Long Title	Materials Science Fundamentals
Long Descr	Atomic structure, atomic bonding in materials, crystallinity, lattice structure. Crystal systems, x-ray diffraction, amorphous materials. Imperfections and diffusion in solids. Phase diagrams and phase transformations. Structures of metals, polymers and ceramics. Corrosion and degradation. Thermal and electrical properties of materials. (2 hr. Lab every other week)
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisite: CHY 102
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTL 300

Course ID	005584
Short Title	Materials Science II
Long Title	Materials Science II
Long Descr	Mechanical Properties of materials, materials testing - tensile properties, hardness, impact, fatigue, creep; failure and modes of fracture; engineering materials systems, interrelationships of structure, properties and processing; structural modifications in metals, polymers, ceramics and composites; strengthening mechanisms, heat treatment; processing and applications of engineering materials. (2 hr. Lab every other week)
Academic Org	Mechanical Engineering
Components	Lecture: 3.00 / Laboratory: 1.00
Requisites	Prerequisites: MTL 200
Equivalencies	
Attributes	Lab Work
Dept Consent	No Special Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Graded
Hegis Code	
GPA Weight	1.00/1.00
Billing Units	1.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

MTL 700

Course ID 004977

Short Title Matrl Selection for Eng Design

Long Title Materials Selection for Engineering Design

Long Descr Comparison of materials, advances in materials, role of materials in design; methodology of materials selection; evaluation of property data, failure analysis, fracture mechanics, crack growth rate; analysis of material performance requirements; reliability and probability; materials data bases, case studies in materials selection.

Academic Org Mechanical Engineering

Components Lecture: 3.00 / Laboratory: 1.00

Requisites Prerequisites: MEC 325 and MTL 300
Equivalencies

Attributes Case Studies
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Graded
Hegis Code
GPA Weight 1.00/1.00
Billing Units 1.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 88A

Course ID 020342

Short Title Co-operative Internship-A

Long Title Co-operative Internship Program-A

Long Descr Third year full-time students may be eligible to enrol in the optional Co-operative Internship Program. Upon successful enrolment in the program and securing an approved co-op job, students are required to spend a period of 8-16 consecutive months in a work placement. After completing the requirements of the co-operative internship work placement, students return to the academic program to complete their final year of studies. Enrolment in the Co-operative Internship extends the program length to five years.

Academic Org Mechanical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Multi-Term Course: Not Graded
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 0.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 88B

Course ID 020343

Short Title Co-operative Internship-B

Long Title Co-operative Internship Program-B

Long Descr Third year full-time students may be eligible to enrol in the optional Co-operative Internship Program. Upon successful enrolment in the program and securing an approved co-op job, students are required to spend a period of 8-16 consecutive months in a work placement. After completing the requirements of the co-operative internship work placement, students return to the academic program to complete their final year of studies. Enrolment in the Co-operative Internship extends the program length to five years. This course is graded on a pass/fail basis.

Academic Org Mechanical Engineering

Components Lecture: 1.00

Requisites
Equivalencies WKT88B/WKT88

Attributes Co-operative Internship
Dept Consent No Special Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 127

Course ID 027104

Short Title Work Term I Mechanical Eng

Long Title Work Term I - Mechanical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechanical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 227

Course ID 027105

Short Title Work Term II Mechanical Eng

Long Title Work Term II - Mechanical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechanical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 297

Course ID 027378

Short Title Double Work Term - Mechanical

Long Title Double Work Term - Mechanical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. This two semester work placement recognizes the experience gained by a student in the semester the student is enrolled in this course as well as in the previous semester while not enrolled in a work placement course. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechanical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 2.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 327

Course ID 027106

Short Title Work Term III Mechanical Eng

Long Title Work Term III - Mechanical Engineering

Long Descr Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.

Academic Org Mechanical Engineering

Components Lecture: 1.00

Requisites
Equivalencies

Attributes
Dept Consent Department Consent Required
Drop Consent No Special Consent Required
Dynamic Date TRANSITION
Grd Basis Pass/Fail
Hegis Code
GPA Weight 0.00/0.00
Billing Units 0.0
Course Count 1.0
Repeat for Credit N
Total Completions 1
Course Topics

WKT 427

Course ID	027107
Short Title	Work Term IV Mechanical Eng
Long Title	Work Term IV - Mechanical Engineering
Long Descr	Co-operative work term placement with an approved industrial partner, in a professional working environment, interacting directly with engineers and other skilled professionals. Participants will gain valuable experience in several different settings. This course is graded on a pass/fail basis.
Academic Org	Mechanical Engineering
Components	Lecture: 1.00
Requisites	
Equivalencies	
Attributes	
Dept Consent	Department Consent Required
Drop Consent	No Special Consent Required
Dynamic Date	TRANSITION
Grd Basis	Pass/Fail
Hegis Code	
GPA Weight	0.00/0.00
Billing Units	0.0
Course Count	1.0
Repeat for Credit	N
Total Completions	1
Course Topics	

Run Control Values

Academic Institution:	RYERU
Academic Career:	UGRD
Academic Group:	
Academic Organization:	ENGSCI
Subject:	
From Date	01-JAN-1901
Thru Date	01-AUG-2024
EFF_STATUS	A
Schedule Course	Y

Course Attributes - Run Control Values

DATETIME_CREATED:	06-OCT-2023
COURSE ATTRIBUTE:	LVL
COURSE ATTRIBUTE VALUE:	
DATETIME_CREATED:	06-OCT-2023
COURSE ATTRIBUTE:	EXPL
COURSE ATTRIBUTE VALUE:	