

# Engineering General (EGEN) Courses

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### EGEN 5099 [0.5 credit]

#### Directed Studies

Independent research project supervised by a full time faculty member who will provide mentorship for the project.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5100 [0.5 credit]

#### Reinforced and Prestressed Concrete Design

Introduction to design of reinforced and prestressed concrete elements using CSA A23.3. Behaviour and design of beams, columns and slabs. Prestressed concrete concepts including flexural analysis, shear, deflections and prestress loss.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5101 [0.5 credit]

#### Design of Steel Structures

Introduction to CAN/CSA - S16, design and behaviour concepts; shear lag, block shear, local plate buckling, lateral torsional buckling, inelastic strength and stability. Design of tension members, axially loaded columns, beams, composite beams, plate girders, stability of structures and members.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5102 [0.5 credit]

#### Masonry Behaviour and Design

Introduction to design of reinforced masonry using CSA S304. Properties of masonry materials and assemblages. Behaviour and design of walls, beams and columns. Applications to low-rise construction.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5103 [0.5 credit]

#### Infrastructure and Pavement Management

Advanced pavement management, network and project level management, data collection and management, pavement evaluation, pavement design, rehabilitation and maintenance, pavement performance models, life cycle analysis, implementation of pavement management systems, future directions and research needs.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5104 [0.5 credit]

#### Traffic Engineering

Traffic control devices, signal warrants, principles of signalized intersection design, signal timing and components, signal optimization and coordination, traffic delay estimation, actuated control, freeway access control.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5105 [0.5 credit]

#### Foundation Engineering

Review of methods of estimating the shear strength of soils; use of in-situ testing for design purposes; bearing capacity and performance of shallow and deep foundations; pile groups.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5106 [0.5 credit]

#### Fundamentals of Fire Safety Engineering

Explores the fire safety system, covering performance-based design, heat transfer, fire development, active fire protection systems, evacuation, life hazard assessment, wildland fires, fire investigation, and fire risk analysis. Compliance with building codes and standards is integrated.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

### EGEN 5107 [0.5 credit]

#### Design for Fire Resistance

Fire safety in buildings, fire and heat, compartment fires; pre- and post-flashover fires; design fires; behaviour of materials and structures at elevated temperatures; fire-resistance tests; fire-resistance ratings; building code requirements; real-world fires; assessing the fire resistance of steel, concrete, and wood building assemblies.

Prerequisite(s): enrolment in the M.Eng.- Civil Engineering Practice program.

### EGEN 5199 [0.5 credit]

#### Special Topics in Civil Engineering

The course tackles specific issues within the field of civil engineering that may not be covered by existing approved courses.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5200 [0.5 credit]****Operating Systems**

Introduction to operating system principles. Structure of an operating system; management of CPU, processes, and memory; dead-lock problems, file systems.

Concurrent programming.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5201 [0.5 credit]****Embedded Systems Development**

Applications of embedded systems and challenges of embedded systems design; embedded processors, embedded reconfigurable hardware, embedded software; specification, modeling, design and verification of embedded systems; real time systems; construction of event-driven systems; performance issues; practical examples.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Computer or Software Engineering or permission of the Director.

**EGEN 5202 [0.5 credit]****Secure Systems Engineering**

Causes and consequences of computer system failure. Structure of fault-tolerant computer systems. Methods for protecting software and data against computer failure. Quantification of system reliability. Introduction to formal methods for safety-critical systems. Computer and computer network security.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Computer or Software Engineering or permission of the Director.

**EGEN 5203 [0.5 credit]****Test-driven and Agile Software Development**

Practice of object-oriented design principles, design patterns, object-oriented frameworks, refactoring, unit-testing, test-driven development, Agile software development principles.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5205 [0.5 credit]****Software Development for Parallel and Distributed Architectures**

Advanced parallel programming and distributed systems, and high-performance computing in engineering. Both shared-memory parallel computers and distributed-memory multicomputers are considered. Aspects of the practice of parallelism will be covered. Emphasis is on thread programming, data-parallel programming, and performance evaluation.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Computer or Software Engineering or permission of the Director.

**EGEN 5206 [0.5 credit]****Web and Mobile Software Development**

Developing web and mobile applications. Topics include: client-side/mobile programming language, development tools, graphical user interface patterns (e.g., event-driven programming, separation of content and presentation, layout policies) and framework, interactions with the server-side.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5208 [0.5 credit]****Databases for Software Engineers**

The relational database model and its logical underpinnings, mapping requirements to a database schema, the Entity-Relationship model, normalization, joins, SQL, indexes and views, transactions, object-relational mapping, migrations, noSQL databases.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5209 [0.5 credit]****Tools for Software Engineering**

Proficiency with everyday software engineering tools: the command line, shell tools and scripting, text processing (regular expressions, grep, sed, awk), basic text editors (vim), graphing (gnuplot/matplotlib, graphviz), version control (git), networking tools (telnet, ssh, scp, curl), build and package management tools (make, apt-get).

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5210 [0.5 credit]****Practical Introduction to Data Analysis and Machine Learning**

Tabular data exploration and visualization (pandas, matplotlib), data-fitting basics (scikit-learn), k-nearest neighbours, linear regression, decision trees, data pre-processing, model evaluation metrics, overfitting vs underfitting, bias/variance, cross-validation, introduction to neural networks, hyperparameter tuning, feature selection, feature importance.

Prerequisite(s): enrolment in the M.Eng.- Software Engineering Practice program.

**EGEN 5299 [0.5 credit]****Special Topics in Software Engineering**

The course tackles specific issues within the field of software engineering that may not be covered by existing approved courses.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5300 [0.5 credit]****Signal Processing Electronics**

Overview of analysis and design of analog and mixed-signal circuit building blocks in continuous- and discrete-time signal processing. Topics: analysis and design of continuous-time filters; discrete-time signal analysis using z-transform; discrete-time filter design; fundamental techniques for digital-to-analog and analog-to-digital converters.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5301 [0.5 credit]****VLSI Design**

Very Large-Scale Integration (VLSI) design techniques and their application. CMOS devices and technology. Modular Design Approach and use of CAD tools in an integrated circuit design flow. Building blocks of CMOS analog and digital circuits. Advanced digital logic circuit techniques.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5302 [0.5 credit]****Modeling and Simulation of Electrical Circuits**

Basic principles of Computer-Aided Design tools used for analysis and design of VLSI circuits and systems. Automated formulation of circuit equations, Frequency, DC and time-domain analysis. Noise and distortion analysis. Interconnect analysis. Sensitivity analysis, and circuit performance optimization.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5303 [0.5 credit]****Silicon Sensors**

Overview of sensor technologies with emphasis on devices suitable for integration with silicon integrated circuits. Sensor design and signal conditioning. Sensor circuitry and adaptations for automotive, biomedical, and other instrumentation applications.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5304 [0.5 credit]****Microprocessor Systems**

Interfacing aspects in microprocessor systems.

Microprocessors and bus structures, internal architecture, instruction set and pin functions. Memory interfacing, input-output, interrupts, direct memory accesses, special processors and multiprocessor systems.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5305 [0.5 credit]****Power Systems**

Introduction to power system and their transient states.

Power system voltage stability; PV and QV curve methods. Power system angular stability; transient stability and equal area criterion; steady-state stability and power system stabilizer. Electromagnetic transients in power systems, insulation coordination and equipment protection.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Electrical Engineering or permission of the Director.

**EGEN 5306 [0.5 credit]****Telecommunications Systems**

Communications fundamentals including decibel, intermodulation, 1dB compression, dynamic range, SNR, noise figure, noise temperature, antenna gain, EIRP, G/T. Links; transceiver architecture, diversity, fade margin, link calculations, multiple accessing.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5307 [0.5 credit]****Control Systems and Robotics**

Fundamental aspects of modeling and control of robot manipulators as devices that involve electronics and mechanics (kinematics and dynamics), electronic actuators, information theory, automation. Principles of proximity, tactile, and force sensing. Programming platforms and languages. Automation strategies.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5308 [0.5 credit]****Integrated Circuit and Device Technology**

Survey of technology used in silicon VLSI integrated circuit fabrication. Crystal growth and crystal defects, oxidation, diffusion, ion implantation and annealing, gettering, CVD, etching, materials for metallization and contacting, and photolithography. Structures and fabrication techniques required for submicron MOSFETs. Applications in advanced CMOS processes.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5399 [0.5 credit]****Special Topics in Electrical Engineering**

The course tackles specific issues within the field of electrical engineering that may not be covered by existing approved courses.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5400 [0.5 credit]****Overview of Environmental Engineering Principles**

Basic mechanisms of chemistry, biology, and physics relevant to environmental engineering. Principles of equilibrium, mass transfer, material balances, microbial growth, water, energy, and nutrient cycles. Applications to environmental systems as biological degradation, mass and energy movement, and design of water and wastewater treatment systems.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5401 [0.5 credit]****Physico-Chemical Processes in Water and Wastewater Treatment**

Theory and design of chemical and physical unit processes utilized in the treatment of water and wastewater, sedimentation, flotation, coagulation, precipitation, filtration, disinfection, ion exchange, reverse osmosis, adsorption, and gas transfer.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5402 [0.5 credit]****Biological Processes in Water and Wastewater Treatment**

Study of the theoretical and applied aspects of wastewater treatment by activated sludge, fixed and moving biological films, conventional and aerated lagoons, sludge digestion, septic tanks, land treatment, and nutrient removal. Guidelines, regulations and economics. System analysis and design of facilities.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5403 [0.5 credit]****Groundwater and Soil Remediation**

Principles of groundwater chemistry, the chemical evolution of natural groundwater flow systems, sources of contamination, and mass transport processes. Hydrogeologic aspects of waste disposal and groundwater remediation.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5404 [0.5 credit]****Solid Wastes and Landfill**

Principles of solid waste management to protect public health. Study of solid waste components, refuse collection, storage, and handling. Design and operation of solid waste transfer and disposal facilities including transfer stations, resource recovery and composting facilities, incinerators, and landfills.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5405 [0.5 credit]****Air Pollution and Emission Control**

Types of gaseous and particulate pollutants and their sources, effects of air pollution on man, vegetation, and materials, indoor air pollution, sampling and analysis of air pollutants, air pollution meteorology and dispersion, control techniques for gaseous and particulate pollutants, and air quality management aspects.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5406 [0.5 credit]****Climate Change and Engineering**

Current and projected impacts of climate change on the circumpolar north, including the land, its biota, northern communities, drivers that shape these interactions, as well as how these impact engineered structures.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5407 [0.5 credit]****Environmental Impact Assessment**

Principles and elements of environmental assessment with an interdisciplinary focus. Topics include types of environmental assessments, when to use them, data required, sampling strategies, how data should be collected and analyzed and ultimately communicated to pass legal and scientific scrutiny.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Environmental Engineering or permission of the Director.

**EGEN 5499 [0.5 credit]****Special Topics in Environmental Engineering**

The course tackles specific issues within the field of environmental engineering that may not be covered by existing approved courses.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5500 [0.5 credit]****Applied Fluid Mechanics**

Kinematics of fluid motion, fundamental fluid equations and concepts, laminar boundary layers, potential flow, stability and transition, introduction to turbulence, practical examples in mechanical engineering.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5501 [0.5 credit]****Computational Fluid Mechanics**

Solutions of the transport equations of momentum, mass, and energy. Transport processes are reviewed but emphasis is placed on the numerical solution of the governing differential equations. Different solution methodologies and software.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5502 [0.5 credit]****Thermodynamics and Energy Systems**

Principles of thermodynamics; properties of homogeneous fluid phases; phase and chemical equilibria; application to industrial and energy problems.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5503 [0.5 credit]****Transport Phenomena (Heat and Mass)**

Transport expressions for physical properties are combined with conservation laws to yield generalized equations used to solve a variety of engineering problems in fluid mechanics, and heat and mass transfer; steady-state and transient cases; special topics in non-Newtonian flow and forced diffusion.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5504 [0.5 credit]****Kinematics and Dynamics of Human Movement**

Kinematics and dynamics of rigid bodies moving in three dimensions. Spatial kinematics of rigid bodies, Euler angles, tensor of inertia and the Newton-Euler equations of motion for rigid bodies.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5505 [0.5 credit]****Controls and Robotics**

Introduction to advanced robotics including mobile robots, redundant manipulators, walking robots, aerial and marine autonomous vehicles. Kinematic and dynamic models for advanced robots. Linear and nonlinear control theory overview with applications to advanced robots.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5506 [0.5 credit]****Mechanics and Fracture**

Basic concepts of linear and nonlinear fracture mechanics: linear and nonlinear stationary crack-tip stress, strain and displacement fields; energy balance and energy release rates; fracture resistance concepts-static and dynamic fracture toughness; criteria for crack growth; fracture control methodology and applications.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5507 [0.5 credit]****Surfaces and Interfacial Phenomena**

Basics of colloid and interfacial phenomena with application to the energy sector, materials, processing, and biomedical industry.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program and an undergraduate degree in Mechanical Engineering or permission of the Director.

**EGEN 5508 [0.5 credit]****Introduction to Advanced Materials**

Introduction to advanced materials focusing on emerging materials like fibre-reinforced composite materials. Manufacturing methods of lightweight, safe and environment-friendly structures and their use in the industry. Standard analytical techniques (Micro and Macro approach) for materials' mechanical characterization and strength theories. Failure analysis of composites.

Includes: Experiential Learning Activity

**EGEN 5509 [0.5 credit]****Engineering Vibrations**

Vibration analysis of free-response damped and undamped single-degree-of-freedom (SDOF) systems. Harmonic excitation and general forced response. The eigenvalue problem and modal analysis for multi-degree-of-freedom (MDOF) systems. Vibration isolation and suppression. Distributed parameter systems. Analytical and Numerical methods.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.

**EGEN 5599 [0.5 credit]****Special Topics in Mechanical Engineering**

The course tackles specific issues within the field of mechanical engineering that may not be covered by existing approved courses.

Prerequisite(s): enrolment in the M.Eng.- Engineering Practice program.