Honours Certificate Program (HCP)

Course Requirements for graduates from
a Canadian university who have completed either:

B.A.Sc. from an Engineering Degree Program
or
B.Sc. Degree Program from Computer Science or Physics

- Eight courses must be taken for the completion of the Certificate.
  Course Requirements:
  - a maximum of 1 course from 2nd year;
  - a maximum of 2 courses from 3rd year; and
  - a minimum of 6 courses from our 4th year elective courses

- When you have been accepted into the HCP, and you are on campus, you must make an appointment to see the Department Head for course selection. The courses available to the HCP are listed below.

Recommended 2nd Year (General Engineering) Course:

85-211. Computer-Aided Analysis II

Introduction to object oriented programming using C++. Numerical schemes including: Gauss-Jordan Method for solving Linear Simultaneous Algebraic Equations; Matrix inversion; Root finding using the Newton-Raphson and the half-interval methods; Lin-Bairstow method for Roots of Polynomials; Least-squares fitting; Numerical Integration using the Trapezoidal and Simpson's 1/3 rule; Solution of Ordinary Differential Equations of any order using Euler, Improved Euler and the fourth-order Runge-Kutta methods. Class development in C++ for numerical schemes covered in the course.

Recommended 3rd Year (Electrical Engineering) Course:

88-330. Digital Logic Design II

Combinational logic circuits; combinational logic design; sequential circuits and design; registers and counters; hardware description languages; memory and programmable logic devices; register transfers and datapaths; sequencing and control; central processing unit designs; memory systems; reconfigurable computing.

Winter Semester 4th Year Electrical Engineering Elective Courses

06-88-419 (Digital Communications)

Digital communication systems; discrete Fourier transform; sampling theory; A/D converters; digital modulation; time-division multiplexing; packet transmission; spread spectrum systems; random processes and spectral analysis for digital systems; error probabilities; noise; wire and wireless digital communication systems.

88-436. Computer Communications

Protocols and architecture; data transmission; data encoding; interfacing; data link control; multiplexing, ISO reference model; wide-area networks; circuit switching; packet switching; ATM and frame relay; LAN technology and systems; internet protocols; inter-network operation; transport protocols; network security.

88-437. Intelligent Computing

Computing models of the human mind. Neural computing models and learning algorithms. Fuzzy set theory and fuzzy systems. Evolutionary computing. Applications of intelligent computing.

88-443. Embedded System Design

Hardware and software for embedded computing systems. Introduction to embedded systems. Custom single-purpose processors: Hardware Design (includes review of FSMs, registers/counters and register files). General-purpose processors: Software; design flow environment and tools; testing and debugging . Standard single-purpose processors: Peripherals. Memory system design. Interfacing issues: serial and parallel communication, bus standards, protocols and arbitration. Putting it all together -- a digital camera example. Course labs will involve use of FPGA embedded processors (Altera NIOS or Xilinx Microblaze), programmable logic (Altera or Xilinx FPGAs) and associated CAD tools for design mapping (modeling, simulation, synthesis and debugging).

88-444. Analog Integrated Circuit Design

Bipolar and CMOS technology; CMOS analog circuit modelling; CMOS device characterization; current sinks and sources; current mirrors, current amplifiers; amplifiers; differential amplifiers; comparators; operational amplifiers; A/D converters; multipliers; wave-shaping; low voltage and power; CAD tools.

88-445. Power Electronics

Power diodes; thyristors; power MOSFETs; controlled rectifiers; DC-DC converters; inverters; AC-AC converters; DC/DC conversion; gate drive circuits; motor drives; direct-torque-controlled drives; fuzzy logic in electric drives; computer simulation of power electronics and motor Drives.

88-448. Digital Computer Architecture

Computer Organization and architecture; number, character and instruction representations; addressing methods and machine program sequencing; central processing unit; input-output organization; memory; arithmetic; pipelining, computer peripherals; advanced computer systems; assembly language programming.

88-449. Automotive Sensor Systems

Evolution of automotive sensors, sensor design and applications in vehicles, sensor electronics and design, automotive pressure sensors, temperature sensors, combustion sensors, torque sensors, displacement and position sensors, accelerometer physics, gas composition sensors, liquid level sensors, design of sensor electronics systems, design of sensor system software, smart sensors and design, sensors for intelligent vehicles on the road, future development of sensor systems.

88-450. Power Systems I

This course is intended to provide students with an understanding of the principles of operation, modeling and analysis of electric power systems. Covered topics are: complex power, phasors and per-unit system; three-phase circuits; power transformer and generator modeling; transmission line parameters; steady-state operation of transmission lines; network matrices and power flow analysis; symmetrical faults; symmetrical components; introduction to alternative energy sources.

Summer Semester 4th Year Electrical Engineering Elective Courses

88-433. Digital Integrated Circuit Design

Physics and modelling of MOSFETs; fabrication and layout of CMOS integrated circuits; the CMOS inverter: analysis and design; switching properties of MOSFETs; static logic gates; transmission gate logic circuits; dynamic logic circuit concepts; CMOS dynamic logic families; CMOS differential logic families; design methodologies and CAD tools; deep-submicron implementations.

88-434. Automotive Electronics

Electrical energy generation and distribution; ignition systems; motor drive controllers; sensors; signal conditioners; power-train management; electromagnetic interference; automatic control; embedded real-time controllers; diagnostics; automotive DSP; telematics; automotive computing.

88-435. Microelectromechanical Systems

Microelectromechanical structures; materials; microactuators and microsensors including micro-motors; grippers, accelerometers and pressure sensors; microlithography, micromachining, microfabrication processes; mechanical and electrical design issues; input/output structures;

integration of MEMS and microelectronics; design project; CAD tools.

88-438. Coding and Information Theory

Abstract algebra, number theory and complexity theory; simple cryptosystems; Shannon's theory; entropy and information theory; data encryption standard, RSA system and factoring; public-key cryptosystems; signature schemes; hash functions; key distribution and key agreement; identification schemes; authentication codes; access structures and general secret sharing; pseudo-random number generation; zero-knowledge proofs.

88-439. Multimedia Systems

Multimedia signals: Audio fundamentals; the Human visual system and perception; multimedia data acquisition. Multimedia signal compression: Transforms and subband decomposition; text representation; digital text, audio, image, and video compression. Multimedia signal processing: Digital audio, image, and video processing. Multimedia systems.

88-440. Wireless Communications

Introduction to wireless communications; cellular system design fundamentals; propagation path loss; fading and multi-path propagation; modulation techniques; diversity; coding and equalization; speech coding for wireless communications; multiple access networking, wireless communications protocols; satellite communication systems.

88-447. Computer Networks and Security

Introduction to computer networking and security; packet switching; networking protocols; local area networks, fiber channel protocols; transport protocol and security, encryption; application on running on various transport protocols, inter-working protocols and security; frame relaying and asynchronous transfer modes; digital switching; emerging computer networking and security technology.

88-460. Power Systems II

This course is intended to introduce advanced analytical tools for power systems such as analysis of abnormal operation, numerical methods, stability and control. Covered topics are: transient stability and voltage stability; control and monitoring of power systems; dynamics and control of multi-machine systems; unsymmetrical faults; power system protection and relaying; economic dispatch; optimal power flow; numerical simulation tools in power systems.