

Department of Electrical Engineering

University of Ottawa
161 Louis Pasteur
Colonel By Hall
Telephone: 564-8213
Fax: 564-6882

The Department

Chair of the Department:

G.I. Costache

Graduate Program Coordinator:

P.A. Galko

The Department of Electrical Engineering is one constituent of the Ottawa-Carleton Institute for Electrical Engineering. Consult the Institute entry on page 126 of this calendar for a faculty list, graduate program descriptions and admission requirements.

Department Facilities

Computing Facilities

- 1) A VMS Cluster consisting of:
 - (a) VAX 3500 server with 8 MB of RAM, and a 800 MB disk
 - (b) Eight VAX Station II systems each with 5 MB of RAM, a 200 MB disk and a 19" monitor
- 2) A Unix network consisting of:
 - (a) Two RISC DecServer 3100s each with 24 MB of RAM and a 1 GB disk
 - (b) Four RISC DecStation 3100s each with 16 MB of RAM and a 100 MB disk and a 19" colour monitor
 - (c) Fourteen RISC DecStation 3100s each with 16 MB of RAM, a 100 MB disk and a 19" monochrome monitor
 - (d) Twelve RISC DecStations 2100 each with 8MB of RAM a 100 MB -3disk and a 15" monochrome monitor
 - (e) A DecServer 5000 with 40 MB of RAM, and a 2 GB disk
- 3) Several other Unix-based workstations in various research laboratories (SUN workstations, Compaq 386, HP386, etc.)

In addition to this, the Department operates dozens of IBM compatible and Apple Macintosh family computers. Essentially all of the Department's computers are linked together in a network using Ethernet and LocalTalk networks. The Department's networks connect the University of Ottawa's IBM mainframe and the Internet network.

In addition to these facilities, students in the Department have access to a computer-aided design laboratory operated by the Faculty of Engineering (University of Ottawa). This facility includes 24 networked Silicon Graphics workstations; it is, however, intended primarily for the use of undergraduate students.

Digital Communications Research Laboratory

This laboratory is equipped with a variety of communication system and signal analysis equipment. This includes some of the latest equipment for data source simulation, data error rate monitoring, spectrum analysis, cross and autocorrelation function measurement, probability density function measurement, noise simulation, filtering, etc. It also includes prototype digital modulation and demodulation equipment, and various digital signal processing hardware and software systems based on the TMS320C25 digital signal processor. The laboratory also features a 14/12 GHz satellite earth station and associated terminal equipment for testing prototype equipment on an actual satellite link.

Lightwave Communications Research Laboratory

This laboratory is equipped with modern optical communications instruments covering the wavelengths from 600 nanometres to 1.5 microns. The laboratory also features several SUN workstations with software for the computer simulation of various aspects of optical communication systems and networks. Current experimental work in the laboratory includes holographic coupler designs, coherent optical networks and indoor infrared multicasting.

Multimedia Communications Research Laboratory

This laboratory is equipped with over 20 UNIX workstations, Macintosh and PC computers interconnected using FDDI, Ethernet and Appletalk. The laboratory is also equipped with video cameras, video display/capture boards, audio input/output devices and a computer controlled VCR. While UNIX (Solaris, SCO OTD, AIX Linux) is the predominant operating system used in the laboratory, Apple System 7 and Windows NT are also available. Development tools available in the laboratory include various C and C++ compilers, Objectstore OODBMS and a variety of multimedia authoring and programing toolkits.

Electromagnetic Research Laboratory

This laboratory is equipped with modern co-axial line and waveguide instruments covering frequencies from 10 MHz to 60 GHz. A computer-controlled frequency domain network analyzer with error correcting capabilities allows reflection and transmission measurements from 5 Hz to 60 GHz. The laboratory is also equipped with a computer-controlled time domain network analyzer and a modern scalar network analyzer (transmission, reflection test set) as well as various frequency counters and spectrum analyzers. A computer controlled three-dimensional scanning system located in an anechoic chamber and used for near-field antenna measurement in both frequency and time domains over the frequency range from 100 MHz to 3GHz. TEM cells at 100 MHz and 3 GHz are available for field probe calibration and EMC/I testing of electronic equipment.

Graduate Courses

- Engineering 92.505 (ELG5162)
Knowledge-Based Systems: Principles and Design
Basic concepts and terminology. Introduction to mathematical logic and to reasoning. Introduction to Lisp and Objective C. Knowledge representation using rules, semantic nets and frames. Case study. Representation in state space. Case study. Use of knowledge. Procedural and declarative knowledge. Demons. Production systems. Case study. Solution searching algorithms. Expert system components. Inference engine principle. Basic schemes for inference engine representation. Knowledge-based system design. Using an expert system shell for the design of knowledge-based systems. Case study: and expert system for process control.
Dan Ionescu.
- Engineering 92.506 (ELG7132)
Topics in Electronics I
Current topics in the field.
- Engineering 92.507 (ELG7133)
Topics in Electronics II
Current topics in the field.
- Engineering 92.508 (ELG7575)
Sujets choisis en électronique
Sujets d'intérêt courant dans la matière.
- Engineering 92.510 (ELG5163)
Machine Vision
Image acquisition. Lighting considerations. Structured light and stereo ranging. Gray-scale and binary images: geometric and topological properties. Regions and image segmentation. Image preprocessing. Edge finding. Image processing. Image recog-

nition techniques. Mathematical models for image representation. Mathematical morphology. Model building. Representation of 3-D objects. Three dimensional scene understanding. Motion detection. Special vision architectures, massively parallel computers, AIS series. Machine vision for manufacturing.

Prerequisite: ELG4153.

Dan Ionescu.

- Engineering 92.512 (ELG5197)
Introduction to Embedded Systems
The purpose of this course is to present the design alternatives of embedded systems. The course covers the following main topics: overview of embedded systems, where they fit and their general characteristics. Simple embedded systems: sequential event response systems and cyclic executives. Design overview: prototype-based designs, multitasking and multiactivity paradigms. Multitasking systems design: elements of real-time operating systems and harmony. Multiactivity systems design: process activity language (PAL) and PAL-based design tools. As part of the course the students will write a major project on an agreed topic and present it to the class if time permits.
Prerequisite: ELG4161 or the equivalent.
Moshe Kreiger.

- Engineering 92.513 (ELG5198)
Parallel Processing with VLSI
Overview of parallel processing. Architectures for parallel processing: array processors, associate processors, vector processors, orthogonal processors, switch lattice architecture, hypercubes, systolic arrays, wavefront arrays, pyramid structures, data flow architectures, and reduction machines. Memory organization, buses, I/O and interconnection networks for parallel processing systems. Connection machine processing hardware, RISC processors, and some VLSI processors. Impact of GaAs technology on parallel processing. Future parallel processing systems implementations. Some representative parallel processing systems. Examples of parallel processing architectures for various applications.
Sethuraman Panchanathan.

- Engineering 92.514 (ELG5199)
Design of Multimedia Distributed Database Systems
The purpose of the course is to provide the students with the basic concepts of the conventional database technology: technology trends and databases, database concepts and architecture, data modelling. Emphasis will be on the relational technology and distributed databases: relational

concepts, relational algebra, distributed database architecture, horizontal and vertical fragmentations, distribution design, distributed transparency, distributed concurrency control. The course will also examine the new generation of databases for advanced applications such as multimedia information retrieval and the limitations of the conventional models for managing multimedia information such as graphics, text, image, audio/video and voice. Extended relational databases and object-oriented database approaches will be discussed. As part of the course the students will write a major project on topics related to both traditional and advanced database technologies and present it to the class. Ahmed Karmouch.

- Engineering 92.515 (ELG5373)
Secure Communications and Data Encryption
Introduction to secure communications. Data encryption and encipherment. Source entropy and average mutual information. Cryptanalysis of encrypted data. Classic encipherment methods: substitution, transposition and product ciphers. Symmetric cryptosystems: shift register sequences, stream ciphers and Data Encryption Standard DES. Public key encipherment concept, RSA cipher, knapsack cipher, computational complexity, Diffie-Hellman public key distribution scheme. Message authentication and identity verification. Applications: electronic funds transfer, secure speech communications.
Prerequisite: ELG5119 or 94.553 or the equivalent.
J.-Y. Chouinard.

- Engineering 92.516 (ELG5113)
Stochastic Systems
Wiener processes. Poisson random measures. Stochastic Wiener-Ito integrals. Stochastic integrals with respect to Poisson measures. Stochastic differentials. Diffusion processes. Ito-stochastic differential equations: existence and uniqueness of solutions, continuous dependence of solutions with respect to parameters. Semigroup theory and generation of semigroups as applied to stochastic differential equations. Applications to engineering systems modelling (computer communications networks, power system networks, etc.).
Prerequisite: Permission of the instructor.
N.U. Ahmed.

- Engineering 92.519 (ELG5119)
Stochastic Processes
Probability spaces. Random variables. Distribution and density functions. Expectation. Functions of random variables. Moments and characteristic functions. Random vectors. Functions of random vectors. Sequences of random variables. Convergence notions. The central limit theorem.

The law of large numbers. Stochastic processes: basic notions, characterizations and examples. Stationarity notions. Poisson processes. Gaussian processes. Transformations of stochastic processes. Ergodicity. Second order random processes. Representation theorems. Markov processes. Homogeneous Markov chains. Applications.

Exclusion: 94.553

P.A. Galko.

- Engineering 92.520 (ELG5120)
Queuing Systems
Stochastic processes: Markov chains, discrete birth-death, etc. Queuing systems: M/G/1, G/M/m, M/M/m/k/n queues, etc. Priority queues. Networks of queues: local/global balance equations, product form solutions for open and closed networks. Mean value analysis, diffusion approximation, non-product form networks. Related models (e.g., Petri nets). Numerical solutions. Examples include throughput analysis from multiprocessors and computer-communication networks.
Prerequisite: ELG5119 or 94.553 or the equivalent.
Exclusion: 94.517
O.W. Yang.

- Engineering 92.527 (ELG5161)
Robotics: Control, Sensing and Intelligence
Robotics as the intelligent connection of perception to action. Robotics in the CIM context. Advanced robotics technologies. Robot arm kinematics and dynamics. Planning of manipulator trajectories. Control of robot manipulators. Robot-level programming. Sensors and sensory perception. Control problems for sensory controlled robotic-based flexible manufacturing systems. Task-level programming. Mobile robots. Knowledge-based control for mobile robots: environment perception, robot's world model, navigation and motion control.
Prerequisite: ELG4161 or the equivalent.
E.M. Petriu.

- Engineering 92.529 (ELG7113)
Topics in Systems and Control I
Current topics in the field, including linear semigroup theory and optimal feedback control.

- Engineering 92.530 (ELG7114)
Topics in Systems and Control II
Current topics in the field, including linear and non-linear filtering and optimal control of stochastic systems.

- Engineering 92.531 (ELG7574)
Sujets choisis en systèmes et réglage automatique.
Sujets d'intérêt courant dans le domaine.

- Engineering 92.535 (ELG5108)

Electromagnetic Compatibility and Interference
Interference phenomena. Shielding of conductors.
Grounding. Other noise reduction techniques. EMI
filters. Noise sources: narrowband and broadband.
Electromagnetic pulse as an interference source.
Modelling EMI/C circuit boards and backplanes.
Prerequisite: ELG4101 or the equivalent.
G.I. Costache and Prakash Bhartia (DREO).

- Engineering 92.538 (ELG7500)

Sujets choisis en électromagnétisme.
Sujets d'intérêt courant dans la matière.

- Engineering 92.541 (ELG5104)

Electromagnetic Waves: Theory and Applications
The homogeneous wave equation. Uniform and
non-uniform plane waves. Inhomogeneous wave
equations. Green's functions. Theory of potentials.
Scattering problems. Numerical methods. Boundary
value problems. Perturbation and variational techniques.
Prerequisite: ELG4101 or the equivalent.
Staff.

- Engineering 92.542 (ELG5379)

Numerical Methods in Electromagnetic Engineering
An introduction into modern numerical methods for
solving electromagnetic field problems. Deterministic
as well as eigenvalue problems will be treated using
the following techniques: finite difference and finite
element techniques, moment methods, sparse
matrix techniques, spectral domain techniques,
hybrid mode analysis, transmission line matrix
simulations. Applications include wire antennas,
waveguides of arbitrary cross-section, micro-strip
and quasiplanar transmission lines, transmission
line discontinuities and computer-aided design
and optimization of microwave components.
Prerequisite: ELG4101 or the equivalent.
G.I. Costache.

- Engineering 92.543 (ELG5504)

Ondes électromagnétiques: théorie et applications
Équation homogène d'ondes. Ondes planes
uniformes et non uniformes. Équation non
homogène d'ondes. Fonctions de Green. Théories
des potentiels. Problèmes de diffraction. Méthodes
numériques. Problèmes avec conditions aux limites.
Méthodes des perturbations et variation.
Préalable: ELG4101 ou l'équivalent.
Staff.

- Engineering 92.544 (ELG7100)

Topics in Electromagnetics I
Current topics in the field.

- Engineering 92.545 (ELG7101)

Topics in Electromagnetics II
Current topics in the field.

- Engineering 92.546 (ELG5779)

Méthodes numériques en génie électromagnétique
Une introduction aux méthodes modernes de
résolution numérique des problèmes électro-
magnétiques. Le cours couvre des problèmes
déterministes et aux valeurs propres. Les méthodes
suivantes seront présentées: différences finies,
éléments finis, analyse dans le domaine spectral,
analyse par modes hybrides, méthode t.l.m. Les
méthodes seront appliquées aux problèmes suivants:
antennes, guides d'ondes à section arbitraire, lignes
microrubans et lignes quasi-planaires, discontinuités
dans les lignes de transmission, conception par
ordinateur de composants hyperfréquences.
Préalable: ELG4101 ou l'équivalent.
G.I. Costache.

- Engineering 92.550 (ELG5371)

Digital Communications by Satellite
Overview of satellite communications. Channel
characterization and link budget calculations.
Transponders: a transponder model, channelization,
frequency plans, processing transponders. Earth station
technology: modems (BPSK, QPSK, MSK, etc.,
coherent versus differential detection), low noise
amplifiers, high power amplifiers. Forward error
correction for satellite links. Propagation and inter-
ference considerations. Satellite access techniques:
FDMA, TDMA, CDMA, random multiple access.
Satellite switching and on-board processing. Network-
ing and Services. Integrated services digital satellite
network. VSAT, MSAT, Intelsat and Inmarsat.
Prerequisite: ELG4171 or the equivalent.
Abbas Yongaçoglu.

- Engineering 92.551 (ELG5170)

Introduction to Information Theory
Introduction to information theory and communica-
tion systems: source coding, channel coding and
data encryption. The measure of information:
entropy, mutual information and average mutual
information. Discrete-source coding: fixed-length and
variable-length codes, stationary sources, ergodic
sources, Markovian sources, the Source-Coding
Theorem. Data compression. The rate-distortion
function. Information estimation: the Neyman-
Pearson Theorem, maximum-likelihood detection,
elementary and asymptotic bounds on performance,
the Chebyshev inequality and the Chernoff bound.
Channel coding: data transmission over discrete
noisy channels, the capacity of discrete memory-
less channels, discrete channels with memory, the
Channel Coding Theorem, block codes and tree
codes. Continuous channels and sources: entropy
and mutual information of continuous-amplitude
discrete-time signals, discrete-time Gaussian sources
and channels with and without memory, the

rate-distortion function of a Gaussian signal, continuous-time Gaussian sources and channels, transmission with a band-width constraint.

Prerequisite: ELG5119 or 94.553 or the equivalent.
J.-Y. Chouinard.

- Engineering 92.553 (ELG5179)

Detection and Estimation

An introduction to the optimal processing of communication signals. The binary hypothesis testing problem. Bayes risk and Neyman-Pearson criteria based receivers. M-ary hypothesis detection problems. Composite hypothesis problems. Parameter estimation criteria; Cramer-Rao bounds; maximum likelihood estimation. Function space concepts. Integral equations; the Karhunen-Loeve Expansion Theorem. Detection problems of signals in additive white Gaussian noise. Detection problems in coloured noise; the whitening filter; singular detection. The noise-in noise problem. Classical signal estimation problems. The linear filtering problem. The Wiener filter. The Kalman filter. Sequential detection (Wald's test). Introduction to non-parametric detection.

Prerequisites: ELG5119 or 94.553; and ELG5375 or 94.554; or the equivalents.

P.A. Galko.

- Engineering 92.554 (ELG5372)

Error Control Coding

General introduction. Algebraic concepts. Linear block codes. Cyclic codes, error trapping, decoding of cyclic codes, BCH codes, majority-logic decoding of cyclic codes, finite geometry codes, burst-error correcting codes. Convolutional codes. Maximum-likelihood decoding, sequential decoding, and majority-logic decoding of convolutional codes. Burst-error correcting convolutional codes. Automatic repeat request strategies. Applications of block coding to data storage systems. Applications of convolutional codes.

Co-requisite: ELG4171 or the equivalent.

Abbas Yongaçoglu.

- Engineering 92.556 (ELG5375)

Principles of Digital Communication

Elements of communication theory and information theory applied to digital communications systems. Characterization of noise and channel models. Analysis of digital data transmission techniques for additive Gaussian noise channels. Efficient modulation and coding for reliable transmission. Spread spectrum and line coding techniques.

Prerequisite: 94.553 or ELG5119 or the equivalent (may be taken concurrently).

Exclusion: 94.554.

P.A. Galko.

- Engineering 92.557 (ELG5376)

Digital Signal Processing

Discrete-time signals, system functions, convolution, correlation, transforms. Frequency domain and Z-domain representations. FIR and IIR filters. Filter design in frequency and time domains. The Discrete Fourier Transform. Fast Fourier Transform algorithms. Realizations: finite word-length effects, quantization of analog signals and filter coefficients; quantization of multiplier and adder outputs, overflow and limit cycles. Decimation and interpolation and their applications. Anti-aliasing filter design. A/D and D/A impairments and specifications. Echo cancellers. The extent to which the above topics are covered will be determined at the beginning of the course based on the student's background.

Prerequisite: ELG5119 or 94.553 or the equivalent.

Exclusion: 94.562

T.A. Aboulnasr.

- Engineering 92.558 (ELG5776)

Traitement numérique des signaux

Méthodes de traitement numérique des signaux dans le domaine fréquentiel et temporel; effets d'arrondissement sur les coefficients et accumulation des erreurs. Réalisations directes à très hautes vitesses. Réseaux systoliques. Réalisations utilisant des micro-ordinateurs. Techniques d'adaptation. Applications aux systèmes de télécommunications.
Préalable: ELG4172 ou l'équivalent.

- Engineering 92.559 (ELG5378)

Image Processing and Image Communications

Linear systems approach to image processing. Two-dimensional transforms for image processing. Image analysis, segmentation, and classification. Applications to inspection, remote sensing, and medicine. Image coding: spatial domain, transform domain. Properties of the human visual system and image displays. Image processing hardware.

Prerequisite: ELG5376 or 94.562 or the equivalent.

S. Panchanathan.

- Engineering 92.560 (ELG7172)

Topics in Signal Processing I

Current topics in the field.

- Engineering 92.561 (ELG7173)

Topics in Signal Processing II

Current topics in the field.

- Engineering 92.563 (ELG7179)

Topics in Signal Processing III

Current topics in the field.

- Engineering 92.565 (ELG7177)

Topics in Communications I

Current topics in the field.

- Engineering 92.566 (ELG7178)

Topics in Communications II

Current topics in the field.

- Engineering 92.567 (ELG5374)

Computer-Communication Networks

Introduction. Network goals. Applications of networks. Network structure. Network architectures. The ISO reference model. Introduction to queuing theory. Delay analysis. The physical layer. The data link layer. The network layer: point to point networks, satellite and packet-radio networks, local area networks. The transport and session layers: interconnection of packet switching networks. The presentation layer: network security and privacy, file transfer protocols. The application layer: distributed data base systems.

Co-requisite: ELG4171 or the equivalent.

Exclusion: 94.521

O.W. Yang.

- Engineering 92.572 (ELG7572)

Sujets choisis en télécommunications et en traitement de signaux.

Sujets d'intérêt courant dans le domaine.

- Engineering 92.573 (ELG5194)

Design and Testing of Reliable Digital Systems

Introduction. Test generation for combinatorial circuits. Fault detection in sequential circuits. Memory testing. LSI/VLSI circuit testing. Deterministic and random testing of digital circuits. Design for testability. Self-checking circuits. Design of fault-tolerant systems. Case studies.

Prerequisite: ELG5195 or the equivalent.

S.R. Das.

- Engineering 92.574 (ELG5180)

Advanced Digital Communication

Digital signalling over channels with intersymbol interference (ISI) and additive Gaussian noise. Error probability analysis. Fading multipath channels as arise in terrestrial line-of-sight (LOS) and mobile/portable communications, diversity concepts: modelling and error probability performance evaluation. Synchronization in digital communications. Spread spectrum in digital transmission over multipath fading channels. Optical communications and networking over fibre and atmosphere. Shot noise, laser intensity noise and Gaussian noise performance limits.

Prerequisite: 94.554 or ELG5375 or the equivalent.

Exclusion: 94.565

Mohsen Kavehrad.

- Engineering 92.575 (ELG5195)

Digital Logic Design: Principles and Practices

Combinational circuit analysis including hazard detection. Number systems and codes. Switching

algebra. Combinational circuit design including PLA and MSI techniques. IC logic families. Flip-flop properties. Switching algebra: special properties; symmetric functions, unate functions, threshold functions, Boolean difference, and functional decomposition. Introduction to sequential circuits; state reduction, incompletely specified machines, state assignment, and series-parallel decomposition. Fundamental mode sequential circuits; race, hazards, and state assignment. Testing aspects of digital systems; failure and fault models, deterministic test generation for combinational circuits, testing sequential circuits, state identification, and testing memories and complex LSI/VLSI circuits. Design for testability techniques: scan techniques, built-in self test (BIST), and easily testable network structures. Semicustom and MSI design. Special sequential circuits including sequential integrated circuits.

S.R. Das.

- Engineering 92.577 (ELG5192)

Microprocessor-Based Systems

The course considers the various design alternatives of microprocessor-based systems. Review of current microprocessor trends. Design alternatives of microprocessor-based system executives. LSI memories and memory system design. Input/output options and the design of various input/output ports. Busing schemes. Design of bit-sliced systems.

Prerequisite: ELG4391 or the equivalent.

Moshe Krieger.

- Engineering 92.578 (ELG5193)

Multi-Microprocessor Systems

Multiprocessor systems: definitions, characteristics, objectives and applications. Multi-microprocessor systems: what, where and why. Task-driven systems. Examples of multi-microprocessor systems. (Students will be expected to do extensive reading of the current literature, a project and class presentation of an assigned topic.)

Prerequisite: ELG5192 or the equivalent.

Moshe Krieger.

- Engineering 92.579 (ELG5196)

Automata and Neural Networks: Applications in Machine Perception

This course is intended to provide a general introduction to the field of automata networks, giving special attention to "artificial neural networks" and their application in modelling perception mechanisms. Introduction: a historical overview of the area and a look at examples of automata network applications in cellular computer architectures, modelling of physical and biological phenomena, and the modelling of cognition and perception mechanisms. Mathematical tools: Boolean networks, discrete

iterative automata, random automata networks, and dynamic automata network behaviour (threshold networks and the behaviour of iterative automata). Neural networks: models for motor control, perception and information retrieval; representation and learning, basic components (the "formal neuron", the perceptron), linear learning, feature discovery by competitive learning, retrieval, multi-layered networks, the "gradient back propagation" learning algorithm for multi-layered networks, and VLSI implementation of a neural network model. Applications in machine perception: self-organization in a perceptual network, the "Adaptive Resonance Theory" of adaptive pattern recognition by a self-organizing neural network, neural networks for adaptive pattern recognition, neural networks for visual pattern recognition, a silicon model of early visual processing and its application to optical flow computing, and a "neural" phonetic typewriter. E.M. Petriu.

- Engineering 92.587 (ELG7186)

Topics in Computers I
Current topics in the field.

- Engineering 92.588 (ELG7187)

Topics in Computers II
Current topics in the field.

- Engineering 92.590 (ELG7573)

Sujets choisis sur les ordinateurs.
Sujets d'intérêt courant dans la matière.

- ELG6000

Engineering Report/Rapport technique
For students in the course work master's program working on the Engineering Report. Pour les étudiants et les étudiantes à la maîtrise qui préparent un rapport technique.

- ELG7999

M.A.Sc. Thesis/Thèse de M.Sc.A.
For students working towards their master's thesis. Pour les étudiants et les étudiantes qui travaillent à leur thèse de maîtrise.

- ELG8000

Co-Op Work Term I/Travail coopératif 1^{er} stage
For students in a cooperative master's program who are on their first work term.
Pour les étudiants et les étudiantes à un programme coopératif de maîtrise qui font leur première session de travail.

- ELG8001

Co-Op Work Term II/Travail coopératif 2^e stage
For students in a cooperative master's program who are on their second work term.

Pour les étudiants et les étudiantes à un programme coopératif de maîtrise qui font leur deuxième session de travail.

- ELG9998

Ph.D. Comprehensive Exam/Examen de synthèse du doctorat

For students undergoing the Ph.D. comprehensive examination.

Pour les étudiants et les étudiantes qui doivent passer l'examen de synthèse du doctorat.

- ELG9999

Ph.D. Thesis/Thèse de doctorat

For students working towards their Ph.D. thesis.

Pour les étudiants et les étudiantes qui travaillent à leur thèse de doctorat.