

GRADUATE DIPLOMA INTERNET TECHNOLOGIES

Summary

- Degree offered: Graduate Diploma
- Registration status options: Full-time; Part-time
- Language of instruction:
 - English
 - French
- Program option (expected duration of the program):
 - within one year
- Academic units: Faculty of Engineering (<http://engineering.uottawa.ca>), School of Electrical and Computer Science (<http://engineering.uottawa.ca/eecs>)

Program Description

Internet is fast becoming the vehicle for integrated multimedia (voice/video/graphics/data) communications.

It may absorb within its standards and protocols other well-established technologies, such as telephony, facsimile, messaging, data and entertainment technologies.

Its fastest growing service, the World Wide Web, has created a true information revolution and is daily pushing the limits of current technologies to cope with its growth.

Internet technologies have become a discipline in themselves. The Internet Protocol (IP) continues to dominate as a standard for ubiquitous global communications, and other Internet standards (for example, DiffServ, RSVP) are quickly emerging to offer quality of service on the Internet.

There is a need to train professionals at the graduate level in this area, where expertise is required beyond basic undergraduate experience.

Learning Outcomes

The objective of the graduate diploma in Internet Technologies is to educate high technology professionals with full undergraduate training for the growing Internet standards, methods, techniques and applications markets.

It includes courses in both the main theories and applications of Internet engineering, as well as basic formation in the intricate world of Internet law and electronic commerce.

Other Programs Offered Within the Same Discipline or in a Related Area

- Master of Applied Science Electrical and Computer Engineering (MASc)
- Master of Applied Science Electrical and Computer Engineering Specialization in Science, Society and Policy (MASc)
- Master of Engineering Electrical and Computer Engineering (MEng)
- Doctorate in Philosophy Electrical and Computer Engineering (PhD)

Fees and Funding

- Program fees:

The estimated amount for university fees (<https://www.uottawa.ca/university-fees>) associated with this program are available under the section Finance your studies (<http://www.uottawa.ca/graduate-studies/programs-admission/finance-studies>).

International students enrolled in a French-language program of study may be eligible for a differential tuition fee exemption (<https://www.uottawa.ca/university-fees/differential-tuition-fee-exemption>).

- To learn about possibilities for financing your graduate studies, consult the Awards and financial support (<https://www.uottawa.ca/graduate-studies/students/awards>) section.

Notes

- Programs are governed by the general regulations (<http://www.uottawa.ca/graduate-studies/students/general-regulations>) in effect for graduate studies.
- In accordance with the University of Ottawa regulation, students have the right to complete their assignments, examinations, research papers, and theses in French or in English.

Program Contact Information

Graduate Studies Office, Faculty of Engineering (<https://engineering.uottawa.ca/graduate-studies-office>)

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Email: engineering.grad@uottawa.ca

Twitter | Faculty of Engineering (<https://twitter.com/uOttawaGenie?lang=en>)

Facebook | Faculty of Engineer (<https://www.facebook.com/uottawa.engineering>)

Admission Requirements

For the most accurate and up to date information on application deadlines, language tests and other admission requirements, please visit the specific requirements (<https://www.uottawa.ca/graduate-studies/programs-admission/apply/specific-requirements>) webpage.

To be eligible, candidates must:

- Have bachelor's degree with honours in electrical engineering, computer engineering, software engineering, computer science, or equivalent, with a minimum average of 75% (B+).

Note: International candidates must check the admission equivalencies (<https://www.uottawa.ca/graduate-studies/>)

international/study-uottawa/admission-equivalencies) for the diploma they received in their country of origin.

- The admissions committee may, however, also recommend other candidates, who satisfy the minimum admission requirements and have a demonstrated knowledge and/or experience in the field.
- Candidates for whom a list of additional qualifying courses will be required may be considered in exceptional cases. In this case, they must obtain a minimum grade of B+ in all their additional courses.
- Pay the \$100 (\$CDN non-refundable) application fee.

Language Requirements

Applicants must be able to understand and fluently speak the language of instruction (English or French) in the program to which they are applying. Proof of linguistic proficiency may be required.

Applicants whose first language is neither French nor English must provide proof of proficiency in the language of instruction.

Language tests recognized by the University of Ottawa:

- TOEFL: 580 (paper-based) or 92-93 (internet-based);
- IELTS: Overall 6.5 – Individual 6.0 (paper-based) or Overall 7.0 – Individual 6.0 (internet –based);
- An equivalent language test (<http://www.uottawa.ca/graduate-studies/programs-admission/apply/required-documents>).

Note: Candidates are responsible for any fees associated with the language tests.

Notes

- The admission requirements listed above are minimum requirements and do not guarantee admission to the program.
- Admissions are governed by the general regulations (<http://www.uottawa.ca/graduate-studies/students/general-regulations>) in effect for graduate studies.

Documents Required for Admission

In addition to the documents required (<http://www.uottawa.ca/graduate-studies/programs-admission/apply/required-documents>) for graduate and postdoctoral studies, candidates must submit the following documents:

- A resume
- Two confidential letters of recommendation from professors who have known the applicant and are familiar with their work.

It is highly recommended that you contact your referee prior to submitting your application to confirm their email address and their availability to complete your letter of recommendation.

- Transcripts from all universities attended:
 - Official transcripts from all universities attended must be submitted (mandatory). This applies to all courses and programs at any university you attended, including regular programs (completed or not), exchanges, letters of permission, online or correspondence courses, courses taken as a special student or visiting student, etc.

- If the transcript and degree certificate are not in English or French, a certified translation (signed and stamped/sealed) must be submitted.

Note: Documents that are not required for admission will not be consulted, conserved or returned to the student. These documents will be destroyed according to our administrative procedures.

Information about how to apply to this program is available under the Apply Now (<http://www.uottawa.ca/graduate-studies/programs-admission/apply/#apply-now>) section.

Students should complete and submit their online application with supporting documentation (if applicable) by the deadline indicated above.

Program Requirements Graduate Studies Diploma

Students must meet the following requirements:

Compulsory Courses:

ELG 5374	Computer Communication Network	3 Units
DCL 7302	Regulation of Internet Communications	3 Units
6 course units from:		6 Units

ELG 5121	Multimedia Communications
ELG 5369	Internetworking Technologies
ELG 5373	Data Encryption
CSI 5105	Network Security and Cryptography

6 optional course units from: 6 Units

CSI 5110	Principles of Formal Software Development
CSI 5111	Software Quality Engineering
CSI 5112	Software Engineering
CSI 5115	Database Analysis and Design
CSI 5122	Software Usability
CSI 5134	Fault Tolerance
CSI 5140	Selected Topics in Computer Systems (Category S)
CSI 5161	Principles of Distributed Simulation
CSI 5166	Applications of Combinatorial Optimization
CSI 5169	Wireless Networks and Mobile Computing
CSI 5380	Systems and Architectures for Electronic Commerce
CSI 5387	Data Mining and Concept Learning
CSI 5389	Electronic Commerce Technologies
ELG 5124	Virtual Environments
ELG 5191	Design of Distributed System Software
ELG 5371	Digital Communication by Satellite
ELG 5372	Error Control Coding
ELG 5378	Image Processing and Image Communications
ELG 5381	Photonics Networks
ELG 5382	Switching and Traffic Theory for Integrated Broadband Networks
ELG 5383	Survivable Optical Networks
ELG 7178	Topics in Communication II

ELG 7186 Topics in Computers I

ELG 7187 Topics in Computers II

Minimum Requirements

The passing grade in all courses is C+.

Fast-track from Diploma to Master's

Students enrolled in the graduate diploma program can request to transfer to the Master of Applied Science degree (MASc) or to the Master of Engineering degree (MEng) or to the Master of Computer Science (MCS).

Applications should be addressed to the Director, Graduate Diploma in Internet Technologies (INTERTECH), School of Information Technology and Engineering.

On completion of the diploma, qualified students meeting admission requirements could apply to one of the master's programs, in particular the master of computer science or the MEng or MASc in electrical engineering, and, upon admission, complete the requirements for those programs with units granted for relevant courses already completed in the diploma. The number of units remaining would be assessed individually, at the time of admission, with relation to the student's chosen master's program.

A maximum of three units in equivalencies or advanced standing may be granted. To be eligible, the units in question must not have counted towards the requirements of a previous diploma or degree. Candidates who have already successfully completed some of the compulsory units may be allowed to replace those units with elective units.

Research

Research Fields & Facilities

Located in the heart of Canada's capital, a few steps away from Parliament Hill, the University of Ottawa is among Canada's top 10 research universities.

uOttawa focuses research strengths and efforts in four Strategic Areas of Development in Research (SADRs):

- Canada and the World
- Health
- e-Society
- Molecular and Environmental Sciences

With cutting-edge research, our graduate students, researchers and educators strongly influence national and international priorities.

Research at the Faculty of Engineering

Areas of research:

- Chemical and Biological Engineering
- Civil Engineering
- Electrical Engineering and Computer Science
- Mechanical Engineering

For more information, refer to the list of faculty members and their research fields on **Uniweb**.

IMPORTANT: Candidates and students looking for professors to supervise their thesis or research project can also consult the website of the faculty or department (<https://www.uottawa.ca/graduate-studies/students/academic-unit-contact-information>) of their program of choice. Uniweb does not list all professors authorized to supervise research projects at the University of Ottawa.

Courses

DCL 7302 Regulation of Internet Communications (3 units)

Seminar analyzing the legal challenges posed by the Internet to the rights of free speech and privacy. Topics include online obscenity, hate speech, defamation, as well as national and international approaches to data privacy protection.

Course Component: Seminar

CSI 5105 Network Security and Cryptography (3 units)

Advanced methodologies selected from symmetric and public key cryptography, network security protocols and infrastructure, identification, anonymity, privacy technologies, secret-sharing, intrusion detection, firewalls, access control technologies, and defending network attacks. This course is equivalent to COMP 5406 at Carleton University.

Course Component: Lecture

Prerequisites: familiarity with basic concepts in networks, network security, and applied cryptography.

CSI 5110 Principles of Formal Software Development (3 units)

Methodologies in formal software specification, development, and verification. The use of theorem proving, automated deduction, and other related formal methods for software correctness. Applications in program verification and secure computation. This course is equivalent to COMP 5707 at Carleton University.

Course Component: Lecture

CSI 5111 Software Quality Engineering (3 units)

Software quality issues. Quality components and metrics. Software process quality. Software reliability engineering. Software design for testability. Requirements capture and validation. Systematic design validation; grey-box approach, test design, implementation and management, case studies in validation and verification of communications software. Object-oriented design and test. Theoretical aspects. This course is equivalent to COMP 5501 at Carleton University.

Course Component: Lecture

CSI 5112 Software Engineering (3 units)

Topics of current interest in Software Engineering, such as requirements engineering, precise and advanced modelling, development processes, change management, standards, and emerging types of applications. This course is equivalent to COMP 5207 at Carleton University.

Course Component: Lecture

CSI 5115 Database Analysis and Design (3 units)

The dimensional and multidimensional data models for data warehousing. Data dependencies and decomposition. Structure and use of data definition and manipulation languages. Database economics, engineering, deployment and evolution. Issues in integrity, security, the Internet and distributed databases. Relationships to decision support systems. This course is equivalent to COMP 5503 at Carleton University.

Course Component: Discussion Group, Laboratory, Lecture, Research, Seminar, Work Term, Theory and Laboratory, Tutorial

CSI 5122 Software Usability (3 units)

Design principles and metrics for usability. Qualitative and quantitative methods for the evaluation of software system usability: Heuristic evaluation, usability testing, usability inspections and walkthroughs, cognitive walkthroughs, formal usability experimentation. Ethical concerns when performing studies with test users. Economics of usability. Integration of usability engineering into the software engineering lifecycle. This course is equivalent to COMP 5301 at Carleton University.

Course Component: Lecture

CSI 5134 Fault Tolerance (3 units)

Hardware and software techniques for fault tolerance. Topics include modeling and evaluation techniques, error detecting and correcting codes, module and system level fault detection mechanisms, design techniques for fault-tolerant and fail-safe systems, software fault tolerance through recovery blocks, N-version programming, algorithm-based fault tolerance, checkpointing and recovery techniques, and survey of practical fault-tolerant systems. This course is equivalent to COMP 5004 at Carleton University.

Course Component: Lecture

CSI 5140 Selected Topics in Computer Systems (Category S) (3 units)

Selected topics in Computer Systems (Category S), not covered by other graduate courses. Details will be available from the School at the time of registration. This course is equivalent to COMP 5900 at Carleton University.

Course Component: Lecture

CSI 5161 Principles of Distributed Simulation (3 units)

Distributed simulation principles and practices. Synchronization protocols: Optimistic vs Conservative, Deadlock detection in conservative simulations, Time warp simulation. Distributed interactive simulation: Data distribution management, Interest management, High Level Architectures (HLA), Run Time Infrastructure (RTI). Distributed web-based simulation. Distributed agent based simulation. Real time applications of distributed simulation. Distributed and collaborative virtual simulations. This course is equivalent to COMP 5606 at Carleton University.

Course Component: Lecture

CSI 5166 Applications of Combinatorial Optimization (3 units)

Topics in combinatorial optimization with emphasis on applications in Computer Science. Topics include network flows, various routing algorithms, polyhedral combinatorics, and the cutting plane method. This course is equivalent to COMP 5805 at Carleton University.

Course Component: Lecture

CSI 5169 Wireless Networks and Mobile Computing (3 units)

Computational aspects and applications of design and analysis of mobile and wireless networking. Topics include Physical, Link Layer, Media Access Control, Wireless, Mobile LANs (Local Area Networks), Ad-Hoc, Sensor Networks, Power Consumption optimization, Routing, Searching, Service Discovery, Clustering, Multicasting, Localization, Mobile IP/TCP (Internet Protocol/Transmission Control Protocol), File Systems, Mobility Models, Wireless Applications. Courses CSI 5169, ELG 6168 cannot be combined for units. This course is equivalent to COMP 5304 at Carleton University.

Course Component: Lecture

CSI 5174 Validation Methods for Distributed Systems (3 units)

Review of formal specification and description techniques for distributed and open systems. Verification techniques. Correctness proofs. Verification of general properties of distributed systems. Analysis and relief strategies. Testing techniques. Test generation strategies. Test architectures. This course is equivalent to COMP 5604 at Carleton University.

Course Component: Lecture

CSI 5380 Systems and Architectures for Electronic Commerce (3 units)

E-commerce system architecture with a focus on relevant design patterns. Web servers, containers, and application frameworks. Web protocols, services, and client technologies. Scalability through load balancing, clustering, and code optimization. Internationalization, accessibility, and privacy. Data mining and sharing approaches for digital targeted advertising. E-commerce user interface design and evaluation. Current research issues. Hands-on experience with an integrated set of current e-commerce tools. E-commerce development project. Courses EBC 5380, CSI 5380 cannot be combined for units. This course is equivalent to COMP 5405 at Carleton University.

Course Component: Lecture

CSI 5387 Data Mining and Concept Learning (3 units)

Concepts and techniques of data mining. Methods for data summarization and data preprocessing. Algorithms for finding frequent patterns and association analysis; classification; cluster analysis and anomaly detection. Model selection, model evaluation and statistical significance testing. Approaches for coping with Big Data. Selected applications of data mining and concept learning.

Course Component: Lecture

Permission of the Department is required.

CSI 5389 Electronic Commerce Technologies (3 units)

Business models and technologies. Search engines. Cryptography. Web services and agents. Secure electronic transactions. Value added e-commerce technologies. Advanced research questions. Courses EBC5389, CSI5389 cannot be combined for units. This course is equivalent to COMP 5401 at Carleton University.

Course Component: Lecture

CSI 5780 Systèmes et architectures des logiciels pour le commerce électronique (3 crédits)

Architecture du système de commerce électronique et patrons de conception. Serveurs Web, conteneurs et cadres d'application. Protocoles, services, et technologies de client Web. Évolutivité grâce à l'équilibrage de la charge, au clustering et à l'optimisation du code. Internationalisation, accessibilité et confidentialité. Méthodes d'exploration et de partage de données pour la publicité ciblée numérique. Conception et évaluation de l'interface utilisateur pour le commerce électronique. Problèmes de recherche actuels. Expérience pratique avec un ensemble intégré d'outils de commerce électronique actuels. Projet de développement du commerce électronique. Les cours EBC 5380, CSI 5380 ne peuvent pas être combinés pour les unités. Ce cours est équivalent à COMP 5405 à la Carleton University.

Volet : Cours magistral

Prerequisite: CSI 5389

CSI 5787 Fouille des données et apprentissage des concepts (3 crédits)

Aspects conceptuels et techniques de l'exploration des données. Méthodes pour l'agrégation et le prétraitement des données. Algorithmes d'extraction de patrons et analyse des règles d'association; partitionnement des données et détection des anomalies. Sélection et évaluation des modèles et tests de signification statistique. Approches pour composer avec les mégadonnées. Choix d'applications en exploration des données et en extraction des concepts.

Volet : Cours magistral

CSI 5789 Technologies du commerce électronique (3 crédits)

Introduction aux modèles et technologies d'entreprise. Moteurs de recherche. Cryptographie. Services Web et agents. Transactions électroniques sécurisées. Technologies du commerce électronique à valeur ajoutée. Questions de recherche avancées. Ce cours est équivalent à COMP 5401 à la Carleton University.

Volet : Cours magistral

Prerequisite: CSI 4110 or equivalent.

ELG 5121 Multimedia Communications (3 units)

Introduction, applications, standards. Networking technologies. Image, video and audio compression. Quality of Service and resource management. Scheduling issues for real-time MM transport. Multimedia synchronization. Multimedia and the Internet. Multimedia conferencing. Multimedia to the home. Satellites and multimedia. Multimedia applications. This course is equivalent to EACJ 5201 at Carleton University.

Course Component: Lecture

ELG 5124 Virtual Environments (3 units)

Basic concepts. Virtual worlds. Hardware and software support. World modeling. Geometric modeling. Light modeling. Kinematic and dynamic models. Other physical modeling modalities. Multisensor data fusion, anthropomorphic avatars. Animation: modeling languages, scripts, real-time computer architectures. VE interfaces. Case studies. This course is equivalent to EACJ 5204 at Carleton University.

Course Component: Lecture

ELG 5191 Design of Distributed System Software (3 units)

Distributed systems design and programming issues; distributed computing. Basics of object oriented technology for distributed computing. Distributed objects technologies. Object oriented models for distributed programming. Distributed computing architecture design. Component based distributed software design. Scalability, interoperability, portability and distributed services. Distributed applications design. This course is equivalent to EACJ 5203 at Carleton University.

Course Component: Lecture

Prerequisite: An undergraduate education in Computer Engineering, or Computer Science, or practical experience in system software design.

ELG 5369 Internetworking Technologies (3 units)

IP Based Internet Technologies: Internet architecture and its protocols. Software/hardware requirements for quality of service (QoS), Integrated services. Scheduling. Fair queueing. Traffic and admission control algorithms. Differentiated services. Multiprotocol label switching (MPLS) and associated software/hardware design issues. Fast internet protocol (IP), asynchronous transfer mode (ATM), internet protocol (IP) over synchronous optical network (SONET), wavelength division multiplexing (WDM), satellite implementations. This course is equivalent to EACJ 5369 at Carleton University.

Course Component: Lecture

Courses ELG 5369, ELG 7187 (EACJ 5808) cannot be combined for units.

ELG 5371 Digital Communication by Satellite (3 units)

Propagation and interference considerations. Link budget calculations. GEO, LEO, HEO systems. Transponders. Earth stations; modems (PSK, MSK, etc.), low noise amplifiers, high power amplifiers. Error control. Access techniques; FDMA, TDMA, CDMA, random access. Switching, onboard processing. Networking. ATM over satellites. Mobile satellite communications and IMT2000. This course is equivalent to EACJ 5500 at Carleton University.

Course Component: Lecture

ELG 5372 Error Control Coding (3 units)

General introduction. Algebraic concepts. Linear block codes. Cyclic codes, BCH and Reed-Solomon codes. Convolutional codes. Maximum likelihood decoding, and sequential decoding of convolutional codes. Burst-error correcting convolutional and block codes. Automatic repeat request. Trellis Coded Modulation. Turbo codes and iterative decoding. This course is equivalent to EACJ 5504 at Carleton University.

Course Component: Lecture

ELG 5373 Data Encryption (3 units)

Secure communications: encryption and decryption. Entropy, equivocation and unicity distance. Cryptanalysis and computational complexity. Substitution, transposition and product ciphers. Data Encryption Standard (DES): block and stream cipher modes. Modular arithmetics. Public key cryptosystems: RSA, knapsack. Factorization methods. Elliptic curve cryptography. Authentication methods and cryptographic protocols. This course is equivalent to EACJ 5105 at Carleton University.

Course Component: Lecture

Prerequisite: ELG 5119 or SYSC 5503 or the equivalent

ELG 5374 Computer Communication Network (3 units)

Network applications, structures and their design issues. Resource sharing/access methods. Network transmission and switching techniques. OSI model. Error control, flow control and various issues related to the physical, data link and network layers. Local area networks. Performance issues of delay-throughput in various protocols. Courses ELG 5374, ELG 6121 (SYSC 5201) cannot be combined for units. This course is equivalent to EACJ 5607 at Carleton University.

Course Component: Lecture

ELG 5378 Image Processing and Image Communications (3 units)

Image acquisition, display and perception: sampling and reconstruction, quantization, human vision. Discrete image representations: color spaces, block, subband and wavelet representations. Image transformations, enhancement and restoration. Image analysis: edge detection, motion estimation. Image and video compression: lossless coding, predictive and transform coding, motion compensation.

Course Component: Lecture

Prerequisite: Probability and Signal Processing at undergraduate or graduate level. This course is equivalent to EACJ 5509 at Carleton University.

ELG 5381 Photonics Networks (3 units)

Optical networks and switch architectures. Static networks. Wavelength routed networks. Linear lightwave networks. Multihop networks. Point-to-point and multipoint. Multiplexing and multiple access schemes. Scheduling. Capacity allocation. Static and dynamic routing. Channel assignment. Logical vs physical topologies, and their applications. Latest development in technology, network, protocols and analysis. Courses ELG 5381, ELG 7178 (EACJ 5606) cannot be combined for units if taken as a special topic in ELG 7178. This course is equivalent to EACJ 5004 at Carleton University.

Course Component: Lecture

ELG 5382 Switching and Traffic Theory for Integrated Broadband Networks (3 units)

Principles of switching theory. Asynchronous Transfer Mode switching architectures. Principle of teletraffic engineering. Queueing theory and performance evaluation techniques as applied to the study of computer network architectures. Current topics in computer network modelling analysis and traffic control for high-speed multimedia networks. This course is equivalent to EACJ 5108 at Carleton University.

Course Component: Lecture

Prerequisite: ELG 5374 or ELG 6121. ELG 5119 or ELG 6153 or ELG 6103 is corequisite to ELG 5382.

ELG 5383 Survivable Optical Networks (3 units)

Optical networks design with emphasis on network survivability. Wavelength division multiplexing (WDM), wavelength conversion, optical switch architectures, routing and wavelength assignment algorithms, IP over WDM, optical network protocols, optical network control architectures, protection and restoration, spare capacity allocation, survivable routing, design and performance evaluation.

Course Component: Lecture

Prerequisite: ELG 5374

ELG 7178 Topics in Communication II (3 units)

This course is equivalent to EACJ 5606 at Carleton University.

Course Component: Lecture

ELG 7186 Topics in Computers I (3 units)

This course is equivalent to EACJ 5807 at Carleton University.

Course Component: Lecture

ELG 7187 Topics in Computers II (3 units)

This course is equivalent to EACJ 5808 at Carleton University.

Course Component: Lecture