

GRADUATE DIPLOMA SYSTEMS SCIENCE

Summary

- Degree offered: Graduate Diploma
- Registration status options: Full-time; Part-time
- Language of instruction:
 - English
- Program option (expected duration of the program):
 - within one year
- Academic units: Faculty of Engineering (<https://engineering.uottawa.ca>), Telfer School of Management (<http://www.telfer.uottawa.ca/en/prospective-students/interdisciplinary-programs>), Department of Mathematics and Statistics (<http://science.uottawa.ca/mathstat/en>), Department of Economics (<https://socialsciences.uottawa.ca/economics>)

Program Description

The Systems Science program provides qualified students with the opportunity for master's-level study in a broad range of areas that emphasize transdisciplinary work in the context of general systems analysis. The emphasis in Systems Science is on the development of analytical and integration skills for use in the resolution of complex applied problems that require a broad-based perspective.

Many professors in Information Technology and Engineering, Mathematics and Statistics, Administration, Economics, and other disciplines are active in the Systems Science program as instructors, student advisers and thesis directors. Others are interested in ongoing Systems Science activities including the seminar series, and Systems Science applications days.

The graduate program in System Science is an interdisciplinary program specially designed for those who are interested in the analysis and modelling (mathematical and computer) of natural and man-made systems. It provides the professional with skills and knowledge required to understand, control, predict and optimize behaviour in a variety of fields from engineering and computer science to management and applied economics. The program is supervised by a Committee composed of representatives from the Department of Economics, the School of Information Technology and Engineering, the Telfer School of Management, and the Department of Mathematics and Statistics.

To accommodate part-time students, the core courses are usually offered in the late afternoon or evening.

Main Areas of Research

Their areas of research, both theoretical and applied, span a wide variety of fields:

- Operations research
- Deterministic and probabilistic modelling
- Optimization
- Computer science
- Information systems
- Control
- Economic modelling

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

- Master of Science Systems Science (MSc)
- Master of Systems Science (MSysSc)
- Master of Science Systems Science Specialization in Environmental Sustainability (MSc)

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 academic 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. Research activities can be conducted either in English, French or both, depending on the language used by the professor and the members of his or her research group.

Program Contact Information

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

STE 1024

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Ottawa ON Canada

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Fax.: 613-562-5129

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 a bachelor's degree in Computer Science, Economics, Engineering, Mathematics, Operations Research, Science or a related area with a minimum average of B (70%).

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.

- Undergraduate courses in probability, linear algebra, differential equations and computer programming are prerequisites for the core courses of the Program. Details regarding the level and content of prerequisite courses are included in the information package which is sent to all applicants. If a student lacks any of these courses, he will normally be required to complete them as a condition of admission. Entering students who lack the required undergraduate preparation may be permitted to enter a qualifying program.
- Pay the \$100 (\$CDN non-refundable) application fee.

Language Requirements

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

Some of the requirements of the program must be fulfilled in English. A very good knowledge of the English language is therefore 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: 550 Paper-based or 79-80 Internet-based; or
- IELTS: Overall 6.5 – Individual 5.0 (Paper-based or Internet-based); or
- 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 academic regulations (<http://www.uottawa.ca/graduate-studies/students/general-regulations>) in effect for graduate studies.
- 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. For details, consult section B.2.7. of the general regulations in place 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 the student work.

You are strongly encouraged to contact your referee(s) prior to submitting your application in order to confirm their email address and their availability to complete your letter of recommendation.

- Transcripts from all universities attended:
 - You must submit official transcripts from all the universities you have attended. 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 Diploma

Students must meet the following requirements:

Compulsory Courses:

SYS 5160	Systems Integration	3 Units
12 course units from:		12 Units
SYS 5100	Systems Engineering	
SYS 5110	Foundation of Modelling and Simulation	
SYS 5120	Applied Probability	
SYS 5130	Systems Optimization and Management	
SYS 5140	Economic System Design	

Transfer from Graduate Diploma to Master's

Students enrolled in the graduate diploma program can request to transfer to the master's in systems science (MSysSc) or to the master of science in systems science (MSc) in accordance with section A.7.1 of the general regulations in effect for graduate studies.

Students enrolled in the graduate diploma who have successfully completed the required 15 units may apply for admission to one of the master's programs in systems science instead of accepting the graduate diploma. Applicants for the MSc must present an outline of their research approved by their potential thesis supervisor. If admitted to the master's, the residency requirements and the diploma courses will be counted towards the requirements of the master's. Admission is competitive, based on academic and professional experience prior to and concurrent with performance in the diploma courses. Diploma students are invited to consult representatives of the program committee regarding their intention to seek acceptance into one of the master's programs.

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

SYS 5100 Systems Engineering (3 units)

Controllability and observability, Euler-Lagrange equations, Pontryagin maximum principle, dynamic programming, linear quadratic regulator problem, matrix Riccati differential equations and properties of their solution, design of optimal regulator based on steady state solution of the Riccati differential equation, time optimal control, LaSalle bang-bang principle, applications to motor speed control, satellite attitude control, etc.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5110 Foundation of Modelling and Simulation (3 units)

Fundamental aspects of systems modelling and the simulation process. Elements of continuous system simulation. Issues relating to the numerical solution of ordinary differential equations. Elements of discrete event simulation. Generation of random numbers and variates. Simulation validation and quality assurance. Introduction to simulation languages.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5120 Applied Probability (3 units)

An introduction to stochastic processes, with emphasis on regenerative phenomena. Review of limit theorems and conditioning. The Poisson process. Renewal theory and limit theorems for regenerative processes; Discrete-time and continuous-time Markov processes with countable state space. Applications to queueing.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5130 Systems Optimization and Management (3 units)

Analysis of user requirements and model design. Data mining. Use of optimization software. Systems thinking and its application to economic systems and hierarchical systems. Applications to economic systems simulation, modeling, optimization and management.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5140 Economic System Design (3 units)

Introduction to the epistemology of systems thinking and its application to economic systems. Basic concepts of complex systems thinking including hierarchical systems and economic systems simulation and behaviour. Soft systems thinking. Examples from other fields of application will be reviewed from an interdisciplinary perspective.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5160 Systems Integration (3 units)

Planning, design of complex systems from continuous to discrete time. Synthesis of systems methodology. State estimation. Parameters identification. Discretization and stochastic effects. Dynamic, logic control. Modelling, discrete event, simulation examples.

Course Component: Lecture

Prerequisites: 6 course units from SYS 5100, SYS 5110, SYS 5120, SYS 5130, SYS 5140.

SYS 5190 Directed Readings in Systems Science (3 units)

Directed Readings in Systems Science

Course Component: Lecture

Courses SYS 5190, SYS 5975 cannot be combined for units.

SYS 5975 Projet en science des systèmes / Project in Systems Science (6 crédits / 6 units)

Volet / Course Component: Recherche / Research

Les cours SYS 5190, SYS 5975 ne peuvent être combinés pour l'obtention de crédits. / Courses SYS 5190, SYS 5975 cannot be combined for units.

SYS 7990 Proposition de thèse de maîtrise / Master Thesis Proposal

Volet / Course Component: Recherche / Research