2018-2019 Graduate Calendar

The information published in this Graduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2018-2019 academic year, including the Summer Semester 2018, Fall Semester 2018 and the Winter Semester 2019.

For your convenience the Graduate Calendar is available in PDF format.

If you wish to link to the Graduate Calendar please refer to the Linking Guidelines.

The University is a full member of:

• Universities of Canada

Contact Information:

University of Guelph
Guelph, Ontario, Canada
N1G 2W1
519-824-4120

Revision Information:

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<th>Date</th>
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<tr>
<td>May 1, 2018</td>
<td>Initial Publication</td>
</tr>
<tr>
<td>August 10, 2018</td>
<td>Revision 1</td>
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Disclaimer
The Office of Graduate Studies has attempted to ensure the accuracy of this on-line Graduate Calendar. However, the publication of information in this document does not bind the university to the provision of courses, programs, schedules of studies, fees, or facilities as listed herein.

Limitations
The University of Guelph reserves the right to change without notice any information contained in this calendar, including any rule or regulation pertaining to the standards for admission to, the requirements for the continuation of study in, and the requirements for the granting of degrees or diplomas in any or all of its programs.

The university will not be liable for any interruption in, or cancellation of, any academic activities as set forth in this calendar and related information where such interruption is caused by fire, strike, lock-out, inability to procure materials or trades, restrictive laws or governmental regulations, actions taken by the faculty, staff or students of the university or by others, civil unrest or disobedience, Public Health Emergencies, or any other cause of any kind beyond the reasonable control of the university.

The University of Guelph reaffirms section 1 of the Ontario Human Rights Code, 1981, which prohibits discrimination on the grounds of race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, sexual orientation, handicap, age, marital status or family status.

The university encourages applications from women, aboriginal peoples, visible minorities, persons with disabilities, and members of other under-represented groups.
Introduction

Collection, Use and Disclosure of Personal Information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) [http://www.e-laws.gov.on.ca/DLB/Laws/Statutes/English/90f31_e.htm](http://www.e-laws.gov.on.ca/DLB/Laws/Statutes/English/90f31_e.htm). This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes. Certain personal information is disclosed to external agencies, including the Ontario Universities Application Centre, the Ministry of Advanced Education and Skills Development, and Statistics Canada, for statistical and planning purposes, and is disclosed to other individuals or organizations in accordance with the Office of Registrarial Services Departmental Policy on the Release of Student Information. For details on the use and disclosure of this information call the Office of Registrarial Services at the University at (519) 824-4120 or see [https://www.uoguelph.ca/registrar/](https://www.uoguelph.ca/registrar/).

Statistics Canada - Notification of Disclosure

For further information, please see Statistics Canada's web site at [http://www.statcan.gc.ca](http://www.statcan.gc.ca) and Section XIV Statistics Canada.

Address for University Communication

Depending on the nature and timing of the communication, the University may use one of these addresses to communicate with students. Students are, therefore, responsible for checking all of the following on a regular basis:

Email Address

The University issued email address is considered an official means of communication with the student and will be used for correspondence from the University. Students are responsible for monitoring their University-issued email account regularly.

Home Address

Students are responsible for maintaining a current mailing address with the University. Address changes can be made, in writing, through Registrarial Services.

Name Changes

The University of Guelph is committed to the integrity of its student records, therefore, each student is required to provide either on application for admission or on personal data forms required for registration, his/her complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation.

Student Confidentiality and Release of Student Information Policy Excerpt

The University undertakes to protect the privacy of each student and the confidentiality of his or her record. To this end the University shall refuse to disclose personal information to any person other than the individual to whom the information relates where disclosure would constitute an unjustified invasion of the personal privacy of that person or of any other individual. All members of the University community must respect the confidential nature of the student information which they acquire in the course of their work.

Complete policy at [https://www.uoguelph.ca/secretariat/office-services/university-secretariat/university-policies](https://www.uoguelph.ca/secretariat/office-services/university-secretariat/university-policies).
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**Computer Science**

The School of Computer Science offers an MSc degree in Computer Science. The program emphasizes both academic and applied research that can contribute to further research, academic studies, industry partnerships, and government programs. The MSc degree encompasses professors at the cutting edge of their fields, course offerings covering a wide range of computer science areas, and competitive financial incentives to eligible students.

There are four main fields that students can study in. However, interaction with other disciplines is encouraged and many of our professors work in collaboration with both industry partners and other Schools/Departments at the University of Guelph. The fields are:

- **Applied Modelling (AM):** Students working in this field will engage in research on topics such as graph theory and algorithms, formal specifications, hardware-software co-design, and interdisciplinary work in environmental modeling and disease spread modeling.
- **Artificial Intelligence (AI):** Students working in this field will engage in research on topics such as Bayesian techniques, artificial neural networks, evolutionary computation, fuzzy systems, data mining, pattern recognition, and, intelligent agents.
- **Distributed Computing (DC):** Students working in this field will engage in research on topics such as parallel computing, distributed systems, embedded systems, multi-agent systems, mobile computing, wireless networks, and ad hoc networks.
- **Human Computer Interaction (HCI):** Students working in this field will engage in research on topics such as context-aware systems, usability, interface design, and mobile and ubiquitous computing.

The School of Computer Science also offers an Interdisciplinary PhD degree in Computational Sciences. More information on can be found at: Computational Sciences

**Administrative Staff**

**Director**
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**Graduate Program Coordinator**
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**Graduate Program Assistant**
Jennifer Hughes (224 Reynolds, Ext. 56402)
gradassist@socs.uoguelph.ca

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**David K.Y. Chiu**
BA Waterloo, BSc Guelph, MSc Queen's, PhD Waterloo - Professor

**Rozita Dara**
BSc Shahid Tesheshi, MSc Guelph, PhD Waterloo - Assistant Professor

**Ali Dehghantanha**
BSc Mashhad, MSc, PhD Putra Malaysia - Assistant Professor

**David Flata**
BSc, MSc, PhD Saskatchewan - Associate Professor

**William Gardner**
BSEE MIT, BEd Toronto, PhD Victoria - Associate Professor

**Dan Gillis**
BSc, MSc, PhD Guelph - Assistant Professor

**Gary Gréval**
BSc Brock, MSc, PhD Guelph - Associate Professor

**Stefan C. Kremer**
BSc Guelph, PhD Alberta - Associate Professor and Director

**Xining Li**
BSc, MSc Nanjing, PhD Calgary - Professor

**Pascal Matsakis**
BSc, MSc, PhD Paul Sabatier (France) - Professor

**Judi R. McCuaig**
BEd, BSc, MS, PhD Saskatchewan - Associate Professor

**Blair Nonnecke**
BSc, MSc Guelph, PhD South Bank - Associate Professor

**Charlie F. Ohimbo**
MSc Kiev, PhD New Brunswick - Associate Professor

**Joseph Sawada**
BSc, PhD Victoria (British Columbia) - Associate Professor and Graduate Program Coordinator

**Fei Song**
BSc Jilin (China), MSc Academia Sinica (China), PhD Waterloo - Associate Professor

**Deborah A. Stacey**
BSc Guelph, MASc, PhD Waterloo - Associate Professor

**Fangjun Wang**
BE Changsha, MSc Peking, PhD Waterloo - Professor

**Mark Wineberg**
BSc Toronto, MSc, PhD Carleton - Associate Professor

**Michael A. Wirth**
BSc New England (Aust.), MSc Manitoba, PhD RMIT Melbourne - Associate Professor

**Yang Xiang**
BSc, MSc BUAA (Beijing), PhD UBC - Professor

**MSc Program**

The MSc is offered in the fields of: 1) applied modelling; 2) artificial intelligence; 3) distributed computing; and 4) human computer interaction.

**Admission Requirements**

Most spaces are filled in March for entry the following September, and in October for entry the following January. Prospective students should check the School of Computer Science website [http://www.socs.uoguelph.ca](http://www.socs.uoguelph.ca) for admission procedures and deadlines.

**General Requirements**

To be considered for admission, applicants must have a four-year honours degree in computer science, or a four-year honours degree in another discipline with a minor in computer science. Applicants must meet the minimum admission requirements of both the university and the School of Computer Science, including at least a 75% average during the previous two years of full-time university study for a degree. In addition to the university and School of Computer Science requirements, applicants must also submit (i) a current CV and (ii) a statement of research that would normally include the following sections:

- Specific research interest with justification.
- Academic and/or practical research experience.

**Course Requirement**

Entrants who have a four-year honours degree in another discipline and a minor (or equivalent) in computer science must have taken at least 12 courses as described below. University of Guelph equivalents are given for comparison as appropriate.

(A) Seven prescribed courses:

- An introductory programming course (CIS*1500).
- An intermediate programming course (CIS*2500).
- An object-oriented programming course (CIS*2430).
- A software systems development course (CIS*2750).
- A course on data structures (CIS*2520).
- A course on discrete structures (CIS*1910 or CIS*2910).
- An introductory course in calculus (MATH*1200).

(B) Three core courses at the second-year or higher level selected from the following:

- A course on hardware and/or assembly language (CIS*2030).
- A course on digital systems (CIS*3120).
- A course on simulation and/or modelling (CIS*2460).
- A database course (CIS*3350).
- An operating systems course (CIS*3110).
- A computer algorithms course (CIS*3490).
- A course on automata theory (CIS*3150).
- A statistics course (STAT*2040).

(C) Two elective courses at the third-year or higher level:

- These courses should be related to the applicant’s proposed research area. They can be from a discipline other than computer science if deemed relevant by the proposed supervisor.
- Applicants who meet requirements (A) and (B) but who do not meet requirement (C) may be granted provisional admission, i.e., they may be granted admission with the provision that they take specified courses within a specified time and achieve grades above a specified threshold.

**English Proficiency**

A test of English proficiency is required of all applicants whose first language is not English. Please refer to the University of Guelph Admission Requirements.

**Degree Requirement**

Once a student has been admitted to the MSc program, the following components are required for the successful completion of the MSc degree:

- Completion of the Technical Communication and Research Methodology course (CIS*6890) and at least four other graduate courses.
- Completion of the seminar requirement.
- An accepted thesis.

**Duration of the Program**

March 1, 2019
The MSc degree is a two-year program during which students complete five courses, give a public seminar and complete and successfully defend a thesis. Heavy emphasis is placed on the thesis, which usually requires at least two semesters. Students should plan on spending at least four full-time semesters (16 months) in the program assuming adequate preparation for graduate work.

**Course Requirement**

An MSc student is required to take the Technical Communication and Research Methodology course CIS*6890 and at least four other CIS graduate courses. Of these four courses, at least two should be outside of the student's thesis topic area. This area and the courses which fall outside of this area are identified by the student's advisor. With approval from the Graduate Program Committee, a CIS graduate course requirement may also be met by a non-CIS graduate course or by a 4000-level course. At most one reading course (CIS*6660) and at most one 4000-level course can count towards the course requirement.

**Seminar Requirement**

An MSc student must give one publicly announced research seminar on his/her MSc thesis research. The student will be allocated times and dates for the seminar. It must be attended by the student's advisor and at least one other member of the student's Advisory Committee. The quality of the presentation is graded on a pass/fail basis. The MSc seminar requirement is intended for students to practice presentation and communication skills and to participate in the process of knowledge dissemination as part of the academic life.

**Thesis Defence**

Arrangements for the MSc thesis defence should be made at least four weeks prior to the anticipated date of the defence, and the student must submit his/her MSc thesis to the Examination Committee at least two weeks prior to the defence. The examination consists of an oral presentation by the student followed by questions from the Examination Committee.

**Collaborative Specializations**

**Artificial Intelligence**

The School of Computer Science participates in the collaborative specialization in Artificial Intelligence. MSc students wishing to undertake thesis research with an emphasis on artificial intelligence are eligible to apply to register concurrently in Computer Science and the collaborative specialization. Students should consult the Artificial Intelligence listing for more information.

**Courses**

**Core Courses**

The core graduate courses are designed to be accessible to any student with an appropriate background in Computer Science and will provide enough introduction for those unfamiliar with the specific area to allow them to keep up with the advanced material.

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<th>Course Code</th>
<th>Course Title</th>
<th>Department(s):</th>
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<tr>
<td>CIS*6000 Distributed Systems</td>
<td>U [0.50] The evolution of distributed computer systems. Models for distributed processing. Taxonomy of multiprocessor systems. Interconnection networks. Memory and I/O for distributed architectures. Performance of distributed systems.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6020 Artificial Intelligence</td>
<td>U [0.50] An examination of Artificial Intelligence principles and techniques such as: logic and rule based systems; forward and backward chaining; frames, scripts, semantic nets and the object-oriented approach; the evaluation of intelligent systems and knowledge acquisition. A sizeable project is required and applications in other areas are encouraged.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6030 Information Systems</td>
<td>U [0.50] Relational and other database systems, web information concurrence protocols, data integrity, transaction management, distributed databases, remote access, data warehousing, data mining.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6070 Discrete Optimization</td>
<td>U [0.50] This course will discuss problems where optimization is required and describes the most common techniques for discrete optimization such as the use of linear programming, constraint satisfaction methods, and genetic algorithms.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6320 Image Processing Algorithms and Applications</td>
<td>U [0.50] Brightness transformation, image smoothing, image enhancement, thresholding, segmentation, morphology, texture analysis, shape analysis, applications in medicine and biology.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6420 Soft Computing</td>
<td>U [0.50] Neural networks, artificial intelligence, connectionist model, back propagation, resonance theory, sequence processing, software engineering concepts.</td>
<td>School of Computer Science</td>
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**Advanced Courses**

The advanced graduate courses are taught with the assumption that the student has sufficient background in the research area to understand the advanced concepts and research ideas. Students who intend to take a course for which they have insufficient background should consult with the instructor prior to enrollment in the course.

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<tr>
<th>Course Code</th>
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<tr>
<td>CIS*6890 Technical Communication and Research Methodology</td>
<td>U [0.50] This course aims to develop students' ability in technical communication and general research methodology. Each student is expected to present a short talk, give a mini lecture, review a conference paper, write a literature survey and critique fellow students' talks and lectures.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6650 Neural Networks</td>
<td>U [0.50] Artificial neural networks, dynamical recurrent networks, dynamic input/output sequences, communications signal identification, syntactic pattern recognition.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6200 Bioinformatics</td>
<td>U [0.50] Data mining and bioinformatics, molecular biology databases, taxonomic groupings, sequences, feature extraction, Bayesian inference, cluster analysis, information theory, machine learning, feature selection.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*5080 Genetic Algorithms</td>
<td>U [0.50] This course introduces the student to basic genetic algorithms, which are based on the process of natural evolution. It is explored in terms of its mathematical foundation and applications to optimization in various domains.</td>
<td>School of Computer Science</td>
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**Collusive Specializations**

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<th>Course Code</th>
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<tr>
<td>CIS*6090 Hardware/Software Co-design of Embedded Systems</td>
<td>U [0.50] Specification and design of embedded systems, system-on-a-chip paradigm, specification languages, hardware/software co-design, performance estimation, co-simulation and validation, processes architectures and software synthesis, reconfigurable code generation and optimization.</td>
<td>School of Computer Science</td>
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<tr>
<td>CIS*6100 Parallel Processing Architectures</td>
<td>U [0.50] Parallelism in uniprocessor systems, parallel architectures, memory structures, pipelined architectures, performance issues, multiprocessor architectures.</td>
<td>School of Computer Science</td>
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<tr>
<td>CIS*6120 Uncertainty Reasoning in Knowledge Representation</td>
<td>U [0.50] Representation of uncertainty, Dempster-Schafer theory, fuzzy logic, Bayesian belief networks, decision networks, dynamic networks, probabilistic models, utility theory.</td>
<td>School of Computer Science</td>
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<tr>
<td>CIS*6130 Object-Oriented Modeling, Design and Programming</td>
<td>U [0.50] Objects, modeling, program design, object-oriented methodology, UML, CORBA, database.</td>
<td>School of Computer Science</td>
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<td>CIS*6140 Software Engineering</td>
<td>U [0.50] This course will discuss problems where optimization is required and describes the most common techniques for discrete optimization such as the use of linear programming, constraint satisfaction methods, and meta-heuristics.</td>
<td>School of Computer Science</td>
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<tr>
<td>CIS*6160 Multiagent Systems</td>
<td>U [0.50] Intelligent systems consisting of multiple autonomous and interacting subsystems with emphasis on distributed reasoning and decision making. Deductive reasoning agents, practical reasoning agents, probabilistic reasoning agents, reactive and hybrid agents, negotiation and agreement, cooperation and coordination, multiagent search, distributed MDP, game theory, and modal logics.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6200 Design Automation in Digital Systems</td>
<td>U [0.50] Techniques and software tools for design of digital systems. Material covered includes high-level synthesis, design for testability, and FPGA's in design and prototyping.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>CIS*6490 Analysis and Design of Computer Algorithms</td>
<td>U [0.25] The design and analysis of efficient computer algorithms: standard methodologies, asymptotic behaviour, optimality, lower bounds, implementation considerations, graph algorithms, matrix computations (e.g. Strassen's method), NP-completeness.</td>
<td>School of Computer Science</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
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<tr>
<td>CIS*6650</td>
<td>Topics in Computer Science I U</td>
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<td>Department(s):</td>
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<tr>
<td>CIS*6660</td>
<td>Topics in Computer Science II U</td>
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