2020-2021 Graduate Calendar

The information published in this Graduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2020-2021 academic year, including the Summer Semester 2020, Fall Semester 2020 and the Winter Semester 2021.

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

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Revision Information:

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<tr>
<td>May 25, 2020</td>
<td>Initial Publication</td>
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<tr>
<td>June 3, 2020</td>
<td>Revision 1</td>
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Disclaimer

The information published in this Graduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2020-2021 academic year, including the Summer Semester 2020, the Fall Semester 2020 and the Winter Semester 2021.

The University reserves the right to change without notice any information contained in this calendar, including but not limited to that related to tuition and other fees, standards of admission, course delivery or format, continuation of study, and the offering or requirements for the granting of, degrees or diplomas in any or all of its programs. The publication of this calendar does not bind the University to the provision of courses, programs, schedules of study, or facilities as listed herein.

The University will not be liable for any failure or delay in performance arising out of any cause or causes beyond its reasonable control. Such causes may include but are not limited to fire, strike, lock-out, inability to procure materials or trades, war, mass-casualty event, flood, local, regional or global outbreak of disease or other public health emergency, social distancing or quarantine restriction, legislative or regulatory requirements, unusually severe weather, failure of public utility or common carrier, or attacks or other malicious act, including but not limited to attacks on or through the internet, or any internet service, telecommunications provider or hosting facility.

In March 2020 the World Health Organization declared a global pandemic of the virus leading to COVID-19. The Governments of Canada, the Province of Ontario, and local Governments responded to the pandemic with legislative amendments, controls, orders, by-laws, requests and requirements (collectively, the “Governmental Response”). It is uncertain how long the pandemic, and the related Governmental Response, will continue, and it is unknown whether there may be a resurgence of the virus leading to COVID-19 or any mutation thereof (collectively, the “Virus”) and resulting or supplementary renewed Government Response. Without limiting the foregoing paragraph, the University shall not be liable for costs associated with any failure or delay in performance arising out of:

1. the continued spread of the Virus;
2. the continuation of or renewed Governmental Response to control the spread of the Virus; and
3. a University decision, made on an organization-wide basis and in good faith, to control the spread of the Virus, even if exceeding the then current specific Government Response.

In particular, the COVID-19 pandemic may necessitate a revision of the format of course offerings such that courses are offered in whole or in part on an alternate delivery model to in-person classes. Tuition and mandatory fees have been set regardless of the method of instruction and will not be refunded in the event instruction occurs remotely for any part of the academic year.

Dates or times of performance including the Schedule of Dates may be extended as appropriate and the University will notify students promptly of the existence and nature of such delay and shall, so far as practicable, use reasonable efforts to minimize and mitigate any such delay or non-performance.

In the event of a discrepancy between a print version (downloaded) and the Web version, the Web version will apply.

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/DBLaws/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/.

Statistics Canada - Notification of Disclosure

For further information, please see Statistics Canada's web site at 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, their 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 their 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.
Learning Outcomes

Graduate Degree Learning Outcomes

On May 27, 2013, the University of Guelph Senate approved the following five University-wide Learning Outcomes as the basis from which to guide the development of graduate degree programs, specializations and courses:

1. Critical and Creative Thinking
2. Literacy
3. Global Understanding
4. Communication
5. Professional and Ethical Behaviour

These learning outcomes are also intended to serve as a framework through which our educational expectations are clear to students and the broader public; and to inform the process of outcomes assessment through the quality assurance process (regular reviews) of programs and departments.

An on-line guide to the learning outcomes, links to the associated skills, and detailed rubrics designed to support the development and assessment of additional program and discipline-specific outcomes, are available for reference on the Learning Outcomes website.

Critical and Creative Thinking

Critical and creative thinking is a concept in which one applies logical principles, after much inquiry and analysis, to solve problems with a high degree of innovation, divergent thinking and risk taking. Those mastering this outcome show evidence of integrating knowledge and applying this knowledge across disciplinary boundaries. Depth and breadth of understanding of disciplines is essential to this outcome. At the graduate level, originality in the application of knowledge (master’s) and undertaking of research (doctoral) is expected.

In addition, Critical and Creative Thinking includes, but is not limited to, the following outcomes: Independent Inquiry and Analysis; Problem Solving; Creativity; and Depth and Breadth of Understanding.

Literacy

Literacy is the ability to extract information from a variety of resources, assess the quality and validity of the material, and use it to discover new knowledge. The comfort in using quantitative literacy also exists in this definition, as does using technology effectively and developing visual literacy.

In addition, Literacy includes, but is not limited to, the following outcomes: Information Literacy, Quantitative Literacy, Technological Literacy, and Visual Literacy.

Global Understanding

Global understanding encompasses the knowledge of cultural similarities and differences, the context (historical, geographical, political and environmental) from which these arise, and how they are manifest in modern society. Global understanding is exercised as civic engagement, intercultural competence and the ability to understand an academic discipline outside of the domestic context.

In addition, Global Understanding includes, but is not limited to, the following outcomes: Global Understanding, Sense of Historical Development, Civic Knowledge and Engagement, and Intercultural Competence.

Communication

Communication is the ability to interact effectively with a variety of individuals and groups, and convey information successfully in a variety of formats including oral and written communication. Communication also comprises attentiveness and listening, as well as reading comprehension. It includes the ability to communicate and synthesize information, arguments, and analyses accurately and reliably.

In addition, Communication includes, but is not limited to, the following outcomes: Oral Communication, Written Communication, Reading Comprehension, and Integrative Communication.

Professional and Ethical Behaviour

Professional and ethical behaviour requires the ability to accomplish the tasks at hand with proficient skills in teamwork and leadership, while remembering ethical reasoning behind all decisions. The ability for organizational and time management skills is essential in bringing together all aspects of managing self and others. Academic integrity is central to mastery in this outcome. At the graduate level, intellectual independence is needed for professional and academic development and engagement.

In addition, Professional and Ethical Behaviour includes, but is not limited to, the following outcomes: Teamwork, Ethical Reasoning, Leadership, Personal Organization and Time Management, and Intellectual Independence.
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X. Collaborative Specializations

Collaborative specializations are intra-university graduate fields of study that provide additional multidisciplinary experiences for students enrolled in and completing the degree requirements of an approved masters or doctoral program.
Artificial Intelligence

The Collaborative Specialization in Artificial Intelligence (AI) provides thesis-based masters students in Computer Science, Engineering, Mathematics and Statistics, and Bioinformatics with a diverse and comprehensive knowledge base in AI. Students wishing to undertake graduate studies at the masters level with emphasis on artificial intelligence will be admitted by a participating department and will register in both the participating department and in the collaborative specialization.

Students will learn from a multidisciplinary team of faculty with expertise in fundamental and applied deep learning and machine learning, while conducting AI-related research guided by a faculty advisor. By the end of this program, graduates will have comprehensive understanding of leading-edge AI techniques and will be able to apply this knowledge to solve real-world problems.

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Mohammad Biglarbegian
Associate Professor, Engineering
Scott Brandon
Assistant Professor, Engineering
David Calvert
Associate Professor, Computer Science
Monica Cojocaru
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Christopher Collier
Assistant Professor, Engineering
Rozita Dara
Assistant Professor, Computer Science
Fantahun Defersha
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Assistant Professor, Computer Science
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Associate Professor, Engineering
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Associate Professor, Engineering
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Zeny Feng
Associate Professor, Mathematics and Statistics
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Associate Professor, Computer Science
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Assistant Professor, Engineering
Bahram Gharabaghi
Professor, Engineering
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Associate Professor, Engineering
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Associate Professor, Computer Science
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Associate Professor, Computer Science
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Professor, Computer Science
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Professor, Mathematics and Statistics
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William Lubitz
Associate Professor, Engineering
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Pascal Matsakis
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Associate Professor, Computer Science
Deborah Stacey
Associate Professor, Computer Science
Graham Taylor
Associate Professor, Engineering
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Assistant Professor, Animal Biosciences
Fanglin Wang
Professor, Computer Science
Mark Wineberg
Associate Professor, Computer Science
Simon Yang
Professor, Engineering
Yang Xiang
Professor, Computer Science

Associated Graduated Faculty

Dirk Steinke
Associate Director Centre for Biodiversity and Adjunct Professor Integrative Biology

MSc/MASc Collaborative Specialization

Admission Requirements

Masters students in the Collaborative Specialization in Artificial Intelligence must meet the admission requirements of the participating department in which they are enrolled. The application process has two stages. First, prospective students will apply to their primary program of interest, identifying interest in the collaborative specialization as a focus. If the student is admitted to the primary program as a thesis student, the second stage is then admission to the collaborative specialization. All applications to participate in the Collaborative Specialization in Artificial Intelligence will be vetted by the specialization’s Graduate Program Coordinator.

Program Requirements

Masters students in the collaborative specialization in artificial intelligence must complete:

UNIV*6080 [0.25] Computational Thinking for Artificial Intelligence
UNIV*6090 [0.50] Artificial Intelligence Applications and Society
One of the following Elective Core courses:
CIS*6020 [0.50] Artificial Intelligence
ENGG*6500 [0.50] Introduction to Machine Learning
STAT*6801 [0.50] Statistical Learning
Two of the following Complementary AI-related courses:
BINF*6970 [0.50] Statistical Bioinformatics
CIS*6050 [0.50] Neural Networks
CIS*6060 [0.50] Bioinformatics
CIS*6070 [0.50] Discrete Optimization
CIS*6080 [0.50] Genetic Algorithms
Required Courses

**UNIV*6080** Computational Thinking for Artificial Intelligence U [0.25]
This course will provide students with an overview of the mathematical and computational foundation that is required to undertake artificial intelligence and machine learning research. Students will also gain an understanding of the historical context, breadth, and current state of the field. Students are expected to have already taken undergraduate courses in probability & statistics, calculus, linear algebra, and data structures & algorithms (STAT*2120, MATH*1210, ENGG*1500, and CIS*2520, or equivalents).

**Offering(s):** Also offered through Distance Education format.

**Department(s):** Dean's Office, College of Engineering and Physical Sciences

**UNIV*6090** Artificial Intelligence Applications and Society U [0.50]
This multidisciplinary, team-taught course provides an in-depth study of how artificial intelligence methodologies can be applied to solve real-world problems in different fields. Students will work in groups to propose solutions whilst considering social and ethical implications of artificial intelligence technologies.

**Prerequisite(s):** UNIV*6080

**Restriction(s):** Restricted to students in the collaborative specialization in Artificial Intelligence

**Department(s):** Dean's Office, College of Engineering and Physical Sciences

Elective Core

**CIS*6020** Artificial Intelligence 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.

**Department(s):** School of Computer Science

**ENGG*6500** Introduction to Machine Learning U [0.50]
The aim of this course is to provide students with an introduction to algorithms and techniques of machine learning particularly in engineering applications. The emphasis will be on the fundamentals and not specific approach or software tool. Class discussions will cover and compare all current major approaches and their applicability to various engineering problems, while assignments and project will provide hands-on experience with some of the tools.

**Department(s):** School of Engineering

**STAT*6801** Statistical Learning U [0.50]
Topics include: nonparametric and semiparametric regression; kernel methods; regression splines; local polynomial models; generalized additive models; classification and regression trees; neural networks. This course deals with both the methodology and its application with appropriate software. Areas of application include biology, economics, engineering and medicine.

**Department(s):** Department of Mathematics and Statistics

Complementary AI-related

**BINF*6970** Statistical Bioinformatics W [0.50]
This course presents a selection of advanced approaches for the statistical analysis of data that arise in bioinformatics, especially genomic data. A central theme to this course is the modelling of complex, often high-dimensional, data structures.

**Restriction(s):** Restricted to students in Bioinformatics programs.

**Department(s):** Dean's Office, College of Biological Science

CIS*6050 Neural Networks U [0.50]

**Department(s):** School of Computer Science

CIS*6060 Bioinformatics 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.

**Department(s):** School of Computer Science

CIS*6070 Discrete Optimization 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.

**Department(s):** School of Computer Science

CIS*6080 Genetic Algorithms 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.

**Department(s):** School of Computer Science

CIS*6100 Parallel Processing Architectures U [0.50]
Parallelism in uniprocessor systems, parallel architectures, memory structures, pipelined architectures, performance issues, multiprocessor architectures.

**Department(s):** School of Computer Science

CIS*6120 Uncertainty Reasoning in Knowledge Representation U [0.50]
Representation of uncertainty, Dempster-Schafer theory, fuzzy logic, Bayesian belief networks, decision networks, dynamic networks, probabilistic models, utility theory.

**Department(s):** School of Computer Science

CIS*6140 Software Engineering U [0.50]
Parallellism in uniprocessor systems, parallel architectures, memory structures, pipelined architectures, performance issues, multiprocessor architectures.

**Department(s):** School of Computer Science

CIS*6160 Multiagent Systems 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.

**Department(s):** School of Computer Science

CIS*6320 Image Processing Algorithms and Applications U [0.50]
Brightness transformation, image smoothing, image enhancement, thresholding, segmentation, morphology, texture analysis, shape analysis, applications in medicine and biology.

**Department(s):** School of Computer Science

CIS*6420 Soft Computing U [0.50]
Neural networks, artificial intelligence, connectionist model, back propagation, resonance theory, sequence processing, software engineering concepts.

**Department(s):** School of Computer Science

ENGG*6100 Machine Vision U [0.50]
Computer vision studies how computers can analyze and perceive the world using input from imaging devices. Topics covered include image pre-processing, segmentation, shape analysis, object recognition, image understanding, 3D vision, motion and stereo analysis, as well as case studies.

**Department(s):** School of Engineering

ENGG*6140 Optimization Techniques for Engineering U [0.50]
This course serves as a graduate introduction into combinatorics and optimization. Optimization is the main pillar of Engineering and the performance of most systems can be improved through intelligent use of optimization algorithms. Topics to be covered: Complexity theory, Linear/Integer Programming techniques, Constrained/Unconstrained optimization and Nonlinear programming, Heuristic Search Techniques such as Tabu Search, Genetic Algorithms, Simulated Annealing and GRASP.

**Department(s):** School of Engineering

January 28, 2020

2020-2021 Graduate Calendar
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<th>Course Title</th>
<th>Type</th>
<th>Description</th>
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<tr>
<td>ENGG*6570</td>
<td>Advanced Soft Computing U [0.50]</td>
<td>Undergrad</td>
<td>Neural dynamics and computation from a single neuron to a neural network architecture. Advanced neural networks and applications. Soft computing approaches to uncertainty representation, multi-agents and optimization. Prerequisite(s): ENGG*4430 Department(s): School of Engineering</td>
</tr>
<tr>
<td>MATH*6020</td>
<td>Scientific Computing U [0.50]</td>
<td>Undergrad</td>
<td>This course covers the fundamentals of algorithms and computer programming. This may include computer arithmetic, complexity, error analysis, linear and nonlinear equations, least squares, interpolation, numerical differentiation and integration, optimization, random number generators, Monte Carlo simulation; case studies will be undertaken using modern software. Department(s): Department of Mathematics and Statistics</td>
</tr>
<tr>
<td>MATH*6021</td>
<td>Optimization I U [0.50]</td>
<td>Undergrad</td>
<td>A study of the basic concepts in: linear programming, convex programming, non-convex programming, geometric programming and related numerical methods. Department(s): Department of Mathematics and Statistics</td>
</tr>
<tr>
<td>MATH*6051</td>
<td>Mathematical Modelling U [0.50]</td>
<td>Undergrad</td>
<td>The process of phenomena and systems model development, techniques of model analysis, model verification, and interpretation of results are presented. The examples of continuous or discrete, deterministic or probabilistic models may include differential equations, difference equations, cellular automata, agent based models, network models, stochastic processes. Department(s): Department of Mathematics and Statistics</td>
</tr>
<tr>
<td>PHIL*6760</td>
<td>Science and Ethics U [0.50]</td>
<td>Undergrad</td>
<td>A consideration of the problems which arise in the conjunction of science and ethics. Department(s): Department of Philosophy</td>
</tr>
<tr>
<td>STAT*6841</td>
<td>Computational Statistical Inference U [0.50]</td>
<td>Undergrad</td>
<td>This course covers Bayesian and likelihood methods, large sample theory, nuisance parameters, profile, conditional and marginal likelihoods, EM algorithms and other optimization methods, estimating functions, Monte Carlo methods for exploring posterior distributions and likelihoods, data augmentation, importance sampling and MCMC methods. Department(s): Department of Mathematics and Statistics</td>
</tr>
</tbody>
</table>

### Undergraduate Complementary AI-related Courses

- **ENGG*4460** [0.50] Robotic Systems
- **STAT*4000** [0.50] Statistical Computing
X. Collaborative Specializations, International Development Studies

The International Development Studies (IDS) collaborative specialization provides a focal point for graduate teaching and research in the area of international development. The collaborative specialization combines training in a particular discipline with exposure to a broad range of social science perspectives. Faculty expertise encompasses various aspects of development in Asia, Africa, Eastern and Western Europe and the Americas. Students wishing to pursue a Master's or PhD degree with the designation "International Development Studies" must enter the collaborative specialization in International Development through a participating department.

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Master's Collaborative Specialization

Students wishing to pursue a Master's degree with the designation “International Development Studies” must enter the collaborative specialization in International Development through a participating department.

Admission Requirements

Students must meet the University's general requirement for a four-year Honours degree, or equivalent, from a recognized post-secondary institution with a B- average over the last two years of full-time equivalent study. Note that some departments set their admission requirement higher than B-.

Students must have completed the following:

• One undergraduate course in economics.
• One undergraduate course in a social science discipline
• One course in social science research methods or equivalent.

Program Requirements

Students complete International Development Studies core requirements and the requirements of their home department. The following are requirements for select departments; consult the IDS Graduate website for other departments.

IDS Master's Core Courses*
IDEV*6200 [1.00] Development Theory, Issues and Process
IDEV*6300 [0.50] Research and Analysis in a Development Context

Optional IDS Courses

Students in the collaborative specialization may undertake two optional interdisciplinary courses:
IDEV*6000 [0.50] Regional Context
IDEV*6500 [0.50] Fieldwork in International Development Studies
Departmental or Program Requirements

Programs not listed below are designed by special arrangements. All departmental requirements are subject to change. Students should confirm the departmental course requirements with the respective Graduate Program Coordinator.

Capacity Development and Extension (MSc)
CDE*6070 [0.50] Foundations of Capacity Building and Extension
CDE*6260 [0.50] Research Design
One of:
RPD*6380 [0.50] Application of Quantitative Techniques in Rural Planning and Development
EDRD*6000 [0.50] Qualitative Analysis in Rural Development
Two additional courses from the following CDE restricted electives group:
CDE*6290 [0.50] Special Topics in Capacity Building and Extension
CDE*6311 [0.50] Community Engagement and Public Participation
CDE*6320 [0.50] Capacity Building for Sustainable Development
CDE*6330 [0.50] Facilitation and Conflict Management
CDE*6410 [0.50] Readings in Capacity Building and Extension
CDE*6420 [0.50] Communication for Social and Environmental Change
CDE*6690 [0.50] Community Environmental Leadership
One open elective [0.50] (one IDS Master’s Core Course will fulfill this requirement)
A thesis OR
CDE*6900 [1.00] Major Research Paper
plus two more courses from the restricted electives group (see course list above)

Economics (MA)
ECON*6000 [0.50] Microeconomic Theory I
ECON*6020 [0.50] Macroeconomic Theory I
ECON*6940 [1.00] Research Project
One of:
ECON*6050 [0.50] Introduction to Econometric Methods
AND
ECON*6180 [0.50] Econometric Methods
OR
ECON*6140 [0.50] Econometrics I

Engineering (MEng in Environmental Engineering or Water Resources Engineering)
Six courses from the list of required graduate courses in Engineering (to be selected in consultation with advisor)
Plus one of:
ENGG*6950 [1.00] Final Project in Environmental Engineering
ENGG*6900 [1.00] Final Project in Water Resources Engineering

Engineering (MSc in Environmental Engineering or Water Resources Engineering)
Three courses from the list of required graduate courses in Engineering (to be selected in consultation with advisor)

English (MA)
Four English courses and a thesis
OR
Six English courses and
ENGL*6803 [1.00] Research Project

Environmental Sciences (MSc)
ENVS*6900 [0.50] Research Seminar in Environmental Sciences
Two other courses in consultation with the department.

Family Relations and Applied Nutrition (MSc)
Applied Human Nutrition
For all students in the MSc program in the field of Applied Human Nutrition, a minimum of 2.25 graduate credits will be chosen in consultation with the student's advisor and advisory committee including:
FRAN*6000 [0.50] Quantitative Research Methods
FRAN*6010 [0.50] Applied Statistics
FRAN*6020 [0.50] Qualitative Research Methods
FRAN*6550 [0.25] Research Seminar
One additional [0.5] graduate elective course such as FRAN*6610, FRAN*6510 or another graduate level elective course related to the student’s research specialization. It can be taken within Family Relations and Applied Nutrition or in other academic units of the university.
Students who enter the MSc-AHN program from a non-nutrition undergraduate program will also be required to take those undergraduate and/or graduate courses necessary to meet foundational knowledge in applied human nutrition. In addition, students must complete a research thesis.

Food, Agricultural and Resource Economics (MSc or MFARE)
Thesis based MSc
FARE*6380 [0.50] Applied Microeconomics for Agricultural Economists
FARE*6970 [0.50] Applied Quantitative Methods for Agricultural Economists
FARE*6910 [0.50] Applied Policy Analysis I
FARE*6100 [0.50] The Methodologies of Economics
FARE*6600 [0.50] Food Security and the Economics of Agri-Food Systems in Developing Countries
FARE*6800 [0.00] Seminar in Agricultural Economics
One additional course
A thesis

Course Work and Major Research Paper MFARE
FARE*6380 [0.50] Applied Microeconomics for Agricultural Economists
FARE*6910 [0.50] Applied Policy Analysis I
FARE*6970 [0.50] Applied Quantitative Methods for Agricultural Economists
FARE*6100 [0.50] The Methodologies of Economics
FARE*6600 [0.50] Food Security and the Economics of Agri-Food Systems in Developing Countries
FARE*6400 [0.50] Advanced Topics in Agricultural Economics
FARE*6800 [0.00] Seminar in Agricultural Economics
FARE*6140 [1.00] Major Paper in Food, Agricultural and Resource Economics

One additional course

Course Work MFARE
In order to satisfy the degree requirements of the course work option, students will complete successfully the following courses:
FARE*6380 [0.50] Applied Microeconomics for Agricultural Economists
FARE*6910 [0.50] Applied Policy Analysis I
FARE*6970 [0.50] Applied Quantitative Methods for Agricultural Economists
FARE*6100 [0.50] The Methodologies of Economics
FARE*6600 [0.50] Food Security and the Economics of Agri-Food Systems in Developing Countries
FARE*6800 [0.00] Seminar in Agricultural Economics
along with three additional graduate courses approved by the student’s advisory committee. Students in this option are restricted from taking FARE*6140

Geography (MA or MSc)
GEOG*6090 [0.50] Geographical Research Methods I
GEOG*6091 [0.50] Geographical Research Methods II
One other Geography course (which can be taken from the IDS core)
Either a thesis OR
GEOG*6180 [1.00] Research Project in Geography
plus one other Geography course not taken as part of the IDS core

History (MA)
Three History courses
One of:
Thesis
HIST*6400 [1.00] Major Paper

Latin American and Caribbean Studies (MA)
LACS*6010 [0.50] Latin American Identity and Culture
LACS*6020 [0.50] Re-Imagining Latin American, Latino and Caribbean Communities
LACS*6030 [0.50] Globalization and Insecurity in the Americas
Plus:
Thesis
Or:
LACS*6100 [1.00] Research Project
One other LACS course

Management (MA)
Degree Requirements
Students are required to take 8 courses (4.0 credits) plus the major research project (1.0 credit).

Core Courses:
MGMT*6100 [0.50] Evidence Based Management Research
MGMT*6200 [0.50] Leadership Assessment and Development

Fields:
Management Research
MGMT*6300 [0.50] Business Consulting
MGMT*6400 [0.50] Project Management
BUS*6800 [0.50] Readings in Leadership I
BUS*6810 [0.50] Readings in Leadership II
BUS*6820 [0.50] Readings in Management
BUS*6840 [0.50] Foundational Theories of Management

Accounting
ACCT*6100 [0.50] Integrated Cases I

2020-2021 Graduate Calendar
January 28, 2020
Restricted Electives:
One quantitative or qualitative research methods course (0.5 credits) with permission:

- ANTH*6140 [0.50] Qualitative Research Methods
- FRAN*6020 [0.50] Qualitative Research Methods
- MGMT*6120 [0.50] Quantitative Methods for Evidence Based Management
- MGMT*6830 [0.50] Applied Univariate Statistical Analysis for Management
- PSYC*6060 [0.50] Research Design and Statistics

Plus one additional course from the Political Science Department (elective)

MA Seminar

Political Science (MA)

IDS Requirements:
- POLS*6900 [0.25] Communications
- POLS*6940 [0.75] Research Design and Methods
- POLS*6730 [0.50] Development and Global Justice

One of:
- Thesis
- POLS*6790 [1.00] Major Research Project

Population Medicine (MSc course work)
- POPM*6200 [0.50] Epidemiology I
- POPM*6210 [0.50] Epidemiology II
- POPM*6250 [1.00] Project in Population Medicine

Note

*NB: A student's Population Medicine advisor may require a student to take POPM*6100, Seminar.

Public Health (MPH)
- PABI*6500 [0.50] Infectious Diseases and Public Health
- POPM*6200 [0.50] Epidemiology I
- POPM*6510 [0.50] Community Health Promotion
- POPM*6520 [0.50] Introduction to Epidemiological and Statistical Methods
- POPM*6530 [0.50] Health Communication
- POPM*6540 [0.50] Concepts in Environmental Public Health
- POPM*6550 [0.50] Public Health Policy and Systems
- POPM*6560 [1.00] Public Health Practice
- POPM*6570 [0.00] Public Health and Data Management
- POPM*6580 [0.00] Public Health Leadership and Administration

IDS Requirements:
- ANTH*6080 [0.50] Anthropological Theory
- ANTH*6140 [0.50] Qualitative Research Methods
- ANTH*6000 [0.50] Public Issues Anthropology

Either a Thesis and one additional course or
- ANTH*6660 [1.00] Major Paper

and three additional courses

Public Issues in Anthropology (MA)

Rural Planning and Development (MSc Planning)

Departmental Requirements
- RPD*6030 [0.50] International Rural Development Planning: Principles and Practices
- RPD*6170 [0.50] Rural Research Methods
- RPD*6240 [0.50] Planning and Development Theory
- RPD*6291 [0.50] Rural Development Administration
- RPD*6380 [0.50] Application of Quantitative Techniques in Rural Planning and Development

Plus a thesis and one additional RPD course
<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEV*6200</td>
<td>Development Theory, Issues and Process F-W [1.00]</td>
<td>This course will examine key issues in development, for example: social justice, poverty and inequality, sustainability, governance and inclusiveness, and how perspectives on these issues have changed over time and differ across disciplinary perspectives. The course will be writing-intensive and focus on the development of skills in oral communication of development issues.</td>
<td>Department(s): Dean's Office, College of Social and Applied Human Sciences</td>
</tr>
<tr>
<td>IDEV*6300</td>
<td>Research and Analysis in a Development Context S [0.50]</td>
<td>Students will explore alternative approaches to development research and analysis across documentary, qualitative and quantitative methods and the ethical issues associated with research in a development context. The course involves guided readings and seminar based discussions related to development research. There will be emphasis on written and oral communication of development research and analysis to diverse audiences. The course will be taught over a two-week period at the start of the summer semester. Subsequently, students will reflect on their own positionality and the development context of their research of practicum through the remainder of the Summer semester and while engaged in this activity.</td>
<td>Department(s): Dean's Office, College of Social and Applied Human Sciences</td>
</tr>
<tr>
<td>IDEV*6500</td>
<td>Fieldwork in International Development Studies U [0.50]</td>
<td>This course recognizes an intensive commitment to research in an archival repository, 'in the field' or at an appropriate development institution in Canada or abroad. The course normally is directed by the student's advisor in consultation with the advisory committee.</td>
<td>Department(s): Dean's Office, College of Social and Applied Human Sciences</td>
</tr>
<tr>
<td>IDEV*6800</td>
<td>Theories and Debates in Development F [0.50]</td>
<td>This course examines recent approaches in development theory explaining international inequality, poverty and long-term change. It also investigates selected current debates in international development – such as food security, trade, good governance, sustainability or gender – from various discipline-based and interdisciplinary perspectives, and analyzes selected regional experiences of development. <strong>Restriction(s):</strong> Restricted to students in doctoral IDEV collaborative specializations. A minimum final grade of 75% is required to remain in the IDEV collaborative specialization.</td>
<td>Department(s): Dean's Office, College of Social and Applied Human Sciences</td>
</tr>
<tr>
<td>IDEV*6850</td>
<td>Development Research and Practice W [0.50]</td>
<td>In this course students establish the linkages between their doctoral research topic and the wider field of development studies and practice. The course will examine development policies and projects, ethical issues related to (cross-cultural) development research, and relationships between research and development practice.</td>
<td>Prerequisite(s): IDEV*6800 <strong>Restriction(s):</strong> Restricted to students in doctoral IDEV collaborative specializations. A minimum final grade of 75% is required to remain in the IDEV collaborative specialization.</td>
</tr>
</tbody>
</table>
Neuroscience

The Neuroscience collaborative specialization provides an opportunity for MSc/MBS/PhD students engaged in research in the rapidly expanding field of neuroscience, to combine their departmental degree program with multidisciplinary exposure to the field of neuroscience. This unique combination of multidisciplinary studies provides students with the best possible foundation for academic careers in neuroscience and related areas. The collaborative specialization includes participation from core faculty in the following departments: Animal Biosciences, Biomedical Sciences, Clinical Studies, Human Health and Nutritional Sciences, Integrative Biology, Molecular and Cellular Biology, Pathobiology, Population Medicine and Psychology. Students wishing to pursue a Master’s or PhD degree with the designation Neuroscience must enter the collaborative specialization in Neuroscience through a participating department.

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Professor, Psychology

Ray Lu
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Associated Graduate Faculty

Geoffrey Power
Contractually Limited Faculty, Human Health and Nutritional Sciences

MSc/MBS Collaborative Specialization

The MSc/MBS collaborative specialization in Neuroscience enables students engaged in neuroscience research to combine their departmental degree program with a multidisciplinary specialization in the field of neuroscience.

Admission Requirements

MSc/MBS students in the collaborative specialization in Neuroscience must meet the admission requirements of the participating department in which they are enrolled. The application process has two stages: first, application to the primary program of interest, identifying interest in the collaborative specialization as a secondary focus. If the student is admitted to the primary program, the second stage is then admission to the collaborative specialization.

Program Requirements

In addition to coursework in their respective departments, students in the MSc/MBS collaborative specialization must complete NEUR*6000 as well as registering for NEUR*6100 each term that they are in the collaborative specialization. In NEUR*6100, students and faculty will meet once a month to discuss issues/hear talks/present research in neuroscience.

PhD Collaborative Specialization

The PhD collaborative specialization in Neuroscience enables students engaged in neuroscience dissertation research to combine their departmental degree program with a multidisciplinary specialization in the field of neuroscience.

Admission Requirements

PhD students in the collaborative specialization in Neuroscience must meet the PhD admission requirements for the participating department in which they are enrolled.

Program Requirements

If a student enters the PhD collaborative specialization in Neuroscience at the doctoral level, in addition, to coursework in their respective departments, students must complete NEUR*6000, or show evidence of course equivalence in prior training. Students must be engaged in neuroscience dissertation research. During each term of their program of studies, doctoral students must enroll in NEUR*6100. The seminar will meet monthly. Students must take their qualifying exams within five semesters of entering the program, as required by University graduate policies. One member on the qualifying exam committee must be a core member of the collaborative specialization in Neuroscience outside the student’s home department or a faculty member from another university approved by graduate studies. As well one member of the student’s advisory committee must be a core member of the neuroscience collaborative specialization outside the student’s home department or a faculty member from another university approved by graduate studies.
<table>
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<tr>
<th>Course Code</th>
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<th>Credits</th>
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</tr>
</thead>
<tbody>
<tr>
<td>NEUR*6000</td>
<td>Principles of Neuroscience U [0.50]</td>
<td></td>
<td>This course is designed to ensure that graduate students with diverse neuroscience backgrounds registered in the collaborative specialization in Neuroscience are exposed to the fundamentals in all areas of neuroscience.</td>
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<tr>
<td></td>
<td>Department(s): Biomedical Sciences</td>
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<tr>
<td>NEUR*6100</td>
<td>Seminar in Neuroscience U [0.00]</td>
<td></td>
<td>This course will expose graduate students to some of the major theories, issues and methodologies driving research in neuroscience. Students will learn to critically evaluate presentations by researchers in this field as well as to communicate the results of their own research.</td>
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<tr>
<td></td>
<td>Department(s): Psychology</td>
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One Health

The Collaborative Specialization in One Health prepares future leaders for the complex challenges at the confluence of human, animal, and environmental health, working across disciplinary boundaries, conducting multidisciplinary research, mobilizing knowledge, and informing policy. Doctoral and Master’s (thesis or course work and MRP) students wishing to undertake graduate studies with emphasis on One Health will be admitted by a participating department and will register in both the participating department and in the collaborative specialization.

The participating academic programs are Animal Biosciences (MSc, PhD), Biomedical Sciences (MBS, MSc, PhD), Computational Sciences (PhD), Computer Science (MSc), Engineering (MEng, MASc, PhD), Environmental Sciences (MES, MSc, PhD), Food Science (MSc, PhD), Geography (MA, MSc, PhD), History (MA, PhD), Human Health and Nutritional Sciences (MSc, PhD), Integrative Biology (MSc, PhD), Molecular and Cellular Biology (MSc, PhD), Pathobiology (MSc, PhD), Political Science (MA, PhD), Population Medicine (MSc, PhD), Philosophy (MA, PhD), Public Issues Anthropology (MA), and Rural Development and Planning (MSc).

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Professor, Pathobiology

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Associated Graduate Faculty

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Masters Collaborative Specialization

Admission Requirements

Masters students in the Collaborative Specialization in One Health must meet the admission requirements of the participating department in which they are enrolled. The application process has two stages. First, prospective students will apply to their primary program of interest, identifying interest in the collaborative specialization as a focus. If the student is admitted to the primary program, the second stage is then admission to the collaborative specialization. Applicants will be required to submit a letter of interest (maximum 500 words) briefly outlining their interest in One Health and explaining how their area of research will align with One Health and intersect with all three pillars (animals, humans, and the environment).

All applications to participate in the Collaborative Specialization in One Health will be reviewed by the specialization’s Graduate Program Coordinator and a committee of 3-5 faculty from different colleges.

Program Requirements

Masters students in the Collaborative Specialization in One Health must complete:

- ONEH*6000  [0.50]  One Health Approaches to Research
- ONEH*6100  [0.50]  Master’s Seminar in One Health

And an acceptable MRP or thesis that applies a One Health approach. For thesis-based master’s students, at least one member of the student’s advisory committee must be a core graduate faculty member of the Collaborative Specialization in One Health. Requirements of this collaborative specialization may also serve as elective requirements in the student’s home program.
Doctoral Collaborative Specialization

Admission Requirements

Doctoral students in the Collaborative Specialization in One Health must meet the admission requirements of the participating department in which they are enrolled. The application process has two stages. First, prospective students will apply to their primary program of interest, identifying interest in the collaborative specialization as a focus. If the student is admitted to the primary program, the second stage is then admission to the collaborative specialization. Applicants will be required to submit a letter of interest (maximum 500 words) briefly outlining their interest in One Health and explaining how their area of research will align with One Health and intersect with all three pillars (animals, humans, and the environment).

All applications to participate in the Collaborative Specialization in One Health will be reviewed by the specialization’s Graduate Program Coordinator and a committee of 3-5 faculty from different colleges.

Program Requirements

Doctoral students in the Collaborative Specialization in One Health must complete:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ONEH*6000</td>
<td>One Health Approaches to Research</td>
<td>0.50</td>
</tr>
<tr>
<td>ONEH*6200</td>
<td>Doctoral Seminar in One Health</td>
<td>0.50</td>
</tr>
</tbody>
</table>

And successfully defend a thesis that applies a One Health approach. At least one member of the student’s advisory committee must be a core graduate faculty member of the Collaborative Specialization in One Health. Students that previously completed ONEH*6000 as part of the master’s collaborative specialization will be exempt from retaking it as part of the doctoral collaborative specialization; however, they will still be required to complete the final Research Proposal and Presentation assignment. Requirements of this collaborative specialization may also serve as elective requirements in the student’s home program.

Courses

**ONEH*6000 One Health Approaches to Research W [0.50]**
A multidisciplinary course for graduate students that provides in-depth knowledge on the One Health approach, exploring complex issues at the interface of human, animal, and environmental health. Active learning lessons will foster strong skill development for One Health research in collaboration, systems thinking, transdisciplinarity, critical thinking, problem solving, leadership, and communication.

*Restriction(s):* Instructor consent required.
*Department(s):* Department of Population Medicine

**ONEH*6100 Master’s Seminar in One Health F [0.50]**
This course offers a university-wide multidisciplinary forum for discussion of One Health. Master’s students will discover One Health through different disciplinary lenses, facilitate and actively engage in academic discussion about One Health, and practice leadership and networking skills necessary for success as a One Health practitioner.

*Prerequisite(s):* ONEH*6000
*Restriction(s):* Instructor consent required.
*Department(s):* Department of Population Medicine

**ONEH*6200 Doctoral Seminar in One Health F [0.50]**
This course offers a university-wide multidisciplinary forum for discussion of One Health. Doctoral students will discover One Health through different disciplinary lenses, facilitate and actively engage in academic discussion about One Health, and practice leadership and networking skills necessary for success as a One Health practitioner.

*Prerequisite(s):* ONEH*6000
*Restriction(s):* Instructor consent required.
*Department(s):* Department of Population Medicine
## Toxicology

The collaborative specialization is the focal point for graduate teaching and research in toxicology. Students wishing to undertake graduate studies at the masters or doctoral level with emphasis on toxicology will be admitted by a participating department and will register in both the participating department and in the collaborative specialization. The participating academic units include the Departments of Animal Biosciences, Biomedical Sciences, Chemistry, Food Safety and Quality Assurance, Human Health and Nutritional Sciences, Integrative Biology, Molecular and Cellular Biology, Pathobiology, Plant Agriculture and the School of Environmental Sciences.

### Administrative Staff

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**Graduate Secretary**

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- **Christopher J. Hall**
  Professor, School of Environmental Sciences

- **Ronald Johnson**
  Associate Professor, Biomedical Sciences

- **P. David Josephy**
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- **Bettina E. Kalisch**
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- **Niel A. Karrow**
  Assistant Professor, Animal Biosciences

- **Gordon M. Kirby**
  Assistant Professor, Biomedical Sciences

- **Jibran Khokhar**
  Assistant Professor, Biomedical Sciences

- **Hung Lee**
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- **Francesco Leri**
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  Associate Professor, Chemistry

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  Professor, Psychology and Canada Research Chair

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- **Cynthia Scott-Dupree**
  Associate Professor, School of Environmental Sciences

- **Paul K. Sibley**
  Assistant Professor, School of Environmental Sciences

- **E. James Squires**
  Professor, Animal Biosciences

- **Glen J. Van Der Kraak**
  Professor, Integrative Biology and Associate Dean, Research, CBS

### Masters Collaborative Specialization

#### Admission Requirements

Masters students in the collaborative specialization in toxicology must meet the masters admission requirements of the participating department in which they are enrolled.

#### Program Requirements

Masters students in the collaborative specialization in toxicology must complete a minimum of 1.50 graduate credits, which must include the toxicology courses TOX*6000 and TOX*6200 and courses required by the participating department in which they are enrolled. It is expected that students’ research (MRP or Thesis) or at least 30% of the courses in a course-based program be in the area of toxicology.

### Doctoral Collaborative Specialization

#### Admission Requirements

Doctoral students in the collaborative specialization in toxicology must meet the doctoral admission requirements of the participating department in which they are enrolled.

#### Program Requirements

Doctoral students in the collaborative specialization in toxicology must meet all the academic requirements specified by the participating department in which they are enrolled. They must also complete the courses TOX*6000 and TOX*6200 if they, or equivalent courses, were not taken as part of a masters program. It is expected that the students' doctoral research be in the area of toxicology.

### Courses

#### TOX*6000 Advanced Principles of Toxicology S [0.50]

An intensive course in the principles of modern aspects of toxicology, taught in a lecture/case study format.

- **Department(s):** Department of Chemistry

#### TOX*6200 Advanced Topics in Toxicology W [0.50]

Advanced topics in toxicology will include oral presentations by students, faculty members, and guest lecturers. The emphasis will be on advanced concepts and techniques in toxicology research with particular relevance to mechanistic, molecular and interpretive toxicology. Offered in conjunction with TOX*4200. Extra work is required of graduate students.

- **Restriction(s):** Credit may be obtained for only one of TOX*6200 or TOX*4200
- **Department(s):** Department of Chemistry

#### TOX*6590 Biochemical Toxicology F [0.50]

The molecular mechanisms of action of carcinogens and other toxic compounds. Enzymes of biotransformation, including a detailed study of cytochrome P-450. Interactions of reactive species with DNA and other macromolecules. Offered in conjunction with TOX*4590. Extra work is required of graduate students.

- **Restriction(s):** Credit may be obtained for only one of TOX*6590 and TOX*6590
- **Department(s):** Department of Chemistry

#### Other courses

- **BIOM*6721** [0.25] Special Topics in Pharmacology-Toxicology
- **BIOM*6722** [0.50] Special Topics in Biomedical Pharmacology-Toxicology
- **CHEM*7310** [0.50] Selected Topics in Biochemistry
- **CHEM*7600** [0.50] Selected Topics in Organic Chemistry