Anthropology

Department of Sociology and Anthropology
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The Department

Chair of the Department: P. Gose
Coordinator of the Graduate Program in Anthropology: J. Pylypa

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and Ph.D. degrees in Anthropology, and the M.A. and Ph.D. in Sociology. This section provides information on the Anthropology programs. For Sociology graduate programs, see the Sociology section of this Calendar.

The Anthropology programs promote exploration of cultural practices and social conditions in diverse contexts throughout the world. The faculty specialize in sociocultural anthropology, with a current M.A. level emphasis on three program fields of study: the anthropology of signs and symbols, the anthropology of indigenous peoples, and the anthropology of development and underdevelopment. The doctoral program is structured around the field of engaged anthropology, which emphasizes practical involvement with the social world through ethnographic and theoretical analyses of cultural frameworks and social fields shaping interactions amongst humans and between humans and the environment.

See the department website for detailed descriptions of the research strengths and teaching areas of individual faculty members.

Qualifying-Year Program

Applicants with general (three-year) bachelor's degrees may be admitted into a qualifying-year program designed to raise their standing to honours status. Students earning at least high honours standing in their qualifying-year courses will be considered for admission into the master's program.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

Master of Arts in Anthropology

Admission Requirements

The deadlines for submitting applications and supporting documents for graduate study in anthropology are:

September admission

- February 1 for students requesting financial assistance
- August 31 for students not requesting financial assistance

January admission

- November 1 for students requesting financial assistance
- December 31 for students not requesting financial assistance

Program Requirements

The Master of Arts program in Anthropology is a total of 5.0 credits, and each candidate is required to select, in consultation with the graduate adviser, one of the three program options.

Thesis Program

- ANTH 5401: Theories and Methods I (normally to be taken in the first fall term after admission to the program) [0.5 credit]
- ANTH 5402 Theories and Methods II [0.5 credit]
- 2.0 credits in electives
- ANTH 5909: Master's Thesis and an oral examination on the thesis [2.0 credits]

Research Essay Program

- ANTH 5401: Theories and Methods I (normally to be taken in the first fall term after admission to the program) [0.5 credit]
- ANTH 5402: Theories and Methods II [0.5 credit]
- 3.0 credits in electives
- ANTH 5908: Research Essay and an oral examination on the essay [1.0 credit]

Course Work Program

- ANTH 5401: Theories and Methods I (normally to be taken in the first fall term after admission to the program) [0.5 credit]
- ANTH 5402: Theories and Methods II [0.5 credit]
- 4.0 credits in electives

Electives may be chosen, in consultation with the student's adviser, from the following courses: anthropology graduate course offerings; sociology graduate courses (especially in theory and methods, or in areas which relate to the student's thesis research interests); from 4000-level courses offered in the sociology and anthropology undergraduate program; or a combination of the above. Normally no more than 1.0 credit may be chosen from course offerings in other departments.

Transfer from One M.A. Option to Another M.A. Option

Students who choose to change from one program option to another (i.e., from/to the thesis, research essay, or course work option), are required to do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

Academic Standing

A grade of B- or better is required in each credit counted toward the master's degree. With the recommendation of the department, and permission of the Dean of the Faculty of Graduate Studies and Research, a candidate may be allowed a grade of C+ in 1.0 credit or each of two 0.5 credits.

Doctor of Philosophy in Anthropology

Note: the Ph.D. in Anthropology is pending final approval for the 2009-2010 session from the Senate of Carleton University.

The Ph.D. Anthropology normally will be undertaken on a full-time basis, however the department will consider admission on a part-time basis. Full-time students are expected to complete the program in four years, and part-time students are expected to complete the program in eight years.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or equivalent) in anthropology, normally with a minimum average of A-, and with no grade below B. A student already enrolled in the Carleton M.A. program in Anthropology who shows outstanding academic performance and research promise may be permitted to transfer to the Ph.D. program upon completion of the M.A. course work and upon the recommendation of the Anthropology graduate committee.

Applicants whose academic preparation has deficiencies in certain areas may be admitted to the Ph.D. program, but will normally be required to complete additional course work. Applicants whose first language is not English must demonstrate a fluent knowledge of English. Please see sections 3.6 in the General Regulations section of this calendar.

The deadlines for submitting applications and supporting documents for admission into the Ph.D. program in anthropology are:

September admission

- February 1 for students requesting financial assistance
- July 1 for students not requesting financial assistance

January admission

- November 1 for all students

Program requirements

Program requirements for the Ph.D. Anthropology are outlined in the General Regulations section of this Calendar. Specific program requirements of the Department of Sociology and Anthropology normally are:

10.0 credits including:

- ANTH 6000 (1.0 credit)
- ANTH 6002 (0.5 credit)
- Two terms satisfactory participation in ANTH 6100 Thesis Writing Seminar (0.0 credit)
- Remaining 1.5 credits chosen from SOCI or ANTH courses at the 5000- or 6000-level or, with the permission of the graduate supervisor, up to 1.0 credit of graduate level courses from another unit at Carleton
- A satisfactory research preparation portfolio
- A satisfactory thesis proposal and (when required) Research Ethics Board clearance to undertake thesis research
- Satisfactory thesis research

- Completion and successful oral defence of thesis ANTH 6909 (7.0 credits).
- Residence requirements

Ph.D. candidates must normally be registered full-time in a minimum of six terms to satisfy the residence requirement. If a candidate is registered part-time the minimum residence requirement is eight terms.

Academic Standing

Candidates must obtain a grade of B- or higher in each course and Satisfactory on the Ph.D. thesis and its oral defence.

Collaborative Ph.D. with a Specialization in Political Economy

The Department of Sociology and Anthropology and the Institute of Political Economy offer a Collaborative Program in Political Economy at the Ph.D. level. For further details, see the Institute of Political Economy's Collaborative Ph.D. with a Specialization in Political Economy section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

In addition to anthropology graduate course, the Department of Sociology and Anthropology offers sociology graduate courses that may also be taken as credit toward the graduate degrees in anthropology. Consult the Sociology section of this Calendar.

ANTH 5004 [0.5 credit]
Ecological Anthropology
Anthropological approaches to the study of human environment relationships and to current problems of ecological degradation affecting native societies around the world.

ANTH 5106 [0.5 credit]
North American Indigenous Peoples
Selected issues in North American Indian, Inuit, and Métis ethnographic studies. Debates over social change, cultural autonomy, native rights, and government policy.

ANTH 5107 [0.5 credit]
Issues in North American Ethnohistory
Methodological and substantive problems in the history of North American indigenous peoples. Controversies concerning the impact of European penetration and colonial policies on inter-tribal relations, cultural identity, and other aspects of native life.

ANTH 5109 [0.5 credit]
Development, Dependency and Gender
Varieties of development and dependency theories, and feminist critiques of both, in analyzing gender relations in the Third and Fourth Worlds.

ANTH 5202 [0.5 credit]
The Anthropology of Underdevelopment
Analysis of theoretical and historically concrete issues in the study of variable economic systems ranging from domestic subsistence and peasant production to slavery and capital-dominated markets.

ANTH 5208 [0.5 credit]

Anthropology of Indigeneity

An international exploration of what it means to claim indigenousness within a variety of contexts. The cultural politics of indigenous status in relation to such issues as primitivism, memory and revivalism in modern nation-states and diasporic communities.

ANTH 5210 [0.5 credit]

Special Topics in Indigenous Studies

Topic varies from year to year, and will be announced in advance of the registration period.

ANTH 5305 [0.5 credit]

Special Topics in Ethnography

Topic varies from year to year, and will be announced in advance of the registration period.

ANTH 5401 [0.5 credit]

Theories and Methods I

Theoretical and methodological debates in contemporary anthropology.

ANTH 5402 [0.5 credit]

Theories and Methods II

Theoretical and methodological debates in contemporary anthropology.
Prerequisite: ANTH 5401 or permission of the Department.

ANTH 5403 [0.5 credit]

Interpreting Symbols

Theoretical and methodological approaches to the anthropology of signs and symbols, including the internal workings of symbolic systems, and their relationship to other aspects of social life. (Also listed as RELI 5403.)

ANTH 5701 [0.5 credit]

Anthropology of Religion

Anthropological literature and theories on religion in light of current debates in anthropology.

ANTH 5704 [0.5 credit]

Anthropology of the Body, Health, Illness and Healing

Issues and applications in medical anthropology. Topics may include the sociocultural meanings inscribed on the body; cultural perceptions of the prevention, causes and treatment of illness; social dimensions of the illness experience; and the political economy of health.

ANTH 5706 [0.5 credit]

Contemporary Material Cultures

The study of material culture and its potential for addressing contemporary social and cultural conditions in a variety of local and transcultural contexts.

ANTH 5708 [0.5 credit]

Special Topics in Anthropology

Topic varies from year to year, and will be announced in advance of the registration period.

ANTH 5807 [0.5 credit]

Special Topics in Symbolism and Culture

Topic varies from year to year, and will be announced in advance of the registration period.

ANTH 5808 [0.5 credit]

Selected Topics in North American Native Studies

Topic varies from year to year. Students should check with the Department regarding the topic offered.

ANTH 5809 [0.5 credit]

Selected Topics in the Anthropology of Development and Underdevelopment

Topic varies from year to year. Students should check with the Department regarding the topic offered.

ANTH 5812 [0.5 credit]
Research Design
Design and methods of anthropological enquiry.

ANTH 5900 [0.5 credit]
Tutorial

ANTH 5906 [0.5 credit]
Fieldwork
Directed field research.
Prerequisite: permission of the Department.

ANTH 5907 [0.5 credit]
Placement in Anthropology
This course offers an opportunity to earn academic credit by engaging in research activities under the supervision of professional researchers in museums, government departments, non-governmental organizations, or other professional research settings. Placement research must be related to the preparation of the master's thesis.
Prerequisite: permission of the Department.

ANTH 5908 [1.0 credit]
M.A. Research Essay
Students will normally enrol in this course for a maximum of three consecutive terms of study, including one summer term. Students must normally enrol in this course not later than the beginning of the second full year of study.

ANTH 5909 [2.0 credits]
M.A. Thesis

ANTH 6000 [1.0 credit]
Doctoral Seminar: Theory and Method in Contemporary Anthropology
An in-depth exploration of theory and method in contemporary socio-cultural anthropology with special emphasis on engaged anthropology. This course is required of all first year doctoral students in anthropology.

ANTH 6001 [0.5 credit]
Selected Topics in Anthropology
Topic varies from year to year. Students should check with the Department regarding the topic offered.

ANTH 6002 [0.5 credit]
Research Design
Issues in the design and methods of anthropological inquiry, including proposal-writing, research ethics, and research funding. Required of all first-year Ph.D Anthropology students.

ANTH 6100 [0 credit]
Thesis Writing Seminar
This seminar will meet on a regular basis for students who are writing their doctoral theses to present draft chapters for constructive critical discussion. Normally required for all Ph.D. Anthropology students who have completed their doctoral research, until the completion of their theses.

ANTH 6900 [0.5 credit]
Tutorial
A tutorial is designed to permit students to pursue individual research on a relevant topic. Topics will be chosen in consultation with at least one faculty member, the student's supervisor, and the Anthropology graduate coordinator.

ANTH 6907 [0.5 credit]

Placement in Anthropology

This course offers an opportunity to earn academic credit by engaging in research activities under the supervision of professional researchers in museums, government departments, nongovernmental organizations, or other professional research settings. Placement research must be related to the preparation of the doctoral research.

ANTH 6909 [7.0 credits]

Ph.D. Thesis

Architecture

Architecture Building 202
Telephone: 613-520-2855
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Web site: arch.carleton.ca/

The School

Director of the School: Marco Frascari
Associate Director (Graduate Programs): Stephen Fai

The Azrieli School of Architecture and Urbanism offers programs of study and research leading to the Master of Architecture Professional degree and a specialized Master of Architecture Post-professional degree.

M.Arch. Professional

The Master of Architecture Professional degree is awarded upon the successful completion of a full two-year program of studies. The program is studio-based with a strong theoretical focus, culminating in a two-credit thesis (ARCS 5909 or ARCN 5909). The thesis is expected to include both a written text and a design component with appropriate modes of two and three-dimensional representation, including digital. It is expected that students will take a minimum of two terms to complete their thesis requirement. Final thesis documentation must satisfy the requirements established by the Faculty of Graduate Studies and Research.

The Canadian Architectural Certification Board (CACB) recognizes this degree as an academic prerequisite for registration in the Intern Architect Program. Further information on professional registration can be obtained from the CACB or from one of the provincial associations.

Qualifying-Year Program

Candidates with deficiencies in certain areas according to CACB requirements may be required to take additional prescribed courses as prerequisites to their graduate work. Applicants who do not possess an equivalent B.A.S. degree (see below) may be admitted to a qualifying-year program, normally consisting of 5.0 credits at the 4000-level. All courses must be approved by the Graduate Admissions Committee of the School in consultation with the Faculty of Graduate Studies and Research. (See General Regulations Section 2.3, 'Completion of the Qualifying Year', for more details.) Completion of the Qualifying Year is not a guarantee of admission to the M.Arch.Professional or Post-Professional Program. Re-application to the M. Arch. program is required.

M.Arch. Post-Professional

Theoretical Issues in Architecture, Culture, and Technology

The Master of Architecture Post-Professional degree is a specialized program with three terms of course work followed by a 2.0-credit thesis that allows students with a professional degree in architecture or equivalent to pursue advanced research at a graduate level. The program is research oriented and culminates with the completion of a thesis. Inter-departmental collaborations are encouraged. Thesis proposals are developed under the tutelage of a prospective thesis supervisor and are expected to address issues of architecture and cultural diversity and/or design and technology

outlined below. The thesis is expected to include a written text and appropriate modes of two and three-dimensional representation, including digital. Final thesis documentation must satisfy the requirements established by the Faculty of Graduate Studies and Research.
Please note that the M.Arch. Post-Professional degree is not recognized by the Canadian Architectural Certification Board as an academic prerequisite for professional certification. Students wishing to pursue professional studies in architecture are referred to the Professional M.Arch. discussed above.

Research in the Post-Professional M.Arch. is organized around two areas of inquiry:

1. Architecture and Cultural Diversity

'Architecture and Cultural Diversity' is concerned with the patterns and interrelationships of cultural issues and processes as they are manifest in built form and as they inform architectural design. For specific areas of faculty research, please consult the School's Web site.

The positioning of these research topics within the broader discourse on the history and theory of architecture is the subject of two core seminars offered consecutively in the fall and winter terms of the first year. The core seminars are supplemented with studies in cultural and architectural history and theory.

2. Design and Technology

'Design and Technology' is concerned with the practical and philosophical determinations of technology upon the design and production of real and virtual environments. This area of the program addresses the need to engage technically-advanced tools in design studies and to bring design expertise to bear on such issues as new media, advanced visualization and simulation technologies, software and interface design, building and manufacturing technologies, and sustainability in urban and architectural design. Research is conducted through traditional and technological modes of inquiry and production as it relates to architecture and related cultural practices.

For specific areas of faculty research, please consult the School's Web site.

The positioning of these research topics within the broader discourse on the history and theory of architecture is the subject of two core seminars offered consecutively in the Fall and Winter terms of the first year. The core seminars are supplemented with studies in cultural and architectural history and theory, technically advanced media and practices, building technologies, and related disciplines.

Qualifying-Year Program

Candidates with deficiencies in certain areas may be required to take additional prescribed courses as prerequisites to their graduate work. Applicants who do not possess a professional degree in Architecture may be admitted to a qualifying-year program, normally consisting of 5.0 credits at the 4000-level. All courses must be approved by the Graduate Admissions Committee of the School in consultation with the Faculty of Graduate Studies and Research. (See General Regulations Section 2.3, 'Completion of the Qualifying Year', for more details.) Completion of the Qualifying Year is not a guarantee of admission to the M.Arch. Professional or Post-Professional Program, and re-application to the program is required.

Admission Requirements

M.Arch. Professional

Students may be admitted to the M.Arch. Professional Program following the successful completion of the Bachelor of Architectural Studies (see Undergraduate Calendar). All applicants are expected to have maintained a minimum academic average of B- in their undergraduate studies. In addition to these academic credentials, applicants must submit for review two examples of academic writing and a portfolio of their most recent studio work demonstrating facility in architectural design and methods of representation. Professional experience may be taken into consideration.

Where applicants do not hold a B.A.S., but hold a four-year undergraduate degree with a concentration in architecture, equivalence may be considered on the basis of a demonstrated, exceptional design ability and high academic standing (B+ minimum average). Applicants are required to submit a complete portfolio of their most recent artistic and design work produced during their undergraduate studies and two examples of academic writing. Professional experience may also be taken into consideration. A Qualifying Year may be required (see above).

When professional work is included as part of an applicant's portfolio, a precise description of the applicant's involvement and responsibilities in the completion of the project must be included.

All applicants must provide two confidential letters of reference on the prescribed forms and a statement of academic and professional objectives.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in Section 3.6 of the General Regulations of this Calendar. Note, however, that students with a TOEFL score below 600 will not be considered for admission to the M.Arch. Professional.

An admissions committee, which includes the supervisor of graduate studies, will determine the merits of each candidate on the basis of academic record, evidence of visual and architectural design ability, and, where applicable, professional experience. Enrolment is limited. The School's admission policy is governed by the availability of graduate student space. Possession of the minimum academic admission requirement does not, in itself, guarantee admission.

Application deadlines can be found at https://gsapplications.carleton.ca .

Applications are not accepted for admission in the winter or summer term. Part-time studies are not permitted. Deferrals are not permitted.

M.Arch. Post-Professional

Students are admitted to the post-professional stream of the M.Arch. program on the basis of a first professional degree in architecture. Students are expected to have maintained a minimum academic average of B-. In addition to these academic credentials, applicants must submit for review two examples of academic writing and a portfolio of creative work demonstrating facility in architectural design and methods of representation. Professional experience may also be taken into consideration.

Where applicants do not hold a professional degree in architecture but possess either a professional degree in a related design discipline or an Honours B.A. in Fine Arts or the Humanities, equivalence will be considered on the basis of a demonstrated, exceptional design ability and a high academic standing (B+ minimum average). Applicants are required to submit a complete portfolio of artistic and

design work produced during their undergraduate education and two examples of academic writing. Professional experience may also be taken into consideration.

All applicants must provide two confidential letters of reference on the prescribed forms and a statement of academic and professional objectives.

An admissions committee, which includes the supervisor of graduate studies, will determine the merits of each candidate on the basis of academic record, evidence of visual and architectural design ability, and, where applicable, professional experience. Enrolment is limited. The School's admission policy is governed by the availability of graduate space. Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in Section 3.6 of the general regulations. Note, however, that students with a TOEFL score below 600 will not be considered for admission to the Post-Professional M.Arch.

Application deadlines can be found at https://gsapplications.carleton.ca

Applications are not accepted for admission in the winter or summer term. Part-time studies are not permitted. Deferrals are not permitted.

Program Requirements

M.Arch. Professional

General requirements:

- 2.0 core course credits
- 1.0 elective course credits
- 3.0 studio credits
- 2.0-credit thesis which must be defended at an oral examination

A list of approved electives is available from the Program Administrator at the School of Architecture. The Associate Director (Graduate Programs) must approve all non-core courses.

Specific requirements:

Year 1

Fall Term

- ARCH 5200, ARCS 5105
- 0.5 credit elective from courses at the 5000-level or above, approved by the Associate Director (Graduate Programs)

Winter Term

- ARCH 5201, ARCC 5100, ARCS 5106

Year 2

Fall Term

- ARCS 5909 or ARCN 5909**
- 0.5 credit elective from courses at the 5000-level or above, approved by the Associate Director (Graduate Programs)

Winter Term
ARCC 5200*
ARCS 5909 or ARCN 5909***

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* ARCS 5909 and ARCN 5909 normally extend over two terms. By the end of the first term of thesis registration, students will submit an architectural project for which an interim grade is awarded. This project will follow guidelines prescribed by the Associate Director (Graduate Programs).

M.Arch. Post-Professional

1. Architecture and Cultural Diversity

General requirements:

- 1.5 core course credits
- 1.5 elective course credits
- 2.0-credit thesis which must be defended at an oral examination

A list of approved electives is available from the Graduate Administrator at the Azrieli School of Architecture and Urbanism. All non-core courses must be approved by the Associate Director (Graduate Studies).

Specific requirements:

- ARCH 5001 (0.5 credit)
- ARCH 5002 (0.5 credit)
- ARCH 5003 (0.5 credit)
- 0.5 credit in the area of architectural theory (an advanced course at the 5000-level in the theory of architecture offered by the Azrieli School of Architecture and Urbanism)
- 0.5 credit in the area of cultural theory at the 5000-level or above in the general field of cultural theory
- 0.5 credit elective chosen from an approved list of courses in the area of cultural studies, cultural theory, cultural production, the built environment and related subjects.
- ARCH 5909 (2.0-credit thesis)

The program is normally completed in six consecutive terms of full-time study.

2. Design and Technology

General requirements:

- 1.5 core course credits
- 1.5 elective credits
- 2.0-credit thesis which must be defended at an oral examination

A list of approved electives is available from the Program Administrator at the Azrieli School of Architecture and Urbanism. The Supervisor of Graduate Studies must approve all non-core courses.

Specific requirements:

- ARCC 5001 (0.5 credit)
- ARCC 5002 (0.5 credit)
- ARCC 5003 (0.5 credit)
- 0.5 credit in the area of architectural theory (an advanced course at the 4000-level in the theory of architecture offered by the Azrieli School of Architecture and Urbanism)
- 0.5 credit in the area of philosophy of technology or science or related practices at the 5000-level or above in the general field of digital media, computer science, environmental studies, or building technologies.
- 0.5 credit elective chosen from an approved list of courses in the area of cultural studies, cultural theory, cultural production, the built environment and related subjects.
- ARCC 5909 (2.0-credit thesis)

The program is normally completed in six consecutive terms of full-time study.

Academic Regulations

See the General Regulations section of this Calendar.

Architecture does not permit the C+ option as stipulated in Section 11.2 of the General Regulations.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Qualified students in other departments may, with permission of the School, enrol in ARCH 5001, ARCH 5002, ARCH 5003, ARCC 5001, ARCC 5002, ARCN 5101 and ARCN 5102.

ARCH 5001 [0.5 credit]
Architecture Seminar 1
An introduction to the intellectual frameworks connecting design and culture as manifest in theories of culture and architecture. The seminar builds on previous undergraduate studies, and is not an introduction to these fields. The field of inquiry is both historical and contemporary.

ARCH 5002 [0.5 credit]
Architecture Seminar II
A continuation of ARCH 5001, this seminar follows the same general description, but concentrates more on architectural design, on the contemporary condition, and on the ways of thinking that characterize embodiment of cultural content in architecture and other artifacts. Prerequisite: ARCH 5001.

ARCH 5003 [0.5 credit]
Design and Culture Workshop
The prime objective of the workshop is to investigate cultural issues in architectural design. The workshop operates as a directed study with specific content, objectives, and scheduling arranged between student and academic advisor.

ARCH 5200 [0.5 credit]

Graduate Seminar 1: Introduction to Critical Thought in Architecture
Critical theories and research approaches relevant to the field of architecture. Identification of issues through a coordinated series of lectures and readings. Development of analytical and interpretative skills through seminar discussions and writing culminating in a scholarly position paper by the student.

ARCH 5201 [0.5 credit]

Graduate Seminar 2: Contemporary Theoretical Perspectives in Architecture
Lectures, readings, and case studies on contemporary issues in architecture and allied fields of study. Critical analysis of trends and possibilities set against traditional modes of architectural thought and practice. This course serves as a forum for a preliminary articulation of the thesis proposal.
Prerequisite: ARCH 5200.

ARCH 5600 [0.5 credit]

Housing and Culture Seminar
Housing as a function of social organization, demographics, market demand and governmental policies. The evolution of housing form, the role of the state, and the participation of architects in the housing marketplace promoting design as a form of social reform.
Precudes additional credit for ARCH 4201.

ARCH 5909 [2.0 credits]

M.Arch. Post-Professional Thesis (Architecture and Cultural Diversity)
A scholarly, written thesis supported by appropriate methods of two and three-dimensional representation. Research undertaken by the student is expected to engage one of the research topics outlined above. Proposals must be approved by the graduate committee of the Azrieli School of Architecture and Urbanism. Final thesis documentation must satisfy the requirements established by the Faculty of Graduate Studies.

ARCC 5001 [0.5 credit]

Introduction to Design and Multimedia
Multimedia and interactive design as they relate to architecture and the field of design. Special topics include virtual environments, user interface in software, Web and product design, perceptual and cognitive science, navigation, film/video and sound editing and animation technologies.

ARCC 5002 [0.5 credit]

Topics in Design and Multimedia: Information Architecture and the World Wide Web
Introduction to the design of Web-based applications, focusing on process, site architecture, usability testing, and Web functionality. Students synthesize and customize software applications. Client and server-side functionality. Introduction to relational database design, JavaScript, cgi scripts, and «middleware» products such as WebObjects and ColdFusion.

ARCC 5003 [0.5 credit]

Design and Technology Workshop
The prime objective of the workshop is to investigate issues in architectural design in relation to technology as a cultural paradigm. The workshop operates as a directed study with specific content, objectives, and scheduling arranged between student and academic advisor.

ARCC 5100 [0.5 credit]

Advanced Building Systems
Introduction to advanced design in building technology and systems integration. Leading edge building materials, technologies and philosophies will be explored through intensive case study research and analysis, comparing, and critically evaluating, traditional methods with current computer modeling and analysis techniques.

ARCC 5200 [0.5 credit]

Professional Practice

The practice of architecture. Professional organization and conduct, the architect's services, business law, office organization and management, contract documents, building codes, contract management, cost control, accounting and site supervision. Guest speakers and case studies.

Precludes additional credit for ARCU 4200.

ARCC 5909 [2.0 credits]

M.Arch. Post-Professional Thesis (Design and Technology)

Basic or applied research in architectural, industrial, and digital design. Areas include interactive education/training, product/interface design, programming/scripting, culture/technology, or research as defined by the student. Proposals must be approved by the Graduate Committee of the Azrieli School of Architecture and Urbanism. Final thesis documentation must satisfy the requirements established by the Faculty of Graduate Studies.

ARCN 5101 [0.5 credit]

Interactive Design Workshop I

An intensive introduction to the design of interactive environments, using multimedia software including Adobe Photoshop, Illustrator, Premiere, Macromedia, Dreamweaver, Fireworks, Director, 3D Modeling programs, and sound editing. Basic design, graphic design, and software literacy. Presentations by design professionals.

ARCN 5102 [0.5 credit]

Interactive Design Workshop II

An introduction to the logistic aspects of producing multimedia products with an emphasis on usability testing and user interface design. Topics include: storyboarding and graphic design, instructional design, rapid prototyping, project streaming, management and marketing, technical writing and product evaluation. Organized as a seminar. Work is done in teams.

ARCN 5909 [2.0 credits]

Thesis - Directed Research Studio (DRS)

An intensive research-based design project. The unit is initiated and guided by a faculty member engaged in organized research. Proposals must be approved by the Graduate Committee of the Azrieli School of Architecture and Urbanism. Final thesis documentation must satisfy the requirements established by the Faculty of Graduate Studies.

ARCS 5105 [1.5 credit]

Graduate Studio 1

An architectural investigation within a contemporary urban setting, usually dealing with central-city sites and complex programs. Projects address the question of urban architecture both from practical and theoretical perspectives. Architecturally relevant building technology and systems will be introduced in the Studio as required.

ARCS 5106 [1.5 credit]

Graduate Studio 2

The design of a large-scale and culturally significant building project, set within a prominent urban or natural landscape. Integrated resolution of the combined issue of site, program, and expression is expected. Architecturally relevant building technology and systems will be introduced in the Studio as required.

Prerequisite: ARCS 5105.

ARCS 5909 [2.0 credits]

Thesis - Independent Study

Student-initiated design investigation, developed with a thesis supervisor, supported by text and appropriate methods of two and three-dimensional representation. Proposals must be approved by the Graduate Committee of the Azrieli School of Architecture and Urbanism. Final thesis documentation must satisfy the requirements established by the Faculty of Graduate Studies.

Other Course Offerings

The School offers graduate-level courses that can be used towards degree programs in the Faculty of Engineering, the School of Canadian Studies, and the Faculty of Public Affairs and Management at Carleton University. In addition, there is an understanding with the Faculty of Environmental Studies at York University, the Centre for Building Studies at Concordia University, and the Faculté de l'Aménagement at the Université de Montréal, recognizing graduate course work undertaken at Carleton University's Azrieli School of Architecture and Urbanism. Members of the School may also supervise graduate research at these institutions.

Faculty interest and expertise lie in the following areas:

History and Theory of Architecture
Scholarly studies in architectural thought of late antiquity, early Christianity, the Renaissance, baroque, the modern movement, post-modernism, and Canadian Architecture and the architecture of Islam.

Architecture and Society
Ethnicity, multiculturalism and architectural expression; international development and indigenous architecture; heritage and preservation; evolution of the architectural profession.

Architecture and Technology
Building envelope and construction detail; design economics; structures; energy; lighting; acoustics; integration of systems.

Architecture and the City
Urban morphologies, architectural content of urban planning and design; social, cultural, economic, and political matrix in the urban society and the contemporary architectural reality.

Computer-Aided Design and Management
Design and modeling, visual communication, computer graphics; computers and architectural practice.

Architecture and Morphology
Studies in form, space, structure, and order; geometric and symbolic orders in architecture.

Design/Build
Applied architectural research, prototype development.

The following courses are available to students from other departments who hold an honours degree or equivalent in a related academic discipline. Permission of the School is required for registration.

ARCH 5000 [0.5 credit]
Directed Studies in History and Theory of Architecture
Reading and research tutorials.

ARCH 5100 [0.5 credit]
Directed Studies in Architecture and Society
Reading and research tutorials.

ARCC 5000 [0.5 credit]
Directed Studies in Architecture and Technology
Reading and research tutorials.

ARCC 5401 [0.5 credit]
Workshop: Technical Studies in Heritage Conservation

ARCU 5000 [0.5 credit]
Directed Studies in Architecture and the City
Reading and research tutorials.

ARCU 5402 [0.5 credit]
Workshop: Urban Studies in Heritage Conservation

ARCN 5000 [0.5 credit]
Directed Studies in Computer-Aided Design
Reading and research tutorials.

ARCN 5001 [0.5 credit]
Directed Studies in Architecture and Morphology
Reading and research tutorials.

Art History

St. Patrick's Building 423
Telephone: 613-520-2342
Fax: 613-520-3575
carleton.ca/artandculture/arthistory

The M.A. in Art History: Art and its Institutions encompasses Canadian/Aboriginal art history and the broader theoretical and historical concerns of an international stage. The program explores institutions of art conceived of in an expanded double meaning: as the material sites of the institutions of cultural visual memory and production - particularly those in the National Capital Region - and as the broader cultural and historical forces which mediate art practice and its conditions of production, reception, and study.

The M.A. program has a two-fold emphasis: explorations of critical and historical concerns, and practical experience. Students examine recent theoretical shifts in art history in the context of various institutions of art and are offered direct experience with collecting, exhibiting, and researching institutions in the National Capital Region. The program's dual approach trains scholars and art institution professionals to attain a critical awareness of contemporary theoretical debates, enabling them to construct new visions within the institutions they study or work.

The M.A. in Art History: Art and its Institutions has a strong practicum program in a number of the collecting, exhibiting and research institutions in and around Ottawa, and adjunct faculty from those institutions provide professional links. Owing to a wealth of repositories of objects of national origin and significance here in Ottawa, the Canadian and Aboriginal component of the program is a strength. The use of national institutions such as the National Gallery of Canada and the Canadian Museum of Civilization defines our broader mandate, inclusive not only of western historical ar t, but of non-western, folk, craft and popular culture. Graduates of the M. A. in Art History: Art and its Institutions will be prepared for careers in the museum, research, and heritage sectors, and for further study in Art History and related disciplines such as Cultural Mediations and Canadian Studies.

Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an Honours degree, but have a 3-year degree with an honours standing (at least B overall) will normally be admitted to a qualifying-year program. Refer to the General Regulations section of this Calendar.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an Honours bachelor's degree (or the equivalent) in art history or a related discipline, with at least high honours standing. Related disciplines may include anthropology, history, and Canadian studies. Applicants without a background in art history may be required to take up to a maximum of 2. 0 credits in certain designated courses from the undergraduate art history program in addition to their regular program.

Program Requirements

The specific program requirements for students in the M. A. program are as follows:

- ARTH 5010 (1. 0 credit)
- 2. 0 credits in Art History, of which 0. 5 credit must be selected from ARTH 5112, 5113, 5114, 5115, 5117, 5119, 5210, 5218, 5402, 5403, 5500, 5600. It is recommended that 1. 0 credit be used for a practicum. The remaining 0. 5 credit may be taken in Art History or, in special cases where the student's program of study justifies it, alternative courses may be selected with the approval of the Graduate Supervisor. Out of the 2.0 credits taken, at least 0. 5 credit must be in an area outside the student's thesis specialization.
- ARTH 5909 (2. 0 credits)

Subject to the approval of the graduate super visor, 0. 5 credit may be taken outside the Art History program. A maximum of 1. 0 credit may be selected from course offerings at the 4000-level in Art History.

The student's program will be developed in consultation with the graduate supervisor and the graduate faculty of Art History, and must be approved by the graduate supervisor to assure that the program of study includes a variety of media, historical periods, and/or national or ethnic traditions outside the subject of the thesis, as determined by the supervisor. The prescribed program will take into account the student's background and special interests, and the research strengths of the Art History graduate faculty.

Deadlines

• Thesis Proposal

Full-time students normally will submit their thesis topic to the thesis proposal board no later than April 15 of the first year of registration for students enrolled full-time, and no later than the middle of the fifth term of registration for students enrolled part-time.

• Thesis

Regulations governing requirements for the master's thesis, including deadlines for submission, are outlined in the General Regulations section of this Calendar.

Language Requirements

Students are required to demonstrate a reading knowledge of French (or another language to be approved by the Art History graduate supervisor).

Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at **central.carleton.ca**

ARTH 5010 [1. 0 credit]

Art and Its Institutions

The institutions of art and art history, the archive, the social institutions of art and their mediations. Gender, Aboriginal culture, commodification, reception, technology, memory and subversive tactics are addressed. Canadian contexts are emphasized.

Precludes additional credit for ARTH 5000.

ARTH 5011 [0. 5 credit]

Graduate Practicum

Practical on-site work in the collecting institutions of the national Capital Region (as available), including a written assignment. The practicum coordinator and the on-site supervisor jointly determine the final mark. A maximum of 1. 0 practicum credit may be applied towards degree requirements.

Precludes additional credit for ARTH 5001.

ARTH 5012 [0. 5 credit]

Directed Readings and Research

Students pursue topics in art and its institutions, which they select in consultation with the graduate faculty of the program.

Precludes additional credit for ARTH 5002.

ARTH 5112 [0. 5 credit]

Topics in Historiography, Methodology and Criticism

Historiographical, methodological, and critical issues in the history of art and criticism in Canadian and/or international contexts.

Precludes additional credit for ARTH 5102.

ARTH 5113 [0. 5 credit]

Perspectives on Pre-Modernity

Issues in premodern art and institutions of art production, and critical theory in light of current concerns and new research.

ARTH 5114 [0. 5 credit]

Feminism and Gender

Art and its institutions in terms of critical issues of feminism and gender studies. Topics include the questioning of the canon, sexuality, the gaze, queer theory, the body, and the use of art as a means to communicate issues of public significance.

Precludes additional credit for ARTH 5104 and ARTH 5106.

ARTH 5115 [0. 5 credit]

Topics in Modern and Contemporary Art

The production and reception of modern and contemporary art in light of current concerns in Canadian and/or international contexts.

Precludes additional credit for ARTH 5105.

ARTH 5117 [0. 5 credit]

Community/Identity

Art and the interrelationships among the artist, architect, patron, critic and public in the context of the contribution of art and its institutions to the articulation or constitution of communal identities in Canadian and/or international contexts.

Precludes additional credit for ARTH 5107.

ARTH 5119 [0. 5 credit]

Aspects of Contemporary Art Practice

Contemporary art practice, including the artist collective, traditional and new media (painting, sculpture, installation, video, digital art), the relationship of artist and society, critical and public reception of contemporary art, and interaction between institutional collecting and artist-run centres in Canadian and/or international contexts.

Precludes additional credit for ARTH 5109.

ARTH 5210 [0. 5 credit]

Topics in Aboriginal Art

The creative production, aesthetic culture, and reception of selected aboriginal peoples in pre-contact, historic, and/or modern time, drawing on postcolonial and critical theory.

Precludes additional credit for ARTH 5200, ARTH 5204, and ARTH 5303.

ARTH 5218 [0. 5 credit]

Museum Studies and Curatorial Practice

Aspects of museum practice, history and theoretical discourse will be examined in a classroom setting, or the preparation, realization, and/or study of an exhibition in an Ottawa-area museum.

Precludes additional credit for ARTH 5207 and ARTH 5208.

ARTH 5402 [0. 5 credit]

The Archive in Art and Architecture

Diverse aspects of the Archive that may include theoretical perspectives, research applications, and access to specialized collections in the local area.

ARTH 5403 [0. 5 credit]

Architecture and Its Institutions

Specialized topics examine theory and practice of architects, architectural historians and critics from historical and contemporary perspectives in Canadian and/or international contexts.

ARTH 5500 [0. 5 credit]

Photography and Its Institutions

Photographic practice and reception with emphasis on social, political and cultural contexts and theoretical approaches to the study of photographs in Canadian and/or international contexts.

ARTH 5600 [0. 5 credit]

Outside the Canon

Specialized topics investigating creative productions usually considered outside the canon. The role of community-based artistic traditions, canon construction and its Others, the discourse surrounding folk art, the influence of the market, social context, and style may be considered in Canadian and/or international contexts.

ARTH 5909

M. A. Thesis

Ottawa-Carleton Collaborative Program in Bioinformatics

30 Marie Curie
Ottawa, ON K1N 6N5
Tel.: 613-562-5800

The Program

Coordinator: Stephane Aris-Brosou, Department of Biology, University of Ottawa
Associate Coordinator: Michel Dumontier, Department of Biology and School of Computer Science, Carleton University

Bioinformatics is an emerging and increasingly important scientific discipline dedicated to the pursuit of fundamental questions about the structure, function and evolution of biological entities through the design and application of computational approaches. Fundamental research in these areas is expected to increase our understanding of human health and disease which will translate to innovation in industry (i.e. drug discovery). As a field of research, it crosses traditional disciplinary boundaries such as computer science, chemistry, biology, biochemistry, engineering and the medical sciences. While individual researchers usually specialize in a particular area, bioinformaticians today must be able to appreciate significant research in other fields and therefore require an understanding of the basic principles of other disciplines. To meet this challenge Carleton University and the University of Ottawa offer a collaborative program leading to a Master of Science degree with Specialization in Bioinformatics or Master of Computer Science degree with Specialization in Bioinformatics.

Participating Institutes and Departments

The primary degree-granting units are:

- The Ottawa-Carleton Institute of Biology, the joint graduate program of the departments of Biology at the University of Ottawa and Carleton University
- The Ottawa-Carleton Institute of Computer Science, the joint graduate program of the School of Information Technology at the University of Ottawa and of the department of Computer Science at Carleton University
- The Ottawa-Carleton Institute of Mathematics and Statistics, the joint graduate program of the department of Mathematics and Statistics at the University of Ottawa and of the School of Mathematics and Statistics at Carleton University
- The Cellular and Molecular Medicine graduate program of the Department of Cellular and Molecular Medicine (CMM) at the University of Ottawa

The Biochemistry graduate program and the Microbiology & Immunology graduate program of the Department of Biochemistry, Immunology and Microbiology at the University of Ottawa.

The collaborative program is managed by a committee made up of representatives of the various participating units. A director and associate director administer the program.

Members of the Collaborative Program

- S. Aris-Brosou, Computational molecular evolution, Ottawa-Carleton Institute of Biology, University of Ottawa
- K. Baetz, Yeast functional and chemical genomics, chromosome stability, identification of drug mode of action, Biochemistry, Microbiology and Immunology, University of Ottawa

- L. Bertossi, Database systems, data integration, computational logic, Ottawa-Carleton Institute of Computer Science, Carleton University
- J. Cheetham, Membrane biochemistry, Ottawa-Carleton Institute of Biology, Carleton University
- F. Dehne, Parallel computing, Ottawa-Carleton Institute of Computer Science, Carleton University
- G. Drouin, Evolution of multi gene families, concerted evolution, gene conversion, Ottawa-Carleton Institute of Biology, University of Ottawa
- M. Dumontier, Semantic web, drug discovery, cell simulation, hardware acceleration, Ottawa-Carleton Institute of Biology, Ottawa-Carleton Institute of Computer Science, Carleton University
- D. Figeys, Proteomics, mass spectrometry, Biochemistry, Microbiology and Immunology University of Ottawa
- A. Golshani, Proteomics, functional genomics, Ottawa-Carleton Institute of Biology, Carleton University
- R. Gorelick, Evolutionary theory, Ottawa-Carleton Institute of Biology, Ottawa-Carleton Institute of Mathematics and Statistics, Carleton University
- J. Green, Protein structure prediction, data mining, Systems and Computer Engineering, Ottawa-Carleton Institute of Computer Science, Carleton University
- M. Kaern, Gene networks, Cellular & Molecular Medicine, University of Ottawa
- E. Kranakis, Analysis of algorithms, computational and combinatorial geometry, distributed computing, and network security, Ottawa-Carleton Institute of Computer Science, Carleton University
- V. Pestov, Topological transformation groups, geometry of large dimensions, Ottawa-Carleton Institute of Mathematics and Statistics, Carleton University
- D. Sankoff, Mathematical genomics, Ottawa-Carleton Institute of Mathematics and Statistics, University of Ottawa
- S. Sinha, Robust inference, time series analysis, biostatistics, longitudinal data analysis, Ottawa-Carleton Institute of Mathematics and Statistics, Carleton University
- A. Stintzi, Microbial genomics, gene expression and regulation, microarray and functional genomics, Biochemistry, Microbiology and Immunology University of Ottawa
- M. Turcotte, Bioinformatics, algorithm design, applications of machine learning, Ottawa-Carleton Institute of Computer Science, University of Ottawa
- G. Wainer, DEVS formalism, real-time modelling, cellular models, parallel / distributed / web-based simulation, Systems and Computer Engineering, Ottawa-Carleton Institute of Computer Science, Carleton University
- X. Xia, Genomics, evolutionary molecular genetics, molecular phylogenetics, Ottawa-Carleton Institute of Biology, Carleton University

Master's Program

Application to the Program

Applications should be directed to the primary participating unit which is the most appropriate to the student's research interests. Once accepted into one of the participating graduate programs, students must then be sponsored into the collaborative program in Bioinformatics by a faculty member. This is normally the student's supervisor. This faculty member must be appointed, cross-appointed or stand as an adjunct at one or more of the participating units.

The program operates within the general framework of the "Regulations and Procedures for Joint Graduate Programs" (www.ocjip.ca) and the general regulations of the graduate faculty at each of the two universities.

Application forms and further information can be obtained by writing directly to any of the participating institutes or departments, or the program coordinator.

Admission Requirements

The requirements for admission to the master's in the Collaborative Program in Bioinformatics are as follows:

- prior admission to the master's program in one of the supporting units participating in the program.
- a letter of recommendation from the participating faculty member of the Collaborative Program, which both recommends admission and indicates the willingness of the faculty member to supervise the candidate's research program in Bioinformatics.

Program Requirements

The student is responsible for fulfilling both the participating unit requirements for the Master’s degree, and the requirements of the Collaborative Program.

The minimum requirements of the collaborative program include successful completion of two required courses, and a master’s thesis on an approved bioinformatics topic.

A three-credit course at the University of Ottawa is equivalent to a 0.5 credit course at Carleton University.

Required courses

- BIOL 5515 Bioinformatics (0.5 credit)
- BIOL 5517 Bioinformatics Seminar (0.5 credit)

Students in programs in Biology, Computer Science, Mathematics & Statistics may use BIOL 5515 Bioinformatics to count towards degree requirements; BIOL 5517 Bioinformatics Seminar must be taken in addition to the regular seminar course.

In addition, the student’s thesis committee or advisory committee may direct the student to take or audit further courses to complement the student’s background and research program.

Thesis

Candidates must successful complete a research thesis on a topic in bioinformatics supervised by a faculty member of the Collaborative Program in Bioinformatics.

Graduate Courses

Required Courses

BIOL 5515 [0.5 credit] (BNF 5106)

Bioinformatics
Major concepts and methods of Bioinformatics. Topics may include, but are not limited to: genetics, statistics and probability theory, alignments, phylogenetics, genomics, data mining, protein structure, cell simulation and computing.

BIOL 5517 [0.5 credit] (BNF 6100)
Bioinformatics Seminar
Current topics in bioinformatics. Students must successfully complete a presentation and written report.

Other Courses

BIOL 5105 (BIO 5302)	Methods in Molecular Genetics
BIOL 5201 (BIO 8301)	Evolutionary Genetics and Computer Analysis
BIOL 5409 (BIO 5306)	Mathematical Modeling for Biologists
BIOL 5500 (BIO 5207)	Selected Topics
BIOL 5501 (BIO 8100)	Selected Topics in Biology I
BIOL 5502 (BIO 8102)	Selected Topics in Biology II
BIOL 5516	Applied Bioinformatics
COMP 5105 (CSI 5132)	Parallel Processing Systems
COMP 5306 (CSI 5100)	Data Integration
COMP 5307 (CSI 5101)	Knowledge Representation
COMP 5704 (CSI 5131)	Parallel Algorithms and Applications in Bioinformatics
COMP 5703 (CSI 5163)	Algorithm Analysis and Design
COMP 5108 (CSI 5126)	Algorithms in Bioinformatics
COMP 5709 (CSI 5165)	Combinatorial Algorithms
COMP 5706 (CSI 5387)	Data Mining and Concept Learning
STAT 5708 (MAT 5170)	Probability Theory
STAT 5709 (MAT 5171)	Probability Theory II
STAT 5703 (MAT 5181)	Data Mining I
STAT 5702 (MAT 5182)	Modern Applied/Computational Statistics
STAT 5600 (MAT 5190)	Mathematical Statistics I
STAT 5501 (MAT 5191)	Mathematical Statistics II
MATH 6508 (MAT 5314)	Topics in Probability and Statistics
MATH 6507 (MAT 5319)	Topics in Probability and Statistics
SYSC 5104 (ELG 6114)	Methodologies for Discrete-event Modeling and Simulation

Biology

207 Nesbitt Building
Telephone: 613-520-2600 ext. 8814
Fax: 613-520-3539
carleton.ca/biology

Ottawa-Carleton Institute of Biology

Director of the Institute: L. Fahrig (Carleton University)
Associate Director: J. Kerr (University of Ottawa)

Students pursuing studies in biological sciences at the M.Sc. and Ph.D. levels in the Ottawa area do so in a co-operative program that combines the resources of the Departments of Biology of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the Institute. Additional criteria for admission include academic performance, research experience, and referees' appraisals. The student must also be accepted by a faculty member who will supervise the research project, and the choice of supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.
Requests for information and completed applications should be sent to the Director or Associate Director of the Institute. Additional information may also be obtained through the Institute Web site.

Members of the Institute
- S. Aitken, *Molecular enzymology (Carleton University)*
- S. Aris-Brosou, *Molecular evolution and bioinformatics (University of Ottawa)*
- J.T. Arnason, *Biochemical ecology (University of Ottawa)*
- S. Bertram, *Behavioural Ecology (Carleton University)*
- B. Blais, *Detection technologies for bacterial pathogens (Adjunct, Carleton University)*
- J.M. Blais, *Bio-geochemistry of toxic substances (University of Ottawa)*
- G. Blouin-Demers, *Reptile conservation and behavioural ecology (University of Ottawa)*
- L. Bonen, *Molecular biology (University of Ottawa)*
- C. Boutin, *Agro-ecosystems, plant conservation, wildlife habitat, herbicides (Adjunct, Carleton University)*
- S. J. Brooks, *Animal biochemistry (Adjunct, Carleton University)*
- N. Cappuccino, *Population and community ecology (Carleton University)*
- G.R. Carmody, *Population genetics (Adjunct, Carleton University)*
- W. Casley, *Genetic complexity in xenobiotic metabolism (University of Ottawa)*
- P.M. Catling, *Plant biosystematics (University of Ottawa)*
- B. Chakravarthy, *Molecular signaling and cell adaptation (Adjunct, Carleton University)*
- N. Chaly, *Cell biology (Carleton University)*
- F. Chapleau, *Fish evolution (University of Ottawa)*
- C. Charest, *Plant physiology (University of Ottawa)*
- J.J. Cheetham, *Membrane biochemistry (Carleton University)*
- K. Conlan, *Arctic ecology (Adjunct, Carleton University)*
- S. Cooke, *Fish Ecology and Conservation Physiology (Carleton University)*
- D.J. Currie, *Macroecology, biogeography (University of Ottawa)*
- A. Danylchuk, *The Island School, Cape Eleuthera, Bahamas (Adjunct, Carleton University)*
- J. Dawson, *Neuroethology and biomechanics of insect flight (Carleton University)*
- G. Drouin, *Molecular genetics (University of Ottawa)*
- M. Dumontier, *Bioinformatics, drug discovery, cell simulation, genome biology (Carleton University)*
- M. Ekker, *Developmental genetics (University of Ottawa)*

- L. Fahrig, *Landscape ecology (Carleton University)*
- C.S. Findlay, *Evolution (University of Ottawa)*
- M.R. Forbes, *Evolutionary ecology (Carleton University)*
- R. Fourney, *RCMP, Forensics Lab (Adjunct, Carleton University)*
- C.M. Francis, *Conservation ecology, population biology, ornithology (Adjunct, Carleton University)*
- K. Gajewski, *Climatology and climatic changes (University of Ottawa)*
- A.J. Gaston, *Conservation biology (University of Ottawa)*
- H. G. Gilchrist, *Behavioral ecology, Arctic ecology and avian ecology (Adjunct, Carleton University)*
- K.M. Gilmour, *Comparative respiratory physiology (University of Ottawa)*
- L. Gillespie, *Systematics and evolution of flowering plants (University of Ottawa)*
- S. Gleddie, *Eastern Cereal & Oilseed Research Centre (Adjunct, Carleton University)*
- J.-G. Godin, *Behavioural ecology of fishes (Carleton University)*
- A. Golshani, *Proteomics, post-proteomics, molecular biology, microbiology (Carleton University)*
- R. Gorelick, *Evolutionary theory and botany (Carleton University)*
- C. Hebert, *Ecology, isotopes (Adjunct, Carleton University)*
- S. Hepworth, *Plant molecular genetics (Carleton University)*
- J.G. Houseman, *Insect physiology (University of Ottawa)*
- B. Johnson, *Cell biology of yeasts and a parasitic protozoans (Adjunct, Carleton University)*
- D.A. Johnson, *Molecular biology (University of Ottawa)*
- R. Kassen, *Experimental evolution ecology and genetics (University of Ottawa)*
- S. W. Kennedy, *Environmental toxicology (University of Ottawa)*
- J. Kerr, *Biodiversity, landscape ecology, geomatics (University of Ottawa)*
- I. Lambert, *Molecular biology and genetic toxicology (Carleton University)*
- D.R.S. Lean, *Ecotoxicology (University of Ottawa)*
- A. Lévesque*, Molecular taxonomy (Adjunct, Carleton University)*
- J. Lewis, *Neurobiology (University of Ottawa)*
- K. Lindsay, *Ecology, behaviour, and systematics (Adjunct, Carleton University)*
- B.L.A. Miki, *Plant molecular biology (Adjunct, Carleton University)*
- P. Mineau, *Ecotoxicology (Adjunct, Carleton University)*
- T.W. Moon, *Comparative physiology and biochemistry (University of Ottawa)*
- A. Morin, *Freshwater ecology (University of Ottawa)*
- J. Nash, *Genomics (Adjunct, Carleton University)*
- T. Ouellet, *Plant molecular pathology, plant molecular biology (University of Ottawa)*
- M. Paulin-Levasseur, *Cell biology (University of Ottawa)*
- S.B. Peck, *Arthropod and beetle evolution systematics (Carleton University)*
- S.F. Perry, *Comparative respiratory physiology (University of Ottawa)*
- B. Philogène, *Ecophysiology of insects, chemical ecology (University of Ottawa)*
- F. Pick, *Aquatic ecology (University of Ottawa)*
- J. Picman, *Behavioural ecology (University of Ottawa)*
- C. Plowright, *Animal cognition and behavioural ecology (University of Ottawa)*
- C.B. Renaud, *Fish biology (University of Ottawa)*
- O. Rowland, *Plant molecular biology and biotechnology (Carleton University)*
- N. Rybczynksi, *Mammalian evolution (Adjunct, Carleton University)*
- M. Saner, *Bioethics (Adjunct, Carleton University)*
- T. Sherratt, *Evolutionary ecology (Carleton University)*
- A. Simons, *Plant life-history evolution (Carleton University)*
- J. Skevington*, Insect systematics (Adjunct, Carleton University)*
- M. Smith, *Fungal molecular genetics (Carleton University)*
- K.B. Storey, *Biochemical adaptations (Carleton University)*
- G. Subramaniam*, Molecular pathology (Adjunct, Carleton University)*
- V. Trudeau, *Comparative endocrinology (University of Ottawa)*
- J.P. Vierula, *Molecular biology (Carleton University)*
- J.-M. Weber, *Metabolic physiology (University of Ottawa)*
- P. White, *Environmental toxicology, molecular toxicology, functional genomics (University of Ottawa)*
- W.G. Willmore, *Biochemistry, biotechnology (Carleton University)*
- X. Xia, *Molecular evolution, bioinformatics (University of Ottawa)*

- T. Xing, *Plant genomics (Carleton University)*
- J. E. Yack, *Behavioural physiology, entomology (Carleton University)*
- C. Yauk, *Mutations, environmental health (Adjunct, Carleton University)*

Ottawa-Carleton Specialization in Behavioural Neuroscience

The Departments of Biology and Psychology at Carleton University, and the School of Psychology at the University of Ottawa provide a graduate specialization in behavioural neuroscience at the M.Sc. and Ph.D. level. For further details see the Neuroscience program section of this Calendar.

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

The Departments of Biology and Chemistry at Carleton University and at the University of Ottawa provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details see the Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology's section of this Calendar.

Each campus is well-equipped for a wide range of biological research. Some major equipment and facilities include scanning and transmission electron microscopes; confocal laser scanning microscope; digital light microscope and image analysis facilities; conventional and digital darkrooms; animal and plant growth facilities; animal cell culture facilities; electro-physiology equipment; computer systems for genomic studies, modeling of ecological systems, and access to the Internet and the Web; DNA and protein analysis facilities, including electrophoresis and chromatographic equipment, and ultra-centrifuges. Students also benefit from the resources of nearby government laboratories and libraries, including Agriculture Canada, Environment Canada, Health and Welfare Canada, and the National Research Council.

Master of Science

Admission Requirements

An Honours B.Sc. or equivalent degree at a standard acceptable to the two universities is required for admission to the M.Sc. program. Applicants with acceptable standing in a non-honours degree may be admitted to a qualifying-year program which will be determined in each case by the admissions committee.

Applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements

The M.Sc. degree will be conferred upon a candidate who has fulfilled the following requirements:

- Completion of the advanced courses specified by the admissions committee and the student's advisory committee; these will range from one to three full (two-term) courses, depending on the background and research program of the student. At least one course at the graduate level must be included, and not more than one course at the fourth-year honours level (completed while registered as a graduate student) may form part of the candidate's course requirements. The passing grade for all required courses is 70% or the equivalent, and the student is not allowed a supplemental examination. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.

- Completion of at least two terms as a full-time student resident at one of the two universities is normally required. Programs for part-time students may be arranged.
- Presentation of one public seminar on the candidate's thesis research.
- Completion of a thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member.
- Successful oral defence of the thesis before an examination board of at least three faculty members, normally drawn from both universities.

Guidelines for Completion of Master's Degree

The maximum time limits for the completion of the requirements of the master's program are listed in the General Regulations, Section 13 of this Calendar. Full-time candidates in the master's program are expected to complete their degree requirements within six terms of first registration for full-time study. Part-time candidates in the master's program, and candidates who elect to complete their program by a combination of full-time and part-time study, are expected to complete their degree requirements within four calendar years or twelve terms from the initial registration in the master's program.

Doctor of Philosophy

Admission Requirements
An M.Sc. from a recognized university is usually required for entry to the Ph.D. program; however, an applicant with a first class B.Sc. and excellent references may be admitted directly to the Ph.D. program. A student already registered for the M.Sc. may be permitted to transfer to the Ph.D. program following a recommendation by the departmental graduate committee and successful completion of the Qualifying Examination required of Ph.D. candidates.

All applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements
The Ph.D. degree will be conferred upon a candidate who has fulfilled the following requirements:

- Completion of the courses at the graduate level specified by the admissions and advisory committees; these will range from one to four full courses (two to six courses if admitted without an M.Sc.), depending on the background and research program of the student. Only graduate courses may form part of the candidate's course requirements. The passing grade for all required courses is 70%, and the student is not allowed a supplemental examination. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.
- Scheduling of an oral Qualifying Examination within approximately 12 months of entry into the program and completion normally within 18 months; this examination will cover the candidate's area of research, and related topics. The format of the examination will be established by the departmental graduate committee. The examination committee generally will be composed of faculty members of both universities.
- Presentation of at least one public seminar on the candidate's thesis research.
- A thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member.
- Completion of at least four terms as a full-time student resident at one of the two universities (or six terms if admitted without an M.Sc.) is required. Under exceptional conditions programs may be arranged for part-time students.

- Successful oral defence of the thesis before an examination board of at least five faculty members, with representation from both universities, and including an external examiner from outside the two universities who is an authority on the thesis research area.

Guidelines for Completion of the Doctoral Degree
The maximum time limits for the completion of the program requirements of the doctoral program are listed in the General Regulations, Section 13 of this Calendar. Full-time candidates in the doctoral program are expected to schedule their oral Qualifying Examination within approximately 12 months of entry into the program, and to complete it within 18 months of entry into the program. Part-time candidates in the doctoral program are expected to schedule their oral Qualifying Examination within approximately 18 months after entry into the program. Full-time candidates are expected to complete their degree requirements within 4 calendar years or 12 terms of registered full-time study. Doctoral candidates who have transferred from the master's to the doctoral program without completing the master's program are expected to complete their degree requirements within 4 calendar years or 12 terms of registered full-time study from initial registration in the master's program. Part-time candidates in the doctoral program, and candidates who elect to complete their program by a combination of full- and part-time study, are expected to complete their degree requirements within 6 calendar years or 18 terms after the date of initial registration.

Graduate Courses

Note: Biology Graduate Courses section revised June 19, 2009. Consult carleton.ca/calendars/grad/0910/updates for details.

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult **central.carleton.ca**

University of Ottawa course numbers (in parentheses) follow the current Carleton course number and credit information.

BIOL 5001 [0.5 credit] (BIO 5101)
Topics in Biotechnology
A course concerned with the utilization of biological substances and activities of cells, genes, and enzymes in manufacturing, agricultural, and service industries. A different topic will be selected each year.
Prerequisite: a course in cell physiology or biochemistry, or permission of instructor.

BIOL 5003 [0.5 credit] (BIO 5103)
Comparative Biochemistry
Advanced topics emphasizing biochemical structures, functions, and methodologies in the context of animal (invertebrates and vertebrates) adaptations to environmental stress. Offered in alternate years.
Prerequisite: an undergraduate biochemistry course.

BIOL 5009 [0.5 credit] (BIO 8124)
Ontario Vegetation: Patterns, Processes and Protection
Patterns of vegetation and plant species distributions in Ontario will be investigated with respect to their origin and maintaining processes. Current methods of protection of significant and representative vegetation using zonal concepts will be considered.

BIOL 5100 [0.5 credit] (BIO 5301)

Plant Development

An advanced course dealing with selected topics in the experimental study of plant development.

BIOL 5105 [0.5 credit] (BIO 5302)

Methods in Molecular Genetics

Review of the fundamental theory and techniques in genetic manipulation of prokaryotes and eukaryotes and examination of some of the innovative new strategies being applied to a variety of problems in molecular biology.
Precludes additional credit for BIOL 4106 or BIOL 5107.
Prerequisite: graduate standing and permission of the Department.

BIOL 5106 [0.5 credit] (BIO 5308)

Laboratory Techniques in Molecular Genetics

This laboratory course, which is complementary to BIOL 5105, is designed to give students practical experience in many of the important techniques in molecular genetics.
Precludes additional credit for BIOL 4109 or BIOL 5107.
Prerequisite: graduate standing and permission of the Department.

BIOL 5201 [0.5 credit] (BIO 8301)

Evolutionary Genetics and Computer Analyses

Students will learn the basic concepts in molecular evolution and gain hands-on experience with the computer analysis of DNA sequences.Topics will include molecular sequence databases, multiple alignments, amino acid and codon usage, molecular clocks, and phylogenetic trees.
Prerequisites: graduate standing plus basic courses in genetics and evolution; permission of the Department.

BIOL 5202 [0.5 credit] (BIO 8302)

Topics in Evolutionary Genetics

A lecture/seminar course on the genetic mechanisms and forces responsible for variation and evolutionary change in natural populations.Topics to include protein and genome evolution, molecular phylogenies, DNA sequences in population biology, and the evolution of multigene families.
Prerequisites: graduate standing plus basic courses in genetics and evolution; permission of the Department (Offered in alternate years).

BIOL 5203 [0.5 credit] (BIO 8303)

Techniques of Light Microscopy

Advanced laboratory and lecture course on the principles and techniques of light microscopy.
Precludes additional credit for BIOL 5200 (BIO 8238) (if taken before 1997-98).
Prerequisite: open to fourth-year and graduate students with consent of the instructor.

BIOL 5204 [0.5 credit] (BIO 8304)

Techniques of Electron Microscopy

Advanced laboratory and lecture course on the principles and techniques of electron microscopy.
Precludes additional credit for BIOL 5200 (BIO 8238) (if taken before 1997-98).
Prerequisite: open to fourth-year and graduate students with permission of the instructor.

BIOL 5205 [1.0 credit] (BIO 5204)

Plant Physiology and Metabolism

Advanced course dealing with selected topics in plant physiology and metabolism.
Prerequisite: graduate standing or permission of the Department.

BIOL 5304 [1.0 credit] (PSY 6201)

Basics of Neuroscience

A comprehensive neuroscience course from cellular levels to neural systems and behaviour. Topics covered include aspects of neuroanatomy, neurophysiology, neuropharmacology and behavioural and cognitive neuroscience. (Also listed as PSYC 5200)

BIOL 5306 [0.5 credit] (BIO 9201)

Photobiology

The interaction between light and living organisms; introduction to photochemistry, detailed study of photosynthesis, vision, photosensitivity, and photoperiodism.
Prerequisite: an advanced course in animal or plant physiology or biochemistry, or permission of the Department.

BIOL 5307 [0.5 credit] (BIO 8122)

Advanced Insect Physiology

Physiological characteristics of insects.

BIOL 5402 [0.5 credit] (BIO 8162)

Developmental Endocrinology/Topics in Comparative Endocrinology

A lecture and reading course concerned with classical and current topics in the field of comparative endocrinology. Special emphasis on the vertebrates. Offered in alternate years.
Prerequisite: an undergraduate course in endocrinology.

BIOL 5405 [1.0 credit] (BIO 9202)

Project in Applied Ecology

A course in the form of a special research project in which the student identifies an environmental problem and the corporate or governmental body that has the power to rectify the problem.

BIOL 5407 [0.5 credit] (BIO 5305)

Quantitative Ecology

Analysis of the distribution and abundance of organisms and of related environmental phenomena.
Prerequisites: graduate standing, courses in elementary ecology, elementary statistics and biostatistics, and permission of the Department.

BIOL 5409 [0.5 credit] (BIO 5306)

Mathematical Modeling for Biologists

This course is designed to develop mathematical tools for the modeling of biological processes. The student is taught the necessary mathematics and a computer language, and guidance is given in the choice of simulation of a biological process.

BIOL 5500 [1.0 credit] (BIO 5207)

Selected Topics

Courses in selected aspects of specialized biological subjects not covered by other graduate courses; course details will be available at registration.

BIOL 5501 [0.5 credit] (BIO 8100)

Selected Topics in Biology I

Courses in selected aspects of specialized biological subjects not covered by other graduate courses; course details will be available at registration.

BIOL 5502 [0.5 credit] (BIO 8102)

Selected Topics in Biology II

Courses in selected aspects of specialized biological subjects not covered by other graduate courses; course details will be available at registration.

BIOL 5503 [0.5 credit] (BIO 5901)

Recent Advances in Biology

A course intended for all first-year graduate students to bring them up to date in the various major areas of biology. The course consists of selected readings, lectures, and invited speakers. Graded Sat/Uns.

BIOL 5506 [0.5 credit] (BIO 5213)

Advanced Insect/Animal Systematics

A lecture and seminar course concerning methods, roles and advances in systematics of insects and other animals. One research project required.
Prerequisite: a 4000-level course in identification or classification of insects or other animals.

BIOL 5508 [0.5 credit] (BIO 8306)

Advanced Topics in Ecology I

Lectures, seminars and discussions on current literature on experimental approaches, concepts, and findings in population and community ecology, ecosystem and landscape ecology, and biostatistics. The content complements BIOL 5509 (BIO 8307).
Precludes additional credit for BIOL 5408 (BIO 9200) (if taken before 1997-98).

BIOL 5509 [0.5 credit] (BIO 8307)

Advanced Topics in Ecology II

Lectures, seminars and discussions on current literature on experimental approaches, concepts and findings in population and community ecology, ecosystem and landscape ecology and biostatistics. The content complements BIOL 5508 (BIO 8306).
Precludes additional credit for Biology 61.548 (BIO 9200) (if taken before 1997-98).

BIOL 5601 [0.5 credit] (BIO 5161)

Advanced Topics in Insect Evolution I

An exploration of major concepts and questions in insect evolution in the areas of systematics, morphology, the fossil record, biology, and behaviour. The content complements BIOL 5602 (BIO 5162).
Precludes additional credit for BIOL 5600 (BIO 5160).

BIOL 5602 [0.5 credit] (BIO 5162)

Advanced Topics in Insect Evolution II

An exploration of major concepts and questions in insect evolution in the areas of systematics, morphology, the fossil record, biology, and behaviour. The content complements BIOL 5601 (BIO 5161).
Precludes additional credit for BIOL 5600 (BIO 5160).

BIOL 5605 [0.5 credit] (BIO 5102)

Field Course

Credit for this 0.5 credit course is based on a total of three weeks of field-course modules, involving one or two weeks of intensive and continuous field work with attendant assignments. For details, see coordinator.

BIOL 5709 [0.5 credit] (BIO 8113)

Chemical Toxicology

An introduction to modeling chemical hazards and exposures at the cellular level. The properties of toxic substances are compared to the responses of enzymatic systems. These interactions are defined as Quantitative Structure-Activity Relationships and used to interpret hazardous materials under regulations such as WHMIS. (Also listed as CHEM 5709/CHM 8157)
Prerequisite: BIOL 6402/CHEM 5708 (BIO 9101/CHM 8156).

BIOL 5801 [0.5 credit] (BIO 5105)

Animal Behaviour

Animal behaviour from an ecological and evolutionary point of view, with additional independent assignments.
Prerequisites: BIOL 3305 and BIOL 3601 or equivalents and registration in a graduate program, or written permission of the Department.

BIOL 5802 [0.5 credit] (BIO 8365)

Advanced Behavioural Ecology I

Recent ideas and research on advanced topics dealing with the evolution of foraging, temporal, spatial, and reproductive strategies are discussed and critically examined. Offered in alternate years.

BIOL 5909

M.Sc. Thesis

BIOL 6001 [0.5 credit] (BIO 8109)

Advanced Molecular Biology I

Recent advances in molecular biology. Topics for discussion may include: DNA structure and function; the organization of the genome; DNA, RNA and protein synthesis; the regulation of gene expression in eukaryotes and prokaryotes. Normally offered in alternate years.

BIOL 6002 [0.5 credit] (BIO 8116)

Advanced Molecular Biology II

Recent advances in molecular biology. Topics for discussion may include: mutagenesis and DNA repair; molecular aspects of gene transfer; recombination and gene arrangement; molecular biology as applied to industrial and medical problems. Normally offered in alternate years.

BIOL 6201 [0.5 credit] (BIO 8117)

Advanced Cell Biology I

Recent advances in cell biology. Topics for discussion may include: the composition, biosynthesis, deployment, three-dimensional organization and functions of the cytoskeleton; cell-substrate attachment; cell motility; transport of organelles and axoplasmic transport; cell surface and extracellular matrix. Normally offered in alternate years.

BIOL 6202 [0.5 credit] (BIO 8118)

Advanced Cell Biology II

Topics for discussion may include: the structure, composition and three-dimensional organization of the nucleus, mechanisms and regulation of genome replication, structure organization of transcription. Nuclear reorganization during gamete development, fertilization, viral infection and the mitotic cell cycle. Normally offered in alternate years.

BIOL 6203 [0.5 credit]

Special Topics in Neuroscience

In-depth study of current topics in neuroscience. Course content varies yearly and has recently included cognitive neuroscience, neuropharmacology, neurodegeneration, and behavioural medicine. (Also listed as PSYC 6300.)

BIOL 6204 [0.5 credit] (ANA 7400)

Neuroscience Techniques

Completion of a research project carried out under the supervision of a neuroscience faculty member. The student will learn a new neuroscience technique and apply it to a research

objective. May be repeated for different projects. Students must obtain approval from the Director of the Neuroscience Specialization. (Also listed as PSYC 6204.)

BIOL 6205 [0.5 credit] (BIO 8319)

Advanced Plant Physiology

A lecture and seminar course dealing with selected topics in advanced plant physiology, available only to graduate students.
Prerequisite: BIOL 4209 or equivalent, or permission of the Department.

BIOL 6300 [0.5 credit] (BIO 8320)

Advanced Plant Biochemistry

A lecture and seminar course, available only to graduate students, dealing with selected topics in advanced plant biochemistry.
Prerequisites: BIOL 4205 and BIOL 4206/4207, or permission of the Department.

BIOL 6304 [0.5 credit] (BIO 8361)

Advanced Topics in Animal Physiology

In-depth study of areas in animal physiology of current research interest.

BIOL 6305 [0.5 credit]

Advanced Seminar in Neuroscience I

A comprehensive pro-seminar series, covering issues ranging from cellular and molecular processes through to neural systems and behaviours as well as psychopathology.
(Also listed as PSYC 6202.)
Precludes additional credit for BIOL 6303 [1.0].
Prerequisite: BIOL 5304.

BIOL 6306 [0.5 credit]

Advanced Seminar in Neuroscience II

A comprehensive pro-seminar series, covering issues ranging from cellular and molecular processes through to neural systems and behaviours as well as psychopathology. (Also listed as PSYC 6203).
Precludes additional credit for BIOL 6303 [1.0].
Prerequisite: BIOL 6305.

BIOL 6401 [0.5 credit] (BIO 8935)

Recent Advances in Plant Biology

Special topics of current interest.

BIOL 6402 [0.5 credit] (BIO 9101)

Principles of Toxicology

This course identifies the basic theorems of toxicology with examples of current research problems. Toxic risk is defined as the product of intensive hazard and extensive exposure. Each factor is assessed in scientific and social contexts and illustrated with many types of experimental material. (Also listed as CHEM 5708/CHM 8156.)

BIOL 6403 [0.5 credit]

Ecotoxicology

Concepts of ecotoxicology, emphasizing whole ecosystem response to hazardous contaminants. The focus is the impacts of chronic and acute exposure of ecosystems to toxicants, the methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues. (Also listed as CHEM 5705/CHM 9109.)
Prerequisite: BIOL 6402/CHEM 5708 (BIO 9101/CHM 8156.)

BIOL 6404 [0.5 credit] (BIO 8938)

Plant: Animal Interactions

Secondary metabolites of plants and their role as attractants or antifeedants to animals and as allelopathic or antifungal agents. Emphasis on co-evolution of plants and phytophagous organisms such as insects and mammals, and the ecological and physiological dimensions of this relationship. Offered in alternate years.

BIOL 6405 [0.5 credit] (BIO 9105)

Seminar in Toxicology

This course introduces the seminar format and involves student, faculty and invited seminar speakers. The student will present a seminar and submit a report on a current topic in toxicology. (Also listed as CHEM 5805/CHM 8167.)

BIOL 6505 [0.5 credit] (BIO 8108)

Advanced Topics in Development

Recent advances in developmental biology. Topics may include embryonic induction, regulation of morphogenesis and differentiation, mechanisms of regional specification and pattern formation, and developmental genetics. Offered in alternate years.

BIOL 6909

Ph.D. Thesis

Biomedical Engineering

Carleton University
Minto Centre, Room 3090
1125 Colonel By Drive
Ottawa, ON, Canada K1S 5B6
Telephone: 613-520-5659
Fax: 613-520-3899
www.ocibme.ca

Please consult the Institute's Web site for application information.

The Institute

Director of the Institute: Rafik Goubran
Associate Director of the Institute: Martin Bouchard

Established in 2006, The Ottawa-Carleton Institute for Biomedical Engineering combines resources from seven participating academic units:

Carleton University

- Department of Systems and Computer Engineering (SCE)
- Department of Mechanical and Aerospace Engineering (MAE)
- School of Computer Science (SCS)
- Department of Physics (PHYS)

University of Ottawa

- Department of Mechanical Engineering (MCG)
- School of Information Technology and Engineering (SITE)
- Department of Chemical Engineering (CHG)

A student is admitted to one of the above participating academic units and is assigned a supervisor or co-supervisor from one of these units.

The Institute draws on the expertise of two participating medical research units: the University of Ottawa Heart Institute and the University of Ottawa Eye Institute. It also draws on the expertise of prominent researchers from other academic units in the two universities and medical professionals from hospitals and well-established medical research institutions. The members of the Institute listed below can act as supervisors.

Members of the Institute

The home department of each member is indicated by:

APA Human Kinetics (Ottawa) BIOL Biology (Carleton)
CHG Chemical Engineering (Ottawa)
CMM Cellular and Molecular Medicine (Ottawa)
DOE Electronics (Carleton)
MAE Mechanical and Aerospace Engineering (Carleton)
MAT Mathematics and Statistics (Ottawa)

MATH Mathematics and Statistics (Carleton)
MCG Mechanical Engineering (Ottawa)
OEI Eye Institute (Ottawa)
OHI Heart Institute (Ottawa)
ORA Audiology and Speech Language Pathology (Ottawa)
PED Pediatrics (Ottawa)
PHYS Physics (Carleton)
PHYO Physics (Ottawa)
PSY Psychology (Carleton)
SCE Systems and Computer Engineering (Carleton)
SCS School of Computer Science (Carleton)
SID School of Industrial Design (Carleton)
SITE Information Technology and Engineering (Ottawa)
TRC Rehabilitation Centre (Ottawa)

- T. Aboulnasr, *Digital signal processing, applications in communications (SITE)*
- A. Adler, *Medical image processing, electrical impedance tomography, physiological monitoring, biometrics (SCE)*
- M. Ahmadi, *Robotic analysis, design, and control, machine and biological locomotion, mechatronics, simulation, virtual reality, distributed and real-time control (MAE)*
- V. Aitken, *Distributed processes, process control (SCE)*
- H. Anis, *Photonics devices and systems (SITE)*
- N. Baddour, *Modeling of signal analysis in biomedical applications (MCG)*
- A. Banihashemi, *Information and coding theory, bioinformatics and genetic coding, image and video processing and transmission (SCE)*
- M. Barbeau, *Telecommunications software, distributed systems, mobile and wireless networks (SCS)*
- J.C. Beddoes, *Physical metallurgy and metal processing (MAE)*
- R. Bell, *Finite element analysis, stress analysis, solid mechanics, fracture mechanics (MAE)*
- P. Berini, *Electromagnetics, photonics, surface plasmons, biosensors (SITE)*
- L. Bertossi, *Database and intelligent information systems, knowledge representation (SCS)*
- M. Bolic, *Computer architectures, signal processing, Bayesian statistical signal processing, wireless communications, RFID systems (SITE)*
- M. Bouchard, *Signal processing for speech/audio/acoustics/hearing aids, adaptive filtering (SITE)*
- A. Boukerche, *Large-scale distributed simulations, algorithms and systems, mobile computing and networking, sensors network (SITE)*
- Y. Bourgault, *Numerical methods, mathematical modeling (MAT)*
- L. Briand, *Software reliability and certification (SCE)*
- X. Cao, *Biomaterials and tissue engineering (CHG)*
- A.D.C. Chan, *Biological signal processing, physiological monitoring, pattern recognition (SCE)*
- J.J. Cheetham, *Membrane biochemistry, bioinformatics (BIOL)*
- A. Cuhadar, *Image-video processing and compression, high-performance computing algorithms, medical imaging, speaker verification/identification, voice authentication (SCE)*
- H. Danjani, *Audiometric instrumentation, auditory-inspired speech processing, speech perception and production, signal processing for cardio-respiratory applications (SITE)*
- R.M. Dansereau, *Digital signal and image processing, biomedical and biometric applications, fractal and multifractal complexity measures: Rényi dimension measures, wavelets (SCE)*
- F. Dehne, *Parallel processing, coarse grained parallel computing, parallel computational geometry, parallel data mining, parallel computational biology (SCS)*
- R. DeKemp, *Medical physics (OHI/PHYS-SITE)*
- D. Deugo, *Large-scale distributed object computing, evolutionary computation (genetic algorithms, genetic programming, artificial life) and object-oriented systems (SCS)*

- M. Dubé, *Polymer reaction engineering, adhesives and coatings from emulsion polymers, pilot plant testing of new sensor technology, parameter estimation (CHG)*
- E. Dubois, *Digital signal processing, multidimensional signal processing, data compression, source coding, image/video processing and coding (SITE)*
- M. Dumontier, *Bioinformatics, drug discovery, cell simulation, genome biology (BIOL)*
- A. El-Saddik, *Collaborative environments and multimedia communications, web engineering, haptic audio visual environments (SITE)*
- C. Ennett, *Medical informatics, medical decision support systems (SCE)*
- A. Fahim, *CAD/CAM, controls (MCG)*
- M. Fenech, *Biomedical engineering, biofluids, biomechanical simulation, biorheology, blood flows, artifical organs (MCG)*
- L. Frankel, *Industrial design, design for elderly/vision impaired, wearable devices for healthcare (SID)*
- M. Frize, *Biomedical instrumentation, clinical engineering, infrared imaging, decision-support systems in medicine, ethics in engineering and human experimentation (SCE/SITE)*
- N.D. Georganas, *Multimedia communications, computer communications (SITE)*
- C. Giguère, *Audiology and hearing aids (ORA/SITE)*
- R.A. Goubran, *Signal processing, sensors, digital systems design, adaptive systems, beam-forming, heart and lung sound analysis, smart homes, echo and noise cancellation (SCE)*
- J.R. Green, *Bioinformatics, machine learning, nonlinear system identification (SCE)*
- M. Griffith, *Artificial human tissues, tissue equivalents and stem cells for in vitro testing and transplantation (CMM)*
- V. Groza, *Real-time embedded systems, smart sensors networks, reconfigurable computing, distributed intelligent instrumentation (SITE)*
- W. Gueaieb, *Machine intelligence and mechatronics, robotics and control systems, computational intelligence (SITE)*
- J. Gu, *Transport phenomena in micro-scale processes, direct methanol fuel cells (MAE)*
- *H. Haddad, Cardiology (OHI/SCE)*
- M.J.D. Hayes, *Space robotics, automated optical robot calibration systems, robot mechanical systems, theoretical kinematics (MAE)*
- B.J. Jarosz, *Medical physics (PHYS)*
- B. Jodoin, *Thermofluids, plasma physics (MCG)*
- P. Johns, *Medical physics (PHYS)*
- M. Johnson, *Combustion/fluid mechanics (MAE)*
- J. Kelly, *Central auditory system, electrophysiology and behaviour (PSY)*
- F.D. Knoefel, *Geriatric rehabilitation, role of technology in "aging in place" (SCE)*
- T. Kovesi, *Respirology (SCE)*
- E. Kranakis, *Communication networks, distributed computing, network security (SCS)*
- T. Kunz, Mobile, *Pervasive, and ubitquitous computing, wireless network protocol (SCE)*
- M. Labrosse, *Mechanics of heart valve and cardiovascular tissues, mechanical aspects in development of cardiovascular diseases, friction and fatigue life of materials (MCG)*
- *R. Laganière, Computer vision, image processing (SITE)*
- M. Lamontagne, *Muscoskeletal knee joint model, mechanical effect of functional knee braces, plantar pressure distribution during winter sports (APA/MCG)*
- C. Lan, *Biochemical engineering, separation technology (CHG)*
- J. Lang, *Image processing, computer graphics, physical modeling, deformable models, motion estimation, stereo vision (SITE)*
- R. Langlois, *Flexible multibody dynamics, vehicle dynamics, aircraft/ship dynamic interface analysis, mathematical modeling simulation, postural stability (MAE)*
- W. Lee, *Face recognition, human-computer interaction, VR in health care (SITE)*
- F. Leenen, *Brain mechanisms determining sympathetic hyperactivity, the role of circulatory versus cardiac renin-angiotensin system in cardiac hypertrophy and remodeling, and antihypertensive agents and the heart (OHI)*
- E. Lemaire, *Physical rehab distance communication (TRC/APA/MCG)*

- G. Lindgaard, *User interfaces and human computer interaction (PSY)*
- X.P. Liu, *Interactive networked systems, robotics, intelligent systems, sensor networks (SCE)*
- A. Longtin, *Nonlinear dynamics, biophysics (PHYO)*
- L. MacEachern, *VLSI, analog IC design, image sensors (DOE)*
- S.A. Mahmoud, *Wireless networks, distributed databases, radio packet switching (SCE)*
- Y. Mao, *Graphical models and statistical inference, communications, bioinformatics (SITE)*
- E.A. Matida, *Pharmaceutical aerosols (inhalation devices), large eddy simulation (MAE)*
- S. Mills, *Data mining, applied statistics, decision support, classification and pattern recognition, dynamic network analysis (MATH)*
- A. Miri, *Control systems, signal processing, biometrics, sensors, security and privacy (SITE)*
- *R. Munger, Medical photonics (OEI/PHYO)*
- M.B. Munro, *Biomedical applications of fibre composite materials (MCG)*
- T. Mussivand, *Medical devices design, evaluation (in vitro, in vivo, clinical), artificial heart sensors, valves and prosthetics (OHI/MAE/SITE)*
- R. Naguib, *Medical informatics, medical decision support systems (SCE)*
- D. Necsulescu, *Mechatronics and dynamics (MCG)*
- M. Nganbe, *Metal composites, biomaterials, corrosion resistance (MCG)*
- D. Nussbaum, *Computational geometry, medical computing, parallel and distributed computing, geographic information systems, robotics and machine vision, data structures and algorithms (SCS)*
- Y. Ono, *Ultrasonic sensor and instrument, physiological monitoring, tissue characterization (SCE)*
- D. Panario, *Discrete mathematics and algorithms, finite fields and applications (MATH)*
- E. Paquet, *Anthropometric visual information processing, 2D and 3D content indexing, tomography (SITE)*
- A. Parush, *Patient safety and human error, navigation, orientation, spatial and graph cognition , simulator-based learning and teaching (PSY)*
- P. Payeur, *3-D modeling for robotics, computer vision, autonomous systems (SITE)*
- D.C. Petriu, *Performance evaluation, software engineering, database systems (SCE)*
- E.M. Petriu, *Robotics, sensing and perception, neural networks (SITE)*
- L. Peyton, *Software engineering, e-commerce, and business process automation (SITE)*
- M.I. Radulescu, *Fluid mechanics and shock wave applications (MCG)*
- G. Robertson, *Sport biomechanics, human locomotion, energetics of human motion (APA)*
- G. Rouhi, *Bone mechanics and bone remodeling theories, bio-continuum mechanics and mixture theory, orthopaedic biomechanics, mechanotransduction of cells, mechanics of the musculoskeletal systems (MCG)*
- D.L. Russell, *Dynamics, controls, medical device design (MAE)*
- J. Ryan, *Hearing aids, signal processing (SCE)*
- J. Sack, *Algorithms and complexity, computational geometry, geographic information systems, spatial modeling, medical computing (SCS)*
- H. Schriemer, *Nanosystems, photonics, wave transport, scanning probe microscopy, finite element analysis (SITE)*
- S. Some, *Software engineering, requirements engineering, reverse engineering, program comprehension (SITE)*
- H. Sveistrup, *Physiotherapy (APA)*
- N. Tait, *MEMS, sensors, IC fabrication (DOE)*
- N.G. Tarr, *Solid state devices, IC fabrication (DOE)*
- S. Tavoularis, *Fluid mechanics, experimental techniques (MCG)*
- D. Taylor, *Computer-assisted learning, object-oriented design (CHG)*
- H. Tezel, *Adsorption and diffusion for separation and biomedical applications, gas and liquid separations for industrial applications, environmental air and water pollution control (CHG)*
- A. Tremblay, *Membrane science and technology, interfacial phenomena (CHG)*
- M. Turcotte, *Bioinformatics, algorithm design, applications of machine learning (SITE)*

- P. van Oorschot, *Authentication, software security, network security, applied cryptography, software protection, security infrastructures (SCS)*
- H. Viktor, *Data mining and machine learning, health informatics (SITE)*
- G. Wainer, *Discrete event simulation, modeling and simulation methodologies, parallel and distributed simulation, real-time systems (SCE)*
- R. Walker, *Medical informatics, medical decision support systems (SCE)*
- T. White, *Mobile agents, swarm and collective intelligence, evolutionary computing (artificial life, genetic algorithms, programming), Internet applications, peer-to-peer computing (SCS)*
- M. Yagoub, *Microwaves and applied electromagnetics, RF monitoring of medical equipment and patients, RFIDs (SITE)*
- J. Yao, *Microwave photonics, optics (waveguides, lasers, amplifiers, sensors), bio-photonics (SITE)*
- M. Yaras, *Cardiovascular assist devices, turbomachinery, aerodynamics, computational fluid dynamics (MAE)*
- J. Zhao, *Image and video processing, multimedia communications (SITE)*
- Y. Zhao, *Applied probability, algorithms and simulation (MATH)*

Master's Program

The Ottawa-Carleton Institute for Biomedical Engineering offers a multi-disciplinary Master of Applied Science degree (M.A.Sc.) in Biomedical Engineering. The program has four fields:

1. Medical Instrumentation:
   This field presents the principles of physiological measurements for diagnostic, therapeutic, and monitoring applications, as well as the design of the medical devices for these applications. Medical instrumentation encompassed in this specialization include devices for cardiology, lung function, cerebral and muscular signals, surgery and anesthesiology, ultrasound, and other more specialized devices used for infants and neonates. Students will be provided with an understanding of related physiological systems, including the cardiovascular system and electrophysiology. Students will learn the various topics concerned with data acquisition systems, including electrochemistry, transducers, amplifiers, filters, and safety. Noise reduction, signal enhancement, visualization, and automated diagnostic techniques will also be discussed.
2. Biomedical Image Processing:
   This field involves acquisition and analysis of images relevant to medicine and biotechnology, such as MRI (magnetic resonance imaging), CT (computed tomography), ultrasound, nuclear medicine, and optical microscopy. These modalities generate a wealth of information that must be distilled, presented and communicated in an efficient and timely manner. Statistical counting noise and systematic biases are always present and hinder the extraction of information from the signals. Challenges exist in image display and filtering, feature detection, pattern recognition, and in the interchange, manipulation, compression, short-term storage, and archiving of the images. Recent technical advances in this field include interchange standards such as DICOM, lossy and lossless compression standards, teleradiology, and Picture Archiving and Communications Systems (PACS). A new tool for the radiologist is Computer Aided Diagnosis (CAD) in which computer analysis provides the equivalent of a 'second reader' of the image, pointing out areas suspect for disease.
3. Biomechanics and Biomaterials:
   This field involves the kinematics and kinetics relevant to human anatomy. Students will be exposed to kinematics relating to human motion, including linear, angular, and nonlinear analyses, and fluid mechanics relating to human physiology (e.g. blood flow), including topics such as flow, resistance, and turbulence. Such analyses are useful for diagnostics (e.g. gait analysis) and device evaluation (e.g. heart valve design). Also included is the design of prostheses and implants, with topics concerning mechanics, biocompatibility of materials, and human interaction with engineered devices.

4. Medical Informatics and Telemedicine:
   This field encompasses the various issues associated with computing technologies in the health care system, medical databases, and tele-medicine. Students will be given an understanding of the operation of the health care system, with an overview of the system and its participants, fundamental biophysical measurement and sensors, and medical management technologies. Included are issues concerning the Canadian health care system, as well as considerations for developing countries. Students will also be exposed to topics associated with biological and medical databases, including database establishment and maintenance, data mining, and automated decision support systems. Tele-medicine, which is concerned with the remote delivery of health care, introduces new technological issues and applications, including wireless access, remote patient monitoring, distributed databases, and mobile computing systems.

Admission Requirements

The normal requirement for admission is a four-year bachelor's degree in engineering, science, computer science, or a related discipline, with an average of at least B+.

Program Requirements

All master's students must successfully complete a total of 5.0 credits, which includes a 2.0 credit master's thesis. Courses must be selected with the approval of the student's supervisor. The specific requirements are:

- 1.0 credit compulsory courses:
  - BIOM 5001 (BMG 5101) (0.5 credit)
  - BIOM 5002 (BMG 5102) (0.5 credit)
- 1.0 credit (or the equivalent) from one of the four fields (including one of its core courses) selected from the graduate courses listed below
- 1.0 credit (or the equivalent) from graduate level courses offered at either Carleton University or University of Ottawa
- 2.0 credit thesis BIOM 5909 (BMG 5909)
- Biomedical Engineering Seminar course BIOM 5800 (BMG 5800) (0.0 credit)

Graduate Courses

Students in this program may choose elective graduate courses from either university, with the approval of their program advisor. All courses are 0.5 credit (one term's duration) with the exception of BIOM 5800 (BMG 5800) (0.0 credits) and BIOM 5909 (BMG 5909) (2.0 credits). Only a selection of courses listed is given in a particular academic year. For information on courses offered in a given year please consult the Institute's web site (www.ocibme.ca).

Notes:

- University of Ottawa course numbers are in parentheses.
- Course descriptions for Biomedical Engineering courses BIOM 5xxx (BMG 5xxx) are listed at the end of this section.
- The course descriptions for other courses are listed in the calendar under the department offering the course.
- Given that the students admitted to this program are from different academic backgrounds, any elective course listed in this program can only be taken by qualified students who satisfy the prerequisites.

Compulsory Courses

- BIOM 5001 (BMG 5101)
- BIOM 5002 (BMG 5102)

Program Fields

1. Medical Instrumentation

Core Courses

- BIOM 5100 (BMG 5103)
- BIOM 5101 (BMG 5104)

Suggested Elective Courses

- BIOM 5106 (BMG 5106)
- SYSC 5600 (ELG 6160)
- SYSC 5602 (ELG 6162)
- SYSC 5603 (ELG 6163)
- SYSC 5604 (ELG 6164)
- MECH 5302 (MCG 5332)
- ELEC 5707 (ELG 6377)
- EACJ 5100 (ELG 5163)
- EACJ 5305 (ELG 5108)
- EACJ 5401 (ELG 5104)
- EACJ 5509 (ELG 5378)
- EACJ 5601 (ELG 7173)
- BIOM 5906 (BMG 7199)

2. Biomedical Image Processing

Core courses

- BIOM 5200 (BMG 5105)
- BIOM 5201 (BMG 5201)

Suggested Elective Courses

- BIOM 5202 (BMG 5107)
- BIOM 5203 (BMG 5203)
- EACJ 5509 (ELG 5378)
- PHYS 5204 (PHY 5112)
- BIOM 5906 (BMG 7199)

3. Biomechanics and Biomaterials

Core Courses

- BIOM 5300 (BMG 5300)
- BIOM 5301 (BMG 5301)
- BIOM 5302 (BMG 5302)

Suggested Elective Courses

- BIOM 5303 (BMG 5303)
- BIOM 5304 (BMG 5304)
- BIOM 5306 (BMG 5306)
- BIOM 5311 (BMG 5311)
- BIOM 5312 (BMG 5312)
- BIOM 5314 (BMG 5314)
- BIOM 5315 (BMG 5315)
- BIOM 5316 (BMG 5316)
- BIOM 5323 (BMG 5323)
- BIOM 5330 (BMG 5330)
- MAAJ 5107 (MCG 5117)
- MAAJ 5502 (MCG 5152)
- MAAJ 5703 (MCG 5173)
- MAAJ 5707 (MCG 5177)
- MECH 5107 (MCG 5317)
- SYSC 5402 (ELG 6142)
- SYSC 5502 (ELG 6152)
- BIOM 5906 (BMG 7199)

4. Medical Informatics and Telemedicine

Core Courses

- BIOM 5400 (BMG 5400)
- BIOM 5401 (BMG 5401)

Suggested Elective Courses

- BIOM 5402 (BMG 5402)
- BIOM 5403 (BMG 5403)
- COMP 5108 (CSI 5126)
- COMP 5101 (CSI 5311)
- COMP 5308 (CSI 5102)
- COMP 5407 (CSI 5116)
- COMP 5503 (CSI 5115)
- COMP 5704 (CSI 5131)
- STAT 5501 (MAT 5191)
- STAT 5600 (MAT 5190)
- STAT 5602 (MAT 5317)
- STAT 5701 (MAT 5198)
- STAT 5703 (MAT 5181)
- STAT 5704 (MAT 5174)
- STAT 5902 (MAT 5992)
- SYSC 5006 (ELG 6106)
- SYSC 5105 (ELG 6115)
- SYSC 5207 (ELG 6127)

- SYSC 5306 (ELG 6136)
- SYSC 5608 (ELG 6168)
- SYSC 5701 (ELG 6171)
- SYSC 5800 (ELG 6180)
- BIOM 5906 (BMG 7199)

Biomedical Engineering Courses

BIOM 5001 [0.5 credit] (BMG 5101)

Engineering Analysis and Modeling of Human Anatomy and Physiology

Engineering systems approaches to analysis and modeling of human anatomy and physiology system. Mechanical and electrical properties of tissues. Muscoskeletal, cardiovascular and pulmonary systems.

Precludes additional credit for MAAJ 5307 (MCG5137A).

BIOM 5002 [0.5 credit] (BMG 5102)

Ethics, Research Methods and Standards

Ethical theories and decision-making, codes; human and animal experimentation, consent, practices of ethical review boards; research methods and regulations for design, manufacture, certification of medical devices; data collection, management, analysis, including security, confidentiality, privacy; bioethical dilemmas, impact of technology and research (social, political, financial).

Precludes additional credit for ELG 7114 (EACJ 5300) and SYSC 5305 (ELG 6305).

BIOM 5100 [0.5 credit] (BMG 5103)

Biomedical Instrumentation

Instrumentation designed to measure physiological variables related to the function of the heart,lungs, kidney, nervous and musculo-skeletal system; emergency, critical care, surgery and anaesthesia equipment.

Precludes additional credit for SYSC 5302 (ELG 6320).

Prerequisite: permission of the instructor.

BIOM 5101 [0.5 credit] (BMG 5104)

Biological Signals

Modeling of neuromuscular biological signals, including subthreshold phenomena, active behaviour of cell membranes, and innervation processes. Measurement of biological signals, including electrode effects. Time domain, frequency domain, and adaptive filtering techniques for noise reduction.(Also offered as SYSC 5307 (ELG 6307)).

BIOM 5106 [0.5 credit] (BMG 5106)

Advanced Topics in Medical Instrumentation

Recent and advanced topics in the field of medical instrumentation and its related areas.

BIOM 5200 [0.5 credit] (BMG 5105)

Biomedical Image Processing

Mathematical models of image formation based on the image modality and tissue properties. Linear models of image degradation and reconstruction. Inverse problems and regularization for image reconstruction. Image formation in radiology, computed tomography, magnetic resonance imaging, nuclear medicine, ultrasound, positron emission tomography, electrical impedance tomography.

Prerequisite: permission of the instructor.

BIOM 5201 [0.5 credit] (BMG 5201)

Introduction to Medical Imaging Principles and Technology

Basic principles and technological implementation of x-ray, nuclear medicine, magnetic resonance imaging (MRI), and other imaging modalities used in medicine. Contrast, resolution, storage requirements for digital images. Applications outside medicine, future

trends.
Precludes additional credit for PHYS 5201.
Prerequisite: permission of the Physics department.

BIOM 5202 [0.5 credit] (BMG 5107)
Wavelet Applications in Biomedical Image Processing
Introduction to wavelet analysis and processing techniques for the quantification of biomedical images and signals. Topics include: multiresolution algorithms for denoising and image restoration, multiscale segmentation and classification for computer aided diagnosis and compression.
Prerequisite: SYSC 5602/ELG 5376 and BIOM 5200/BMG 5105, or permission of the instructor.

BIOM 5203 [0.5 credit] (BMG 5203)
Advanced Topics in Biomedical Image Processing
Recent and advanced topics in the field of biomedical image processing and its related areas.
Prerequisite: permission of the instructor.

BIOM 5300 [0.5 credit] (BMG 5300)
Biological and Engineering Materials
Properties of structural biological materials (bone, tendon, ligament, skin, cartilage, muscle, and blood vessels) from an engineering materials viewpoint. Selection of engineering materials as biomaterials. Introduction to biocompatibility. Histology of soft tissues. Viscoelasticity, mechanical properties and models of muscles, ligaments and tendons.
Co-requisite: BIOM 5100 (BMG 5100).
Prerequisite: permission of the instructor.

BIOM 5301 [0.5 credit] (BMG 5301)
Biomechanics of Skeletal System, Motion and Tissue
Analysis of human motion. Kinematics and kinetics of various activities. Engineering analysis and modeling techniques applied to human motion. Injury mechanics, treatment, prosthetic replacements. Fracture behaviour and healing processes.
Prerequisite: permission of the instructor.

BIOM 5302 [0.5 credit] (BMG 5302)
Biofluid Mechanics
Properties of blood. Blood flow models for vessels, circulation systems and the heart. Artificial blood vessels. Kidney flow and exchange. Modeling of perfused tissues and cells. Transport phenomena across membranes. Molecular and ionic transport. Other body fluids.
Prerequisite: permission of the instructor.

BIOM 5303 [0.5 credit] (BMG 5303)
Ergonomics and Design
Review of ergonomic issues encountered in engineering design, including biomechanical, physical and physiological issues. Strategies for human interaction with complex systems, such as aircraft cockpits, equipment control consoles, human-robotic interactions, and tele-operated equipment.
Prerequisite: permission of the instructor.

BIOM 5304 [0.5 credit] (BMG 5340)
Advanced Topics in Biomechanics and Biomaterials
Recent and advanced topics in the field of biomechanics and biomaterials and its related areas.

BIOM 5306 [0.5 credit] (BMG 5306)
Special Topics in Mechanical and Aerospace Engineering: Biomechanics
Overview of human anatomy and physiology with emphasis on artificial organ and prosthetic device design requirement. Application of engineering principles to cells and tissues, biofluid mechanics, human body energetics, measurement techniques, mechanics of human body

systems, with emphasis on the artificial heart. Offered at the undergradate level, with different requirements, as MAAE 4906, for which additional credit is precluded.
Precludes additional credit for MCG 5489/MECH 5801.

BIOM 5311 [0.5 credit] (BMG 5311)

Design of Medical Devices and Implants

Solutions to clinical problems through the use of implants and medical devices. Pathology of organ failure and bioengineering and clinical aspects of artificial organs. Examples: blood substitutes, oxygenators, cardiac support, vascular substitutes, pacemakers, ventricular assist devices, artificial hearts and heart valves.
Prerequisite: permission of the instructor.

BIOM 5312 [0.5 credit] (BMG 5312)

Design of Orthopaedic Implants and Prostheses

Anatomy of the musculo-skeletal system. Electromyography. Static and dynamic analysis of the human skeleton. Materials and manufacturing considerations for orthopaedic devices. Strength and failure theories. Implant fatigue, fracture and corrosion.
Prerequisite: permission of the instructor.

BIOM 5314 [0.5 credit] (BMG 5314)

Biocontrols

Application of traditional control system principles to the human body. Functionality of sample actuators and sensors. Characterization of human body control loops with emphasis on system stability, robustness, and effect of adverse external disturbance.
Prerequisite: permission of the instructor.

BIOM 5315 [0.5 credit] (BMG 5315)

Biorobotics

Interpretation of physical laws as applied to human motion, kinematics and dynamics of humanoid robots, modeling of biological sensors and actuators, artificial muscles, tele-manipulation, robot assisted surgery, and multi-fingered end-effectors. Design of mechatronic devices including rehabilitators, extenders, haptic devices, and minimally invasive surgery systems.
Prerequisite: permission of the instructor.

BIOM 5316 [0.5 credit] (BMG 5316)

Biotransport Processes

Application of chemical engineering principles to medicine and biology. Principles of mass transfer and fluid dynamics in topics such as hemodialysis, artificial kidney, diffusion in blood, mass transfer in the eye, drug distribution in the body, and advanced life support systems.
Prerequisite: permission of the instructor.

BIOM 5323 [0.5 credit] (BMG 5323)

Rehabilitation Engineering

Multidisciplinary approach to assistive-device design. Biomechanics applied to rehabilitation. Gait, neurological disorders, pathological gait, prosthetics, orthotics, seating, and mobility. Transducers, bio-instrumentation, EMG, FES. Augmentive communication and sensory aids. Human-assistive device interfaces, human-robot interfaces, computer-vision-guided rehabilitation aids, telerehabilitation.
Prerequisite: permission of the instructor.

BIOM 5330 [0.5 credit] (BMG 5330)

Electromagnetic Fields and Biological Systems

Review of electromagnetic waves at radio and microwave frequencies. Electrical and magnetic properties of tissue. Impact of electromagnetic waves on tissue. Cellular effects.
Prerequisite: permission of the instructor.

BIOM 5400 [0.5 credit] (BMG 5400)

Medical Computing

Introduction to information technology research used in the medically related fields such as biotechnology, cancer treatment, and biometric. Topics may include: medical imaging, telemedicine, telesurgery, DNA analysis, and medical information systems.
Prerequisite: permission of the instructor.

BIOM 5401 [0.5 credit] (BMG 5401)

Health Care Engineering

Health care system, technology management in health care in developed and developing countries; sensor technologies, safety considerations (EMI, etc); telemedicine applications; examples of research in biomedical engineering, bioethics, reliability, risk management and liability issues.
Precludes additional credit for SYSC 5300 (ELG 6130) or EACJ 5303 (ELG 5123).
Prerequisite: permission of the instructor.

BIOM 5402 [0.5 credit] (BMG 5402)

Interactive Networked Systems and Telemedicine

Telemanipulator; human motoring and sensory capabilities; typical interface devices; mathematical model of haptic interfaces; haptic rendering; stability and transparency; remote control schemes; time delay compensation; networking and real-time protocols, history and challenges of telemedicine; telemedicine applications: telesurgery, tele-monitoring, tele-diagnosis and tele-homecare.
Prerequisite: permission of the instructor.

BIOM 5403 [0.5 credit] (BMG 5403)

Advanced Topics in Medical Informatics and Telemedicine

Recent and advanced topics in the filed of medical informatics and telemedicine and its related areas.

BIOM 5800 [0.0 credit] (BMG 5800)

Biomedical Engineering Seminar

This course is in the form of seminars presented by graduate students and other researchers in the area of Biomedical Engineering. To complete this course, a student must attend at least ten seminars and make one presentation in the context of this seminar series.

BIOM 5906 [0.5 credit] (BMG 7199)

Directed Studies in Biomedical Engineering

Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above-listed course topics where they are not offered on a formal basis.

BIOM 5909 [2.0 credits] (BMG 5909)

M.A.Sc. Thesis

Biostatistics

Ottawa-Carleton Collaborative Program in Biostatistics
Herzberg Physics 4318
Telephone: 613-520-2600x8020
Fax: 613-520-3536 ext. 8020
E-mail: cate_palmer@carleton.ca
math.carleton.ca

The Specialization

Coordinator, Mathematics and Statistics (Carleton University): K. Cheung
Coordinator, Mathematics and Statistics (University of Ottawa): R. Blute
Coordinator, Epidemiology (University of Ottawa): B. Wilson

Biostatistics is an interdisciplinary area of research linking statistics, biology and medicine. This growing area demands knowledge of the theory behind statistical procedures, an ability to put that theory into practice, and an understanding of the areas of application. The applications range from clinical trials to population epidemiology and the development of new procedures.

The Specialization in Biostatistics is intended to prepare a student for a career as a biostatistician in health-related industry, or for a doctoral program in biostatistics. This program takes advantage of several resources particular to the Ottawa area. The Ottawa-Carleton Institute of Mathematics and Statistics offers a strong program in statistics. The Department of Epidemiology and Community Medicine at the University of Ottawa offers a broad range of courses in epidemiology. In addition, there are several research institutes and teaching hospitals in the Ottawa area. These resources provide students with opportunities to develop analytic skills, to interact with practitioners and to work on current research projects in a variety of areas.

The program is administered by a committee of representatives from the primary departments which include: the Department of Epidemiology and Community Medicine at the University of Ottawa, the School of Mathematics and Statistics at Carleton University, and the Department of Mathematics and Statistics at the University of Ottawa.

Members of the Specialization

The home department of each member is indicated by (C) for the School of Mathematics and Statistics, Carleton University; (O) for the Department of Mathematics and Statistics, University of Ottawa; (EPI) the Department of Epidemiology and Community Medicine, University of Ottawa.

- Mayer Alvo, *Nonparametric statistics, sequential analysis* (O)
- N.J. Birkett, *Dynamical systems in medicine* (EPI)
- Miklós Csörgó, *Probability and statistics (C)*
- D.A. Dawson, *Stochastic processes and probability theory (C)*
- Patrick Farrell, *Sampling, discrete data, applied statistics (C)*
- Roger Herz-Fischler, *History and sociology of mathematics (C)*
- G.B. Ivanoff, *Probability, point processes, martingales (O)*
- Daniel Krewski, *Applied statistics in medicine (C)*
- D.R. McDonald, *Applied probability (O)*
- S.E. Mills, *Applied statistics, statistical methods, inference (C)*
- M. Mojirsheibani, *Resampling, classification and pattern recognition (C)*
- R.C. Nair, *Effects of blood and plasma transfusion on certain groups (EPI)*

- Chul Gyu Park, *Statistics (C)*
- J.N.K. Rao, *Sample surveys theory and methods (C)*
- A.K.Md.E. Saleh, *Order statistics, mathematical statistics (C)*
- Avi Singh, *Longitudinal time series and methods for their analysis; categorical-data time series (C - Adjunct)*
- S. Sinha, *Biostatistics, longitudinal data analysis, robust inference, time series analysis (C)*
- R.A. Spasoff, *Analysis of clinical trials (EPI)*
- Barbara Szyszkowicz, *Statistics (C)*
- G.A. Wells, *Clinical trial design and analysis (EPI)*
- Yiqiang Zhao, *Applied probability (C)*

Master of Science

Admission Requirements

The Specialization is open to suitable candidates enrolled in a master's program in any of the participating departments. There are two streams to the Specialization.

Students requesting admission through the Department of Epidemiology and Community Medicine will normally have an Honours B.Sc. with high honours standing (or the equivalent) in health sciences or biology, and strong analytic skills. Students admitted through the Department of Epidemiology and Community Medicine follow a program with an emphasis on population or clinical epidemiology.

Students requesting admission through the Ottawa-Carleton Institute of Mathematics and Statistics, either through the University of Ottawa or Carleton University, will normally have an Honours B.Sc. with high honours standing (or the equivalent) in statistics and experience in the analysis of data. Students in this stream follow a program with an emphasis in clinical trial design or epidemiologic methodology.

Students should normally apply for acceptance in the Specialization in Biostatistics at the same time as they apply for admission into the master's program in Mathematics or Epidemiology. If accepted into the regular program, the student will then be considered by the program coordinators for admission into the Specialization. Students intending to apply for admission to the Specialization should normally contact prospective thesis supervisors before submitting the application and establish a thesis supervisor and research topic.

Program Requirements

In addition to fulfilling the requirements for the master's program of the department in which they are enrolled, all students in the Specialization in Biostatistics must complete one of the two following optional program patterns:

Master's degree by thesis:

- 3.5 credits
- A compulsory 0.5 credit seminar, STAT 5902 (MAT 5992)
- A thesis equivalent to 1.0 credits

Students in the M.Sc. Mathematics program will normally include EPI 5240, EPI 5241, EPI 6178, EPI 6278, MAT 5190 (STAT 5600), MAT 5191 (STAT 5501) and another course from the Department of Mathematics and Statistics at the graduate level.

Students in the M.Sc. Epidemiology program will normally include EPI 5240, EPI 5241, EPI 5330, EPI 6276, plus two approved courses at the graduate level in Mathematics and Statistics, among their courses.

Master's degree by course work:

- 4.5 credits
- A compulsory 0.5 credit seminar, STAT 5902 (MAT 5992)

Students in the M.Sc. Mathematics program will normally include EPI 5240, EPI 5241, EPI 6178, EPI 6278, MAT 5190 (STAT 5600), MAT 5191 (STAT 5501) and another course from the Department of Mathematics and Statistics at the graduate level. The degree awarded will in each case specify the discipline of the participating unit with Specialization in Biostatistics.

Most of the program requirements must be fulfilled in English. Students may write papers, submit theses and write examinations in both English and French.

Thesis

The thesis may contain new research in the area of mathematics and statistics or provide a review of the literature in one area. The thesis normally will be on statistics applied to health or biology; for example, the development of a new statistical procedure, the design of a new experiment or the analysis of data. The thesis should extend beyond the routine analysis of data. The supervisor and other members of the examination board may be drawn from faculty members in either epidemiology or mathematics and statistics or in other related departments.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, visit central.carleton.ca

University of Ottawa course numbers (in parentheses, three letters followed by four numbers) follow the current Carleton course number and credit information.

STAT 5902 [0.5 credit] (MAT 5992)
Seminar in Biostatistics
Students work in teams on the analysis of experimental data or experimental plans. The participation of experimenters in these teams is encouraged. Student teams present their results in the seminar, and prepare a brief written report on their work.

Mathematics and Statistics (see Mathematics and Statistics for course descriptions)

- STAT 5600 (MAT 5190)
- STAT 5501 (MAT 5191)
- STAT 5902 (MAT 5992)
- MATH 5909 (MAT 7999)

Epidemiology

- EPI 5240 Epidemiology I
- EPI 5241 Epidemiology II

- EPI 6178 Clinical Trials
- EPI 6278 Advanced Clinical Trials
- EPI 5330 Vital and Health Statistics

Business

Sprott School of Business
710 Dunton Tower
Telephone: 613-520-2388
Fax: 613-520-4427
sprott.carleton.ca

The School

Dean of the School: Jerry Tomberlin
Associate Dean (Research and Graduate Programs): Steven Murphy
Ph.D. Program Director: Shaobo Ji
M.B.A. Director: Ian Lee

The Sprott School of Business offers a program of study and research leading to the degrees of M.B.A. and Ph.D. in Management.

Information about the Sprott Ph.D. follows the M.B.A. program and courses section.

Master of Business Administration (M.B.A.)

The Sprott School of Business at Carleton University is a leading national school for teaching and research in business administration. Since its establishment in 1950, the School has prepared its students for professional careers in the private and public sectors, both in Canada and abroad. While the private sector has always been dynamic, the communications technology (ICT) revolution, liberalized trade agreements, globalization and the emergence of the knowledge-based enterprise have ensured that the business environment in recent years has been even more complex.

The MBA program provides advanced management knowledge and skills in all management disciplines, including those required to analyze, make decisions, and lead. This program is designed for individuals who are employed in a managerial capacity in the private or public sector and who wish to broaden, deepen and enhance their management competencies and acquire more advanced knowledge to advance their management careers. The Sprott MBA is designed to facilitate the development of analytical skills that are the foundation of strategic thinking and decision making.

The Sprott MBA is a professional program offered in two distinct streams. The evening stream is open to applicants with two years minimum of management or professional experience, and may be completed on a part-time basis. The daytime stream is open to applicants with less than two years management or professional experience and is designed to be completed in four terms (including the internship) on a full-time basis. All courses must be successfully completed within five years of admission.

The program concentrations are Financial Management, Management and Change, Technology Management, and International Business.

The M.B.A program is described in detail below. Further information and application packages can be obtained from the School's Web site or by contacting the Sprott School of Business.

M.B.A. Admission Requirements

Admission Policy

Admission is judged primarily on the applicant's ability to successfully undertake advanced study in management based on his/her work experience and achievement, GMAT score (see below) and undergraduate grades. Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

As the M.B.A is a professional degree, advanced standing is not offered for undergraduate courses completed in related courses or disciplines.

Successful applicants will be assigned to one of two streams:

The daytime stream is for successful applicants with less than two years management or professional experience. All courses in this stream will be offered during the day on a full-time basis only. Successful applicants are accepted for September admission annually as a cohort.

The evening stream is designed for successful applicants who have at least two years of management or professional full time employment experience and this stream will be offered in the evening.

Admission Requirements for Daytime Stream

Students are expected to have the equivalent of an Honours bachelor's degree, with a minimum undergraduate average of B, and must have completed the GMAT with a minimum score of 550. All applicants admitted to the day time M.B.A stream are required to complete their courses in the daytime program as a condition of admission.

Admission Requirements for Evening Stream

The evening stream is reserved for professionals with a minimum of two years of full-time management or professional employment experience. Students admitted to the evening stream, may with the permission of the M.B.A. Director, complete courses in the daytime stream.

Applicants to the evening stream are expected to hold the equivalent of an Honours bachelor's degree, with a minimum overall average of B. In determining equivalence for those applicants who do not have an Honours degree, the School will give due consideration to the length and level of seniority of the applicant's employment record. All applicants must have completed the GMAT with a minimum score of 550.

Graduate Management Admission Test (GMAT)

The Sprott School requires that all applicants submit scores obtained in the Graduate Management Admission Test (GMAT) offered by Pearson Vue, Bloomington, MN.

Language Requirements

Proficiency in English is necessary to pursue graduate studies at Carleton University. See Section 3.6 of the General Regulations of this Calendar for English proficiency rules.

M.B.A. Program Requirements

Graduate students in the School of Business are subject to the General Regulations section of this Calendar.

There is a mandatory non-credit one week immersion period for daytime M.B.A students shortly before the M.B.A courses commence. Details are available at **sprott.carleton.ca/mba**

With the permission of the M.B.A. Program Director, students must also complete all of the courses required for at least one of the concentrations listed below. The remaining credits may be selected from any of the concentration courses listed below.

All students must successfully complete the 4.25 credits (17 quarter-courses) compulsory courses, and at least one of the following concentrations:

- Financial Management
- Management and Change
- Technology Management
- International Business

Once the compulsory 4.25 credits are completed, students may then choose one of the following program options:

Evening Stream

M.B.A with one concentration (Total: 7.5 credits)

- 4.25 compulsory core credits (17 quarter-courses), plus
- 2.25 credits in the chosen concentration (9 quarter-courses), plus
- 1.0 credit from one or more of the other concentrations (4 quarter-courses).

M.B.A. with one concentration plus a minor concentration (Total: 7.5 credits)

- 4.25 compulsory core credits (17 quarter-courses), plus
- 2.25 credits (9 quarter-courses) in the chosen concentration, plus
- 1.0 credit (4 quarter-courses) in a second, minor concentration (4 quarter-courses). See the lists under Minor Concentration in the next section for specific course requirements.

M.B.A. with two concentrations (Total: 8.75 credits, see Note below)

- 4.25 compulsory core credits (17 quarter-courses), plus
- 2.25 credits in one concentration (9 quarter-courses), plus
- 2.25 credits in a second chosen concentration (9 quarter-courses).

Note: the two concentrations option described above includes an additional 1.25 credits (5 quarter-courses) to fulfil degree requirements.

The evening M.B.A program may be completed on a part-time basis. However, all courses must be successfully completed within 5 years of admission. Candidates admitted to the evening M.B.A may complete the M.B.A in the daytime MBA program with the permission of the MBA Director.

Daytime Stream

Note: students with less than 2 years of management or professional employment experience must successfully complete BUSI 5999 [1.0] in order to graduate. Details and requirements for the practicum are available from the School.

M.B.A. with one concentration
(Total: 8.5 credits)

- 4.25 compulsory core credits (17 quarter-courses), plus
- 2.25 credits (9 quarter-courses) in the chosen concentration, plus
- 1.0 credit (4 quarter-courses) from one or more of the other concentrations, plus
- BUSI 5999 [1.0 credit] Practicum

M.B.A. with one concentration plus a minor concentration (Total 8.5 credits)

- 4.25 compulsory core credits (17 quarter-courses)
- 2.25 credits (9 quarter-courses) in a chosen concentration, plus
- 1.0 credit (4 quarter-courses) in a second, minor concentration (4 quarter-courses). See the lists under Minor Concentration in the next section for specific course requirements.
- BUSI 5999 [1.0 credit] Practicum

M.B.A. with two concentrations (Total: 9.75 credits, see Note below)

- 4.25 compulsory core credits (17 quarter-courses)
- 2.25 credits (9 quarter-courses) in each of two concentrations, plus
- 2.25 credits in a second chosen concentration (9 quarter-courses)
- BUSI 5999 [1.0 credit] Practicum

Note: the two concentrations option above includes an additional 1.25 credits (5 quarter-courses) to fulfil degree requirements.

The daytime M.B.A courses are designed to be completed in 3 terms on a full time basis. the practicum are available from the School. Students admitted to the daytime M.B.A program are not permitted to enrol in evening M.B.A courses.

M.B.A. Course Categories

M.B.A. Compulsory Core Courses

ACCT 5001	Financial Accounting
ACCT 5002	Managerial Accounting
BUSI 5801	Statistics for Managers
BUSI 5802	Business Ethics
BUSI 5803	Managerial Economics
FINA 5501	Financial Management
FINA 5502	Corporate Finance
IBUS 5701	International Business
ITIS 5401	Fundamentals of IT Service Management

MGMT 5101	Managing People
MGMT 5102	Managing Organizations
MKTG 5201	Marketing Strategy Formulation
MKTG 5202	Marketing Strategy Implementation
TOMS 5301	Modeling Business Decisions
TOMS 5302	Operations Management
STGY 5901	Corporate and Business Strategy
STGY 5902	Strategic Management Capstone Project

Minor Concentration Required Courses

Minor Concentration in Financial Management

If taken with:
Concentration in Technology Management *or*
Concentration in Management and Change

ACCT 5011	Financial Statement Analysis
ACCT 5012	Performance Measurement and Control
FINA 5512	Valuation
FINA 5513	Mergers and Acquisitions

If taken with:
Concentration in International Business

ACCT 5011	Financial Statement Analysis
ACCT 5012	Performance Measurement and Control
FINA 5511	Investments
FINA 5512	Valuation

Minor Concentration in Management and Change

MGMT 5113	Managing Teams
MGMT 5115	Leadership
MGMT 5121	Fundamentals of Organizational Change
MGMT 5122	Leading and Managing Organizational Change

Minor Concentration in Technology Management

Students with a minor concentration in Technology Management must select the equivalent of 1.0 credit (or equivalent) from the Technology Management concentration courses. ITIS 5421/TOMS 5321 Strategic Management of Technology (Concentration Integration Course) may not be used to fulfil this requirement.

Minor Concentration in International Business

IBUS 5711	International Marketing and Trade
IBUS 5712	Business and Government in Emerging Economies
IBUS 5713	Doing Business in the United States

IBUS 5721	Regional and Global Business Strategies (Concentration Integration course)

M.B.A. Concentration Courses

Concentration in Financial Management

ACCT 5011	Financial Statement Analysis
ACCT 5012	Performance Measurement and Control
ACCT 5013	Public Sector and NGO Accounting
ACCT 5014	Financial Corporate Governance and Accountability
FINA 5511	Investments
FINA 5512	Valuation
FINA 5513	Mergers and Acquisitions
FINA 5514	International Finance
FINA 5521	Financial Management Concentration Integration

Concentration in Management and Change

MGMT 5111	Conflict and Negotiation
MGMT 5112	Power and Influence
MGMT 5113	Managing Teams
MGMT 5114	Cross-Cultural Management and Diversity
MGMT 5115	Leadership
MGMT 5116	Managing Performance
MGMT 5117	Knowledge Management
MGMT 5121	Fundamentals of Organizational Change Concentration Integration
MGMT 5122	Leading and Managing Organizational Change Concentration Integration

Concentration in Technology Management

ITIS 5411	IT Service Support
ITIS 5412	IT Service Delivery
ITIS 5413	Enterprise Architecture and Governance
TOMS 5311	Quality Management
TOMS 5312	Technology Development
TOMS 5313	Technology Adoption for Services
TOMS 5314	Supply Chain Management
MKTG 5211	Technology Marketing
ITIS 5421/ TOMS 5321	Strategic Management of Technology Concentration Integration

Concentration in International Business

IBUS 5711	International Marketing and Trade
IBUS 5712	Business and Government in Emerging Economies
IBUS 5713	Doing Business in the United States
IBUS 5721	Regional and Global Business Strategies Concentration Integration

FINA 5512	Valuation
FINA 5513	Mergers and Acquisitions
MGMT 5114	Cross-Cultural Management and Diversity
MGMT 5117	Knowledge Management
TOMS 5314	Supply Chain Management

Academic Standing in M.B.A.

A grade of B- or better is normally required in each credit counted towards the degree. However, a candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed to count a grade of C+ in two quarter-credit courses.

M.B.A. Courses

Accounting

ACCT 5001 [0.25 credit]
Financial Accounting
Fundamentals of financial accounting. Techniques used to measure business transactions, preparation of financial statements, recording and valuation of assets, liabilities and equities.
Precludes additional credit for BUSI 5004 (no longer offered).

ACCT 5002 [0.25 credit]
Managerial Accounting
Fundamentals of managerial accounting and control. Techniques for management decision-making, planning, and control including cost-volume-profit analysis, product costing, variance analysis, relevant costing, transfer pricing and the balanced scorecard.
Precludes additional credit for BUSI 5005 (no longer offered).
Prerequisite: ACCT 5001.

ACCT 5011 [0.25 credit]
Financial Statement Analysis
A user-oriented approach to the study of financial statements. The role of the financial statements and the annual report in the financial reporting process, using ratio analysis to analyze firm performance and make forecasts of future performance.
Precludes additional credit for BUSI 5000 (no longer offered).

ACCT 5012 [0.25 credit]
Performance Measurement and Control
Efficacy and efficiency of corporate strategies. Design and use of performance measurement systems from an organizational integrated systems view. Balanced scorecard, activity-based management, and other performance measurement and control systems.
Precludes additional credit for BUSI 5000 (no longer offered).

ACCT 5013 [0.25 credit]
Public Sector and NGO Accounting
Governmental and NGO accounting principles, practices, and unique financial reporting requirements. Comparison with private sector financial reporting and performance evaluation.

ACCT 5014 [0.25 credit]
Financial Corporate Governance and Accountability
Corporate governance functions including management and controllership, boards of directors, auditors, security commissions and the control of enterprise-wide risk management. Historical development and evaluation of current practices, including Sarbanes Oxley and its implications.

Business

BUSI 5500 [0.5 credit]

Seminar in Finance

Contemporary finance theory and practice. Innovations in corporate financing, financial planning, financing strategies, valuation of contingent claims, implications of agency theory. Emphasis on financial decisions of technology-based firms.
Prerequisite: permission of the M.B.A. Director.

BUSI 5501 [0.5 credit]

Current Topics in Financial Research

Topical and classical research and empirical issues in investments, portfolio management, corporate finance, and capital markets. Innovative research methods and their applicability to contemporary areas of financial products.
Prerequisite: Permission of the M.B.A. Director.

BUSI 5801 [0.25 credit]

Statistics for Managers

Techniques for using data to make an informed use of statistics. Applications, interpretation and limitations of results. Sampling, descriptive statistics, probability concepts, estimation and testing of hypotheses and regression, using practical business situations.
Precludes additional credit for BUSI 5904.

BUSI 5802 [0.25 credit]

Business Ethics

Impact of corporate decisions on society. Models and standards of business ethics and corporate social responsibility (CSR). Methods of measuring and reporting. The rise of corporate power, stakeholder analysis, corporate governance, sustainability, national and international pressures on CSR.

BUSI 5803 [0.25 credit]

Managerial Economics

The application of economic principles and methodologies to business decision problems. The logic and consequences of consumer and producer decision-making and the resultant market outcomes.
Precludes additional credit for BUSI 5604.

BUSI 5900 [0.5 credit]

Tutorials/Directed Studies in Business

Tutorials or directed readings in selected areas of business, involving presentation of papers as the basis for discussion with the tutor.
Prerequisite: admission to the program prior to the fall term of 2008 and permission of the M.B.A. Program Director. Completion of an undergraduate business course may be required.

BUSI 5902 [0.5 credit]

Business Research Methods

Basic issues of scientific research as applied to business problems.The logic of scientific research, proof and verification, hypothesis testing, the logic of statistical inference, research design.
Prerequisite: admission to the program prior to the fall term of 2008 and permission of the M.B.A. Program Director.

BUSI 5903 [0.5 credit]

Multivariate Statistics for Business Research

Classical methods of multivariate statistics including multiple regression; emphasis on assumptions and coping with violations; theoretical understanding of methods and practical computer-based data analysis skills. Provides background for studying more advanced

statistical topics.
Prerequisite: admission to the program prior to the fall term of 2008 and permission of the M.B.A. Program Director.

BUSI 5907 [0.5 credit]
M.B.A. Thesis Tutorial
A seminar designed to help the student formulate and evaluate specific research topics. The successful submission of a thesis proposal is necessary for the completion of the course.
Prerequisite: admission to the program prior to the fall term of 2008 and permission of the M.B.A. Program Director.

BUSI 5908 [1.0 credit]
M.B.A. Research Project
Prerequisite: admission to the program prior to the fall term of 2008 and permission of the M.B.A. Program Director.

BUSI 5909
M.B.A. Thesis Research
Prerequisite: BUSI 5907 and admission to the program prior to the fall term of 2008 and permission of the M.B.A. Program Director.

BUSI 5999 [1.00 credit]
Practicum
As a condition for graduation, all students in the daytime stream with less than 2 years of management or professional employment experience are required to have a minimum of four months practical management experience. The practicum will be selected and assigned by the Director of the M.B.A. program. Details are available from the School.

Finance

FINA 5501 [0.25 credit]
Financial Management
Overview of finance from the perspective of the financial manager. Corporate governance issues, financial markets, time value of money, valuation and yields of financial securities, capital budgeting, financial statement analysis, and the trade-off between risk and return. Precludes additional credit for BUSI 5504.

FINA 5502 [0.25 credit]
Corporate Finance
Aspects of corporate finance of most concern to managers: investment, financing and payout decisions, corporate restructuring. Case studies will be used.
Prerequisite: FINA 5501.

FINA 5511 [0.25 credit]
Investments
The analytical foundations and tools necessary for successful decision making by investment managers and analysts and by individual investors. Includes a significant hands-on component.

FINA 5512 [0.25 credit]
Valuation
Valuation techniques needed for enterprise valuation. The identification of value drivers, insights into the valuation of companies in different settings. Step-by-step procedures for valuing businesses. Includes a team case analysis and presentation.

FINA 5513 [0.25 credit]
Mergers and Acquisitions
Theory and practice of mergers and acquisitions. Skills needed to be effective in mergers and acquisitions. Best practices in deal origination, design, implementation and post merger

integration.
Precludes additional credit for BUSI 5500.
Prerequisite: FINA 5512.

FINA 5514 [0.25 credit]
International Finance
Issues encountered by the multinational financial manager in making financing and investment decisions within a global context. Foreign exchange markets, parity conditions, currency quotation methods, management of foreign exchange/political risk and international capital budgeting.

FINA 5521 [0.25 credit]
Financial Management Concentration Integration
Integrates and applies all the accounting and finance concentration coursework. Critical thinking is stressed via the case study approach. Focuses on complex problems and allows students to gain a deeper understanding of the salient issues discussed within the financial management concentration.
Precludes additional credit for BUSI 5500.

International Business

IBUS 5701 [0.25 credit]
International Business
Managerial and strategic implications of differing international environments for a variety of business functions including structure and control, managing human resources, marketing, finance and logistics. Complexities of working across political and cultural boundaries.
Precludes additional credit for BUSI 5300 (no longer offered).

IBUS 5711 [025 credit]
International Marketing and Trade
Models for understanding factors that influence buyer decisions in different markets. Product adaptation, distribution networks, promotion practices, cross-border pricing strategy and regulatory and other limitations. The macro and micro effects of culture provide a connecting theme.
Precludes additional credit for BUSI 5301 (no longer offered).

IBUS 5712 [0.25 credit]
Business and Government in Emerging Economies
Projects in emerging economies often involve partnerships between businesses, local governments and foreign donors. Emerging forms of cooperation which address issues of poverty, infrastructure and education. The role of international firms in the process of economic transition.
Precludes additional credit for BUSI 5300 (no longer offered).

IBUS 5713 [0.25 credit]
Doing Business in the United States
The role of the United States as Canada's most important foreign trade partner. The U.S. as a distinct business environment. Regulatory structures, competitive environment, buyer behaviour and business culture in the U.S. and Canada.
Precludes additional credit for BUSI 5300 (no longer offered).

IBUS 5721 [.25 credit]
Regional and Global Business Strategies Concentration Integration
Regional and global business expansion strategies and how global interdependence and regional trade groups affect international investment and marketing strategies. Environmental and political factors that influence policy within and between trade blocs and how businesses participate in these processes.
Precludes additional credit for BUSI 5301 (no longer offered).

Prerequisite: successful completion of all courses in the International Business concentration. Students in the Minor in International Business must have successfully completed 0.75 credits from courses in the International Business concentration.

Information Systems

ITIS 5401 [0.25 credit]

Fundamentals of IT Service Management

ITIL and ISO 20000 topics including service support and service delivery fundamentals. Service support includes service/help desk, configuration, incident, problem, release, and change management. Service delivery includes security, service level, capacity, continuity, availability and IT financial management.
Precludes additional credit for IBUS 5701 and ITIS 5413.

ITIS 5411 [0.25 credit]

IT Service Support

Management of IT processes crucial to business operations. IT service management (ITSM) best practices including service desk management, incident management, problem management, change management, release management, and configuration management.
Precludes additional credit for BUSI 5401.

ITIS 5412 [0.25 credit]

IT Service Delivery

Service level management, services reporting, service continuity and availability management, budgeting and accounting for IT services, capacity management and information security management. Service level agreements (SLAs) and information technology security techniquesr subjects.
Precludes additional credit for BUSI 5401.

ITIS 5413 [0.25 credit]

Enterprise Architecture and Governance

Exploration and analysis of enterprise architecture frameworks used to guide organizations in aligning business and IT strategies and goals while enhancing organizational efficiency in the adoption and use of IT. Models of IT Governance.

ITIS 5421/TOMS 5321 [0.25 credit]

Strategic Management of Technology Concentration Integration

Components and aspects of technology strategy formulation and its successful implementation in an organization. Technology strategy from a general management perspective, designing and developing technology strategy for sustaining competitiveness. Project-based course.
Prerequisite: successful completion of all courses in the Technology Management concentration.

Management

MGMT 5101 [0.25 credit]

Managing People

Understanding organizations through the relationships that define them. Theories, concepts and experiential exercises are used to help students understand their own values, attitudes and goals; how to motivate, communicate, teach and lead others, and how to apply these concepts to improving personal and organizational performance.
Precludes additional credit for BUSI 5100 (no longer offered).

MGMT 5102 [0.25 credit]

Managing Organizations

The design and function of complex organizations including the effects of size, environment, and technology on organizational structures and systems. Sources of uncertainty and strategies for managing environmental relationships. Work teams, group dynamics and organizational culture.

Precludes additional credit for BUSI 5101.

Prerequisite: MGMT 5101

MGMT 5111 [0.25 credit]

Conflict and Negotiation

Conflict, negotiation and bargaining. The bargaining process, conflict handling and how to analyze, plan and implement successful negotiations. Management and labour objectives and strategies that lead to conflict.

MGMT 5112 [0.25 credit]

Power and Influence

The role of power and influence in organizations. Sources of power, the effectiveness of various influence tactics, the implications of powerlessness, types of empowerment, organizational politics and fostering constructive versus destructive political behaviour in organizations.

Precludes additional credit for BUSI 5101.

MGMT 5113 [0.25 credit]

Managing Teams

Factors affecting team performance. Team development, the impact of team size, team processes, organizational practices that support teams, potential team interventions and the unique challenges faced by virtual teams.

MGMT 5114 [0.25 credit]

Cross-Cultural Management and Diversity

Issues arising from diversity within organizations including the challenges confronting organizations operating in multicultural settings. The implications of cultural differences for motivation, communication, conflict and leadership. Identification of practices that facilitate the effective management of diversity.

MGMT 5115 [0.25 credit]

Leadership

Post-heroic leadership theories, with a practical emphasis on developing and honing leadership skills in practicing managers. A highly self-reflective course, requiring students to question and share their own leadership styles and situational antecedents.

MGMT 5116 [0.25 credit]

Managing Performance

Principles and techniques relating to the development, support, and evaluation of employee performance in organizations. Models of individual and organizational performance; identifying high performing employees; methods of measuring performance; employee development and incentive systems.

MGMT 5117 [0.25 credit]

Knowledge Management

Knowledge as a resource; methodologies for managing ongoing and future knowledge needs in businesses. As required knowledge is dispersed and developed throughout the globe, international dimensions of knowledge management.

MGMT 5121 [0.25 credit]

Fundamentals of Organizational Change Concentration Integration

A macro view of organizational change. The nature of change, forces for and against change, tools to diagnose what needs to be changed, and various change strategies. Key conceptual models for understanding organizational change.

Precludes additional credit for BUSI 5806 (no longer offered).
Prerequisite: successful completion of all Management and Change concentration courses. Students taking a minor concentration in Management and Change must have completed 0.5 credits (or the equivalent) of Management and Change concentration courses.

MGMT 5122 [0.25 credit]

Leading and Managing Organizational Change Concentration Integration
What change means for individuals and groups. Conceptual models for understanding change at the micro level. Responses to change, managing its negative impacts, gaining commitment to change, change management competencies and changing organizational culture.
Precludes additional credit for BUSI 5806 (no longer offered).
Prerequisite: MGMT 5121 and successful completion of all Management and Change concentration courses; students in minor concentration in Management and change must have at least 0.5 credits (or the equivalent) from the Management and Change concentration courses.

MKTG 5201 [0.25 credit]

Marketing Strategy Formulation
Basic concepts underlying development and sustaining of successful buyer-seller relationships including the core concepts and practice of marketing, the role of marketing in the organization, relationship and exchange bases, environmental scanning, competitor assessment, marketing research, segmentation, positioning, targeting of markets and strategy planning.
Precludes additional credit for BUSI 5204 (no longer offered).

MKTG 5202 [0.25 credit]

Marketing Strategy Implementation
Development and implementation of marketing strategy and plans, including interpretation of strategic positioning into product, promotion, pricing and channel decisions and the measurement and tracking of marketing success. Special attention to the role of product innovation and introduction.
Precludes additional credit for BUSI 5200 (no longer offered).
Prerequisite: MRKT 5201.

MKTG 5211 [0.25 credit]

Technology Marketing
Marketing in technology-intensive environments, with focus on business buying processes. Buyer behaviour, competitive and environmental analysis, planning and implementation of product and service innovations, targeting and positioning in the early stages of introduction, management through the growth stages, tracking success and contingency planning.

Strategic Management

STGY 5901 [0.25 credit]

Corporate and Business Strategy
Strategic analysis, formulation and implementation. Strategic management emphasizes the determination and evaluation of environmental opportunities and threats in light of strengths and weaknesses in the organization's value chain using VRIO in order to enhance its core competencies and craft a sustainable competitive advantage.
Precludes additional credit for BUSI 5808.

STGY 5902 [0.25 credit]

Strategic Management Capstone Project
Research and analyze a firm according to principles of STGY 5901 course. Using Factiva, Mergent, Hoovers, Bloomberg, Statistics Canada, US Census Bureau, industry associations, SEC, SEDAR, identify and analyze data to construct case study and analysis of corporate and

business strategies of a single firm.
Precludes additional credit for BUSI 5808.

Technology and Operations Management

TOMS 5301 [0.25 credit]
Modeling Business Decisions
Quantitative methods for strategic, tactical, and operational business decision making. Optimization, simulation, project management, decision analysis, and multi-criteria analysis. Underlying ideas, model formulation, computer implementation, and analysis of model results, with applications from various business functions.
Precludes additional credit for BUSI 5600 (no longer offered).
Prerequisite: BUSI 5801.

TOMS 5302 [0.25 credit]
Operations Management
The provision of services and goods to customers, with focus on efficiency, effectiveness, and productivity. Planning and control of processes involving products, workers, equipment, suppliers, and customers. Effects of variation and uncertainty on lead time, inventory, quality, and customer service.
Precludes additional credit for BUSI 5600 (no longer offered).
Prerequisite: BUSI 5801.

TOMS 5311 [0.25 credit]
Quality Management
Defining quality, quality improvement, six sigma, lean enterprise, benchmarking and control charts; quality audits, ISO 9000, ISO 20000 and the progressive excellence program; role of quality assurance in service and product development; Process management and performance excellence.
Precludes additional credit for BUSI 5401 (no longer offered).

TOMS 5312 [0.25 credit]
Technology Development
Transformation of knowledge and ideas into products, processes and services. Development/innovation process models, successful and efficient integrated product/process/service development, cross functional teams, quality function deployment, lead-user approach, open innovations paradigm, disruptive innovations, and intellectual property management.
Precludes additional credit for BUSI 5401 (no longer offered).

TOMS 5313 [0.25 credit]
Technology Adoption for Services
Adoption and implementation of technology- driven products and processes for enhanced services. Technology forecasting and scanning; transfer of technologies including technology sourcing, pricing, transfer modes, and success factors; selection of appropriate technology, its vendor and consultant; risk management; managing change.
Precludes additional credit for BUSI 5700 (no longer offered).

TOMS 5314 [0.25 credit]
Supply Chain Management
Organizational, strategic and operational aspects of managing supply chain from domestic and international perspectives. Outsourcing strategies, supplier relationship and information sharing, supplier networks, contracting and procurement management, logistic integration, role of information technology, and supply chain performance and metrics.
Precludes additional credit for BUSI 5601 (no longer offered).

Doctor of Philosophy (Ph.D.)

The focus of the Ph.D. program in Management is applied and basic research on complex management problems in a rapidly changing and globally oriented environment. The doctoral program in management is designed to develop graduates skilled in research with both a theoretical and practical understanding of the complex problems of business and managers. These graduates will pursue careers in university education and research, in training and research in private and public sector organizations, and in business management.

The program is designed to accomplish its objectives by its orientation to a holistic, integrative, and discipline-supported approach to management problem solving, focused on critical issues facing managers in organizations in both the private and public sectors.

The degree will normally be pursued on a full-time basis for the first two years.

Admission Requirements

Admission into the Ph.D. program will be judged primarily on the applicant's ability to undertake research successfully and his/her prospects for completion of the program. Admission to the Ph.D. program is governed by the requirements stated in the General Regulations section of this Calendar.

The normal requirement for admission to the doctoral program in management is a master's degree (or equivalent) in business or a related field with an A- average. A number of years of work experience is desirable.

A student enrolled in the M.B.A. program (or a similar research-based master's program in business) who has completed a minimum of 2.5 credits and who has shown outstanding academic performance and research promise may be admitted to the Ph.D. program without completing the master's program. Normal Ph.D. program requirements, as stated below, will apply. Each case will be considered on an individual basis for advanced standing in the Ph.D. program. Advanced standing will be considered for a maximum of 1.5 credits.

Applicants who have completed a thesis-based master's program in business or a related area may have their program requirements, as set out below, adjusted at the time of admission.

All Ph.D. candidates, regardless of their previous field of specialization, are expected to have or to acquire a basic knowledge of statistics and at least two of the following areas of management: finance, marketing, organizational behaviour, management science, information systems, and productions/operations management. Students will be admitted to the program with a course of study designed where appropriate to supplement previous education, experience, and training.

The School requires that all applicants submit scores obtained in the Graduate Management Admission Test (GMAT) offered by the Education Testing Service of Princeton, New Jersey. Successful candidates will normally have a GMAT score of at least 600. All applicants whose native tongue is not English must be tested for proficiency in the English language and obtain a minimum score of 550 on the TOEFL, or its equivalent. See Section 3.6 of the General Regulations section of this Calendar for details.

Deadline for applications is March 1 for fall term admissions and October 1 for winter term admissions. Applicants for fall term wishing to be considered for financial assistance must submit their completed applications before December 1. Program Requirements

The program requirements for the Ph.D. in Management are:

- 10.0 credits comprised of: 1.5 credits in research and analysis methods; 1.5 credits of seminar courses in functional areas of business; 1.0 credit from a selection of advanced course electives in the School of Business; and 1.0 credit of free electives which must be approved by the thesis supervisor;
- A thesis normally equivalent to 5.0 of the 10.0 required credits, which must be defended at an oral examination;
- One written and one oral comprehensive examination;
- Participation in the School of Business seminar series on current business issues for one year;
- Participation in a seminar series on, and classroom experience in, teaching methods;
- Presentation and oral defence of the thesis proposal.

Course Requirements

All students in the doctoral program are required to complete successfully:

The following 0.5-credit courses:

- BUSI 6902, BUSI 6907 and either BUSI 6905 or BUSI 6906.
  Note: students who have not successfully completed BUSI 5903 (or the equivalent) must do so before enrolling in BUSI 6905;
- 1.5 credits of advanced seminars including at least one two-course sequence, from the following doctoral seminar courses: BUSI 6100 and BUSI 6101; BUSI 6200 and BUSI 6201; BUSI 6300 and BUSI 6301; BUSI 6400 and BUSI 6401; BUSI 6500 and BUSI 6501;
- 1.0 credit from the following advanced seminars: BUSI 6701, BUSI 6702, BUSI 6703, BUSI 6704, BUSI 6801, BUSI 6802, BUSI 6803, BUSI 6804, BUSI 6805.

Students are strongly encouraged to complete 0.5 credit from BUSI 6701, BUSI 6702, BUSI 6703, or BUSI 6704, a series of courses which focuses on the dimensions of complex problem representation and analysis. Students are also strongly encouraged to complete 0.5 credit from BUSI 6801, BUSI 6802, BUSI 6803, BUSI 6804, or BUSI 6805, a series of courses oriented to specific management issues.

The remaining 1.0 credit elective, chosen with the approval of the thesis supervisor to assist in the thesis research process, normally will be chosen from either those courses at the 5000- or 6000-level in the School of Business listed above, or from outside the School in a supporting discipline or in the area of statistics. Thesis

All Ph.D. candidates are required to complete successfully a thesis normally equivalent to a minimum of 5.0 credits on a topic approved by the School. Students with appropriate background will be reviewed for possible adjustment of thesis weight.

Comprehensive Examinations

All Ph.D. candidates are required to successfully complete one written and one oral examination. The written examination will consist of a major essay that provides a comprehensive analytical review of the literature in an area of the student's specialization. The issues dealt with in the essay will be distinct from the student's thesis topic. The submission of the essay will be followed within three to four weeks by a comprehensive oral examination. In addition to questions based on the written portion, the oral comprehensive will include questions on peripheral topics previously assigned by the student's comprehensive examination committee.

The comprehensive examinations must be completed successfully before the Ph.D. proposal defence is scheduled. In normal circumstances, the oral defence must occur within four calendar terms of the student's initial registration in the Ph.D. program. Students who do not fulfil this requirement may be asked to withdraw from the program. Academic Standing

Doctoral students must normally obtain a grade of B- or better in each credit, and Satisfactory on the comprehensive examinations, the Ph.D. thesis and its oral defence.

Ph.D. Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult central.carleton.ca

BUSI 6100 [0.5 credit]

Seminar in Modern Organization Theory

The development of post-structuralist organization theory is examined. Theories of organizational culture and symbolism, political theories of organization, ethnomethodological, decision-based and population ecology approaches are investigated. The social, economic, and intellectual forces shaping organization theory provides a major focus.

BUSI 6101 [0.5 credit]

Current Topics in Organizational Behaviour

Current topics and debates in the research on organizational behaviour. Potential topics include motivation, learning, communication, decision-making, small group behaviour, leadership, careers, power and conflict.

BUSI 6200 [0.5 credit]

Seminar in Marketing I

Marketing theory, history, and developments through the analysis, synthesis, and extension of theoretical and empirical papers on: the marketing concept, the role of marketing in various types of organizations, defining and segmenting markets; managing new product introductions, established products and marketing planning.

BUSI 6201 [0.5 credit]

Seminar in Marketing II

Marketing decision-making practice and theory in business and not-for-profit organizations in such areas as consumer decision-making, organizational decision-making, analytical methods, and research methods to aid in marketing decision-making.

BUSI 6300 [0.5 credit]

Seminar in Management of Production/Operations I: Strategic Management of Production Systems

Developing the firm's strategies with respect to facilities, locations, production technologies, and sourcing arrangements. Recent developments in management policies and practices that enable production systems to operate at full potential in the wake of time- and quality-based competition.

BUSI 6301 [0.5 credit]

Seminar in Management of Production/Operations II: Production/Technology/Strategy Interface

The evolution and management of process innovation; management of productivity using production technologies; integration of production strategy and technology; and interactions with research and development. Topics include quality function deployment and the deployment of process innovations.

BUSI 6400 [0.5 credit]

Seminar in Information Systems I: Information and Computing Technologies in Management

The role of computing and communications technologies and information systems in the functioning of organizations and managers. Current developments in the information systems field.

BUSI 6401 [0.5 credit]

Seminar in Information Systems II: Analysis and Design of Information Systems

Theory and practice concerning factors determining the effective use of computing technologies, particularly on the match between the information systems and its users.

BUSI 6500 [0.5 credit]

Seminar in Finance I

Selected topics in financial theory. Topics are chosen according to new developments in theory and with the interests of the students in mind. These may include theory of derivatives, pricing theory, information asymmetries, agency theory, economic efficiency, and empirical methods.

BUSI 6501 [0.5 credit]

Seminar in Finance II

Emerging areas in finance such as total quality management, left-hand financing, activity-based costing, multi-criteria decision-making, neural networks, etc. Integrative problems spanning two or more functional disciplines in management, such as taxation.

BUSI 6701 [0.5 credit]

Choice Behaviour

Examines choice behaviour from a variety of disciplines. Topics covered may include individual choice models in economics, Von-Neumann-Morgenstern utility, Luce Choice Axiom and its extensions, multi-criteria individual choice behaviour, and multi-criteria group choice behaviour.

BUSI 6702 [0.5 credit]

Analysis and Representation of Complex Problems

This course uses qualitative and quantitative techniques and theoretical frameworks to represent organizational systems, problems and decisions that executives and managers face. The qualitative models are viewed as primary, providing the setting for the quantitative models, selection of choice mechanism, and interpretation of solutions.

BUSI 6703 [0.5 credit]

Systems Concepts in Management

A unified outlook toward management theory is developed through specifying system variables, components, boundaries and limitations. The importance of computer-based systems for analyzing and managing integrated systems in the context of control, decision-making and model-building.

BUSI 6704 [0.5 credit]

Managing the Change Process

The process of organizational change and the external forces which drive such changes. Topics include both micro and macro theories of change and issues around change management such as leadership and resistance to change.

BUSI 6801 [0.5 credit]

Management of Technology

Introduction to issues in the management of technology. Topics include: technology strategy and policy, technology forecasting and planning, the process of technology innovation from concept to market, research and development management, technology adoption, diffusion and implementation, technology transfer, and technology and social issues.

BUSI 6802 [0.5 credit]

Women in Management

An exploration of the research and organizational challenges arising from changing gender roles. Topics include: the sex segregation of work, gender differences in management styles, work-family conflict, women's careers, managing sexual harassment, employment equity and pay equity.

BUSI 6803 [0.5 credit]

Corporate Strategy and Policy

Theories of the firm, origins of the modern corporation, analysis of the external environment, industry analysis, value chain analysis, resource-based theory, distinctions between corporate and business strategy, economies of scope, diversification and sustainable competitive advantage.

BUSI 6804 [0.5 credit]

International Business Strategy

An advanced examination of contemporary theory on international business expansion. Topics include trade and investment flow interactions; expansion modes, location theory, and sequential expansion; globalization, consumer behaviour, and culture; trans-border information flows; internationalization by firm size; strategic alliances; and free trade blocs.

BUSI 6805 [0.5 credit]

Canadian Business Competitiveness

Competitiveness at the country, industry, and firm levels, examined in the context of Canada's unique characteristics from various domestic and international perspectives including industrial organization theory, comparative perspectives on industrial concentration, internalization theory, Porter's competitiveness diamond, business-government interactions,and government support programs for business.

BUSI 6806 [0.5 credit]

Entrepreneurship

An examination of research in entrepreneurship focusing on theory building and empirical testing of factors that shapes the identification, evaluation and exploitation of opportunities and the creation of new organizations. Topics include: environmental influences on formation and growth, theories of growth and entrepreneurial clustering.

BUSI 6900 [0.5 credit]

Directed Readings

Directed readings in selected areas of business, involving presentation of papers as the basis for discussion. A part of the requirement for the course may be participation in an advanced course at the undergraduate/graduate level.
Prerequisite: permission of the School.

BUSI 6901 [0.5 credit]

Special Topics

Designed to expose students to new and emerging issues in selected areas of business research. Integrative problems involving two or more areas of business research are also explored. The topics covered may vary from year to year.
Prerequisite: permission of the School.

BUSI 6902 [0.5 credit]

Research Methodology in Business

The study of research techniques commonly used in research on business and management issues. The development of knowledge of these methodologies and their application, and their possible use in the thesis research of the student are the two main goals of this course.

BUSI 6905 [0.5 credit]

Advanced Statistical Methods for Business Research

A practical introduction to advanced statistical methods used in business research, with particular focus on discrete categorical data. Topics include the analysis of two-way and three-

way tables; loglinear modeling; logistic regression; generalized linear models. Students will analyze real data using appropriate software packages.

BUSI 6906 [0.5 credit]

Advanced Methods and Models of Management Science

Advanced study of decision-making under certainty and uncertainty. Topics include: constrained and unconstrained optimization; project management; scheduling and facilities location; multi-objective dynamic programming; multi-attribute utility theory; discrete choice. Links between theory and application will be illustrated through case studies and applied modeling.

BUSI 6907 [0.5 credit]

Ph.D. Thesis Tutorial

An intensive preparation for Ph.D. thesis research, under the direction of one or more members of the School. The successful submission of a thesis proposal is necessary for the completion of the course.

BUSI 6908

Ph.D. Comprehensives

Preparation for comprehensive examinations.

BUSI 6909

Ph.D. Thesis

Canadian Studies

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The School

Director:. André Loiselle
Graduate Supervisor: TBA

The School of Canadian Studies offers unique interdisciplinary programs of study and research leading to the degrees of M.A. and Ph.D. in Canadian Studies.

The graduate programs in Canadian Studies enable students to develop individual areas of concentration to meet particular interests in a broad range of Canadian issues.

At the M.A. level, students can undertake interdisciplinary research areas, which include Aboriginal Studies and the North, Gender Studies, Canadian Cultural Studies and Cultural Policy, and Heritage Conservation.

Students in the Gender Studies program area in Canadian Studies examine ways in which gender affects our local, national and global environment. In particular, students examine the interplay within the Canadian context between sex/gender as a dynamic principle in the processes of nation building and the construction of cultural and political identities.

The Aboriginal Studies and the North program area was initiated through a grant from the Donner Foundation. Students research a wide range of cultural, economic and political issues concerning First Nations, Métis and Inuit communities as well as Northern Canada. Although the same conditions and requirements apply as in other program areas, here special consideration may be given to candidates for admission who have extensive knowledge of the north or of Aboriginal peoples.

The School also offers a program area in Canadian Cultural Studies and Cultural Policy. The program is geared towards students with a broad interest in traditional and popular music, art, film, literature, performing arts, cultural theory, and the role of cultural institutions and cultural policy.

The Heritage Conservation program area offers an interdisciplinary focus on Canadian intangible and tangible heritage. It is designed primarily as a professional development path, but also provides a setting for reflective academic inquiry.

Students interested in examining the interplay between Policy, Economy, and Canadian Society will develop a critical interdisciplinary perspective on policy debates informing the changing nature and the struggles to define and claim Canada. Students are invited to engage competing perspectives on Canadian identity and values, and major policy debates in Canada.

Students can also explore the complexities of individual, collective and communal identities in a Canadian context. Intersections, relationships and conflicts among gender, racial, spatial, class, sexual and national identities can be examined. Students are encouraged to undertake critical analyses of Canadian theoretical debates in this field, as well as international scholarship in identity studies.

A joint Ph.D. program with Trent University was introduced in 2000. This program builds on the combined strengths of the M.A. programs at the two universities, and provides Canada's only full interdisciplinary doctoral program in Canadian Studies. It has further enriched the graduate offerings by including five fields of study: Culture, Literature and the Arts; Environment and Heritage; Women's Studies; Policy, Economy and Society; and Identities.

The work of the School is conducted with the assistance of faculty and availability of coursework in a variety of supporting departments including: Architecture, Art History, Economics, English, Film Studies, French, Geography, History, Journalism and Communication, Law, Linguistics and Applied Language Studies, Mass Communications, Music, Political Economy, Political Science, Psychology, Public Policy and Administration, Social Work, Sociology and Anthropology, and Women's and Gender Studies. Carleton University's proximity to the National Library, the National Gallery of Canada, the national museums, the Library of Parliament, the National Archives of Canada, Statistics Canada, the Heritage Canada Foundation, Parks Canada, embassies and the libraries of various government departments ensures excellent research facilities for graduate candidates in Canadian Studies.

Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may, in exceptional cases, be admitted to a qualifying-year program. However, admission to the qualifying-year program does not imply automatic admission to the master's program. At the end of the qualifying-year program the student will be required to apply for entry into the master's program, at which time the School will determine the student's eligibility to enter the program.

Master of Arts

Admission Requirements

Applicants are required to hold an Honours B.A. (or the equivalent), with at least high honours standing. Application deadlines can be found at https://gsapplications.carleton.ca

Language Requirement

The School requires a reading knowledge of French. This is a program requirement and not an admission requirement. This requirement may be satisfied in the following ways:

- Successful completion of FINS 3105 or its equivalent (with a grade of B- or better).
- Successful completion of a French language examination.
- Alternatively, a student may fulfil this requirement with a demonstrated knowledge of an Aboriginal language.
- The School conducts the French language examinations in September and January. Students choosing the first option should note that examination results in these courses form part of their record, although they are additional to the course requirements for the degree.

Program Requirements

The minimum requirements for the master's program are outlined in the General Regulations section of this Calendar. The School of Canadian Studies specifies that all candidates must select one of the following three program patterns:

- 4.0 credits plus a 0.0 credit Comprehensive Examination

- 3.0 credits plus a 1.0 credit Research Essay
- 2.0 credits plus a 2.0 credit Thesis

Students must declare their option as comprehensive, thesis, or research essay no later than the end of the second term of registration for students enrolled full-time, and no later than the end of the fifth term of registration for students enrolled part-time. For students beginning their program in September the deadline is the following April 30, and for students starting in January the deadline is the following August 31.

Comprehensive Examination Option

- M.A. Comprehensive Examination CDNS 5907 [0.0 credit]
- CDNS 5001 M.A. Core Seminar: Conceptualizing Canada [0.5 credit]
- 1.0 credit chosen from: CDNS 5101, CDNS 5102, CDNS 5201, CDNS 5202, CDNS 5301, CDNS 5302, CDNS 5401, CDNS 5402, CDNS 5501, CDNS 5601
- An additional 2.5 credits chosen from the courses listed above, or CDNS 5801, CDNS 5901, or an approved coursed listed in the Selection of Courses

Research Essay Option

- M.A. Research Essay CDNS 5908 [1.0 credit]
- CDNS 5001 M.A. Core Seminar: Conceptualizing Canada [0.5 credit]
- 1.0 credit chosen from: CDNS 5101, CDNS 5102, CDNS 5201, CDNS 5202, CDNS 5301, CDNS 5302, CDNS 5401, CDNS 5402, CDNS 5501, CDNS 5601
- An additional 1.5 credits chosen from the courses listed above, or CDNS 5801 or CDNS 5901, or an approved course listed in the Selection of Courses

Thesis Option

- M.A. Thesis CDNS 5909 [2.0 credits]
- CDNS 5001 M.A. Core Seminar: Conceptualizing Canada [0.5 credit]
- 1.0 credit chosen from: CDNS 5101, CDNS 5102, CDNS 5201, CDNS 5202, CDNS 5301, CDNS 5302, CDNS 5401, CDNS 5402, CDNS 5501, CDNS 5601
- An additional 0.5 credit chosen from the courses listed above, or CDNS 5901, or an approved course listed in the Selection of Courses

Comprehensive Examinations

The comprehensive examination is in two parts: part one based on CDNS 5001 and part two based on one of CDNS 5101, CDNS 5201, CDNS 5301, CDNS 5302 or CDNS 5401. Students must pass both parts of the examination in order to obtain a passing grade.

Students are required to file with the School their choice of the Comprehensive Examination option no later than the end of the second term of registration for students enrolled full-time, and no later than the end of the fifth term of registration for students enrolled part-time. A committee will be assigned to each candidate choosing this option. The committee will advise and assist the student to prepare for the comprehensive examination. Normally, the comprehensive examinations are written, but may, with the approval of the graduate supervisor, be oral. The comprehensive examination normally will be undertaken in the academic year in which the student completes CDNS 5001, but, with the approval of the graduate supervisor, may be undertaken at a later point in the student's program. The School schedules comprehensive examinations in December and April.

Thesis/Research Essay Proposal

At the time of declaring their option, thesis/research essay students are encouraged to declare a preliminary topic and tentative list of potential supervisors. Thesis/research essay students must submit a research proposal to the School that has been approved by their thesis/research essay supervisor prior to registering in the M.A. Research Essay (CDNS 5908) or the M.A. Thesis (CDNS 5909).

Proficiency in English

Proficiency in English is necessary to pursue graduate studies at Carleton University. All applicants whose first language is not English must satisfy this requirement by presenting a TOEFL score of 600 or better.

Ph.D. Program in Canadian Studies (joint program between Carleton University and Trent University)

Doctor of Philosophy

The doctoral program is offered jointly by the School of Canadian Studies at Carleton University and the Frost Centre for Canadian Studies and Native Studies at Trent University.

The Ph.D. program offers five fields of study: Culture, Literature, and the Arts; Environment and Heritage; Policy, Economy and Society; Identities; and Women's Studies. The program of courses and thesis guidance, drawing upon the faculty of the two academic units and universities, will encompass course requirements, comprehensive examinations, and a thesis.

The Ph.D. program in Canadian Studies normally will be undertaken on a full-time basis. In cases of exceptional merit, the School will accept a few candidates for the degree on a part-time basis.

Admission Requirements

The requirement for admission into the Ph.D. program is a master's degree (or equivalent), with at least high honours standing in Canadian Studies or one of the disciplines represented in the School. Applicants should note, however, that meeting the admission requirement does not guarantee admission to the program. Application deadlines can be found at https://gsapplications.carleton.ca .

Language Requirement

All doctoral students are required to pass the Ph.D. program's language test. The language test entails the translation into English of a French text (or a text in another approved language such as an Aboriginal language indigenous to Canada or another language if it is demonstrably relevant to their research interest). The language test is two hours long, and students are permitted to use a dictionary. Grades for the language test are Pass or Fail.

Students who have taken a language test as a requirement for their M.A. cannot use it to meet the Ph.D. language requirement. In order to establish equal treatment of all students, all doctoral candidates will be required to pass the Ph.D. language test.

Program Requirements

Doctoral candidates must successfully complete 10.0 credits. Candidates with deficiencies in certain areas may be admitted to the Ph.D. program, but normally will be required to complete additional work. The specific requirements are as follows:

- 1.0 credit for successful completion of CDNS 6900, the mandatory core seminar;
- 1.0 credit for successful completion of two courses or tutorials (or the equivalent) drawn from the graduate list offered by the School, below, with one 0.5-credit course drawn from each of the candidate's two major fields of study; a GPA of 9.0 or better must be obtained in these courses for students to be allowed to proceed to the comprehensive examinations;
- 1.0 credit for successful completion of two 0.5-credit written comprehensive examinations. Students will be examined in two fields;
- Satisfactory demonstration of an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute an Aboriginal language indigenous to Canada or another language if it is demonstrably relevant to their research interests;
- A public defence, in English, of a written thesis proposal. Following the completion of their comprehensives, students will be expected to defend a proposal of the research and analysis they plan to undertake in completing their Ph.D. thesis. The thesis proposal defence should normally occur within six months after completion of a student's comprehensive examinations. The thesis committee will be composed of three faculty members, always including one from each university;
- A 7.0-credit thesis, which must be successfully defended in English at an oral examination.

Academic Standing

All Ph.D. candidates must obtain at least B+ standing or better (GPA 9.0) in each course counted towards the degree. Comprehensive examinations (which will be graded on a Satisfactory, Unsatisfactory or Pass with Distinction basis) are exempted from this required standing.

Comprehensive Examinations

Full-time students are expected to complete their comprehensive examinations within 24 months of their initial registration in the Ph.D. program. Part-time Ph.D. students should finish their comprehensive examinations within 36 months of completing course work. Both full-time and part-time students should complete their comprehensive examinations before defending their dissertation proposal.

Candidates are required to take an oral examination after each written examination.

The fields of study for the Ph.D. comprehensive examinations are to be chosen from the following list:

Culture, Literature, and the Arts
: A general knowledge of theories of culture in general, Canadian theoretical discourses on cultural practices, and on the interplay among theory, art, and literature, and their social contexts.

Environment and Heritage
: A general knowledge of locality, landscape, environment and region in Canada.

Policy, Economy and Society
: A general knowledge of the complex web of relationships linking economy, civil society, and public policy in Canada and their interaction within social, political, and cultural life.

Identities

A general knowledge of the character and experience of individual, collective and communal identities in Canada.

Women's Studies

A general knowledge of women's experiences of the major dynamics of social, political, economic and cultural development at all levels of Canadian life.

Thesis Proposal

All students must defend publicly a thesis proposal after completing their comprehensive examinations. Full-time students must complete this requirement within the first 27 months of registration in the program.

Canadian Studies Courses at Carleton University by Fields of Study

Culture, Literature, and the Arts
CDNS 5301, CDNS 5302

Environment and Heritage
CDNS 5401, CDNS 5402

Policy, Economy and Society
CDNS 5302, CDNS 5501, CDNS 5601

Identities
CDNS 5101, CDNS 5102, CDNS 5501

Women's Studies
CDNS 5201, CDNS 5202, CDNS 5501

To meet program requirements Carleton students must take at least one of the 0.5 credit courses from the Canadian Studies courses listed above. Students can also choose from approved graduate courses at the Frost Centre for Canadian Studies and Native Studies at Trent University. Students should consult with the Graduate Studies Administrator for the complete listing of acceptable graduate courses available at Trent University in any given year.

Students may also register in graduate courses offered outside Canadian Studies. A list of courses with substantial Canadian content follows the Canadian Studies course list.

All graduate courses must be approved by the Ph.D. Coordinator in Canadian Studies at Carleton University.

Collaborative Ph.D. with a Specialization in Political Economy

The School of Canadian Studies and the Institute of Political Economy offer a Collaborative Program in Political Economy at the Ph.D. level. For further details, see the Institute of Political Economy's Collaborative Ph.D. with a Specialization in Political Economy section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult central.carleton.ca

Students not registered in the M.A. program in the School of Canadian Studies may take interdisciplinary seminars, with permission of the School of Canadian Studies.

CDNS 5001 [0.5 credit]
M.A. Core Seminar: Conceptualizing Canada
Interdisciplinary perspectives on theoretical and methodological approaches to Canadian Studies.
Prerequisite: Graduate standing in the School.

CDNS 5002 [0.5 credit]
Interdisciplinary Methods
A survey of the issues raised by problem-directed methodologies; critiques of existing methodology including from the standpoints of feminist and Aboriginal scholarship.

CDNS 5003 [0.5 credit]
Selected Topics in Canadian Studies
Topic varies from year to year.

CDNS 5101 [0.5 credit]
Aboriginal Peoples, Canada and the North
Interdisciplinary seminar exploring selected Aboriginal issues as they relate to historical and ongoing changes in material, social, and cultural phenomena and relationships.
Precludes additional credit for CDNS 5100.

CDNS 5102 [0.5 credit]
Indigenous Politics and Resurgence in Canada
Interdisciplinary seminar exploring selected themes in Aboriginal politics, experience, and philosophy since the 1960s. Builds on CDNS 5101.
Precludes additional credit for CDNS 5100.
Prerequisite: CDNS 5101 or permission of the School of Canadian Studies.

CDNS 5201 [0.5 credit]
Critical Perspectives on Canadian Feminism
Interdisciplinary seminar examining Canadian contributions to feminist and gender theory as well as developments in women's movements in a Canadian context.
Precludes additional credit for CDNS 5200.

CDNS 5202 [0.5 credit]
Gendering Canada: Selected Contemporary Debates
Interdisciplinary seminar focusing on specific themes that define Canadian women's and gender studies. Themes change yearly but past topics have included sexuality and sexual practices, health and reproductive rights, the body, motherhood and work.
Precludes additional credit for CDNS 5200.

CDNS 5301 [0.5 credit]
Canadian Cultural Studies
The arts, belief systems, institutions and communicative practices in Canada in relation to other social and historical structures.
Precludes additional credit for CDNS 5300.

CDNS 5302 [0.5 credit]
Canadian Cultural Policy
Evolution of Canadian cultural policy from its origins through to the contemporary search for cultural cohesion within a global context, emphasizing developments since the Massey Commission.
Precludes additional credit for CDNS 5300.

CDNS 5401 [0.5 credit]

Heritage Conservation I: History, Principles, and Concepts

History of heritage conservation theory in Canada and abroad, as it affects both tangible and intangible heritage; development of the field's conceptual frameworks and operational principles for understanding, evaluating, conserving and managing significant Canadian places of heritage value. Note: students registering in this course are strongly encouraged to register in CDNS 5402.

Precludes additional credit for CDNS 5400.

CDNS 5402 [0.5 credit]

Heritage Conservation II: Theory in Practice

Application of heritage conservation theory to practice. Models for conservation and management of heritage resources in Canada. Research, planning, development, interpretation and the interplay of disciplines within these conservation domains. Frameworks for evaluating programs and policies. Field exercises and visits.

Precludes additional credit for CDNS 5400.

Prerequisite: CDNS 5401 or permission of the School of Canadian Studies.

CDNS 5501 [0.5 credit]

Decolonizing Canada: Cultural Politics and Collective Identities

Interdisciplinary examination of the politics of race, gender, class and cultural pluralism in Canada. Critical theoretical exploration of nationalism, regionalism, multiculturalism, neoliberalism, Aboriginal politics, diaspora and global human rights regimes and claims.

CDNS 5601 [0.5 credit]

Constructing Canada: The Politics of National Identity

Interdisciplinary examination of national identity, public opinion, and public policy; the intersection of national visions of Canada and public policy; and the articulation of Canadian distinctiveness and sovereignty on the world stage. Topics include nationalism and national identity, branding Canada, and selected policy fields.

CDNS 5700 [0.5 credit]

Arctic Passages: The Changing Dynamics of Canada's North

Interdisciplinary exploration of changing political, economic, and cultural relationships between Inuit and non-Inuit interests in the Canadian Arctic. Emphasis on the role of global processes, such as the rise of the circumpolar movement and environmental change, in mediating these relationships.

CDNS 5801 [0.5 credit]

Internship/Practicum

Internships or practicum placements are set in an institutional setting outside of the University. Students are restricted to a maximum of 0.5 credit in an Internship/Practicum. Students are required to complete a formal written paper in addition to their internship/practicum activities. The written work is evaluated jointly by the student's internal and external advisers.

Prerequisite: completion of one full credit of coursework in Canadian Studies and prior approval of the School of Canadian Studies.

CDNS 5901 [0.5 credit]

Directed Studies

Reading and research tutorials supervised by a qualified adviser, in an area not covered by an existing seminar. Directed Studies are organized by individual students with a faculty member. Students are restricted to a maximum of 0.5 credit in a Directed Studies.

Prerequisite: prior approval of the School of Canadian Studies.

CDNS 5907 [0.0 credit]

M.A. Comprehensive Examination

The comprehensive examination is in two parts: part one based on CDNS 5001 and part two based on one of CDNS 5101, CDNS 5201, CDNS 5301, CDNS 5302 or CDNS 5401. Students must pass both parts of the examination in order to obtain a passing grade.

CDNS 5908 [1.0 credit]
Research Essay
Approval of the Research Essay Proposal is required prior to registration in this course.

CDNS 5909 [2.0 credits]
M.A. Thesis
Approval of the Thesis Proposal is required prior to registration in this course.

CDNS 6900 [1.0 credit]
Ph.D. Core Seminar: Interdisciplinarity in Canadian Studies: Concepts, Theories & Methods
Available only to Ph.D. students in Canadian Studies. An examination of the complex theoretical and methodological issues associated with the discourse on an interdisciplinary study of Canada. Offered at Carleton and Trent through a combination of joint sessions at both universities and regular electronic communication.
Prerequisite: enrolment in the Canadian Studies Ph.D. program.

CDNS 6901 [0.5 credit]
Ph.D. Tutorial
Available only to Ph.D. students in Canadian Studies. Reading and research tutorials. A program of research and written work in an area not covered by an existing graduate seminar.
Prerequisite: permission of the School of Canadian Studies.

CDNS 6902 [0.5 credit]
Ph.D. Tutorial
Available only to Ph.D. students in Canadian Studies. Reading and research tutorials. A program of research and written work in an area not covered by an existing graduate seminar.
Prerequisite: permission of the School of Canadian Studies.

CDNS 6905 [0.5 credit]
Ph.D. Comprehensive Examination
Available only to Ph.D. students in Canadian Studies. Students will receive a grade of Satisfactory, Unsatisfactory or Pass with Distinction.
Prerequisite: permission of the School of Canadian Studies.

CDNS 6907 [0.5 credit]
Ph.D. Comprehensive Examination
Available only to Ph.D. students in Canadian Studies. Students will receive a grade of Satisfactory, Unsatisfactory or Pass with Distinction.
Prerequisite: permission of the School of Canadian Studies.

CDNS 6909
Ph.D. Thesis
Prerequisite: permission of the School of Canadian Studies.

Selection of Courses

In addition to the graduate courses offered by the School, the following courses are of particular relevance to students in Canadian Studies. The list is not exclusive and is subject to change. Students in the master's program in the School must complete 3.5 credits of the 4.0 credits required for the degree at the 5000-level, with the possibility of 0.5 credit at the 4000-level with prior approval from the School of Canadian Studies.

Students may take any 5000- or 6000-level courses in this list and count them toward their master's program. All other courses require prior approval from the Graduate Supervisor or Ph.D. Co-ordinator.

Note: the number of spaces in graduate courses offered by other departments may be limited, and registration may be conditional upon obtaining the prior approval of the department concerned. It is the

student's responsibility to ensure that permission is obtained from the appropriate department prior to registering in any of that department's courses.

Anthropology
ANTH 5106, ANTH 5107, ANTH 5308
Architecture
ARCH 5000, ARCH 5001, ARCH 5002,
ARCC 5401, ARCU 5402
Art History
ARTH 4000 Topics in Canadian Art: Art of the Land
ARTH 4005 Historic Dress Traditions of Canadian Indian Peoples
ARTH 4601 Topics in Twentieth-Century Art: Women Artists and Modernism in Europe and America
ARTH 4800 Readings in Twentieth-Century Architectural History
ARTH 4900 Directed Readings and Research
ARTH 4901 Directed Readings and Research
ARTH 4902 Directed Readings and Research
ARTH 5000, ARTH 5001, ARTH 5002, ARTH 5101
Comparative Literary Studies
CLST 5302, CLST 5508
Economics
ECON 4306 Employment Economics and Labour Policy
ECON 4800 Urban Economics
ECON 5301, ECON 5302, ECON 5303, ECON 5305, ECON 5401, ECON 5402, ECON 5801, ECON 5802
English Language and Literature
ENGL 4802 Canadian Ethnic Minority Lit.
ENGL 4803 English and French Canadian Lit.
ENGL 4806 Studies in Canadian Lit.
ENGL 4808 First Nations Literatures I
ENGL 4809 First Nations Literatures II
ENGL 5801, ENGL 5802, ENGL 5803, ENGL 5805, ENGL 5807, ENGL 5809
Film Studies
FILM 5208, FILM 5209
French
FREN 4002 Littérature nationales
FREN 5003 Linguistique du fran<0x00E7>ais II
FREN 5004 Linguistique du fran<0x00E7>ais canadien
FREN 5500, FREN 5700
Geography
GEOG 4203 Urban Revitalization
GEOG 4207 Urban Development and Analysis
GEOG 4301 Advanced Cultural Geography
GEOG 4305 Historical Geography
GEOG 4407 Canadian Agriculture
GEOG 5405, GEOG 5700, GEOG 5703
History
HIST 4302 Canada: Ideas & Culture
HIST 4304 Canada: Politics & Society
HIST 4306 Canada: Ethnicity & Community
HIST 4505 Sem. in Women's & Gender Hist.
HIST 5000, HIST 5310, HIST 5311, HIST 5312, HIST 5313, HIST 5506, HIST 5509, HIST 5700, HIST 5808
Journalism and Communication
JOUR 5000, JOUR 5305, JOUR 5401, JOUR 5500
Law

LAWS 4001 Law, Family and Gender
LAWS 4002 Feminist Theories of Law
LAWS 4107 Law in Advanced Capitalist Society
LAWS 4309 Criminal Proceedings and Dissent: Political Offences and National Security Measures
LAWS 4405 Labour Relations in the Public Service
LAWS 4501 Selected Problems in Comparative Constitutional Law
LAWS 4504 Aboriginal Peoples and the Canadian Criminal Legal System
LAWS 4507 Administrative Law and Control

LAWS 5002, LAWS 5007, LAWS 5008,
LAWS 5302, LAWS 5405, LAWS 5500,
LAWS 5503, LAWS 5900, LAWS 5901,
LAWS 5903, LAWS 5904

Mass Communication

MCOM 4100 Selected Topics in Mass Communication Analysis
MCOM 4102 Selected Topics in Mass Communication Analysis
MCOM 4500 Mass Media and Capitalist Democracy I
MCOM 4501 Mass Media and Capitalist Democracy II
MCOM 5201, MCOM 5203, MCOM 5205, MCOM 5301, MCOM 5505, MCOM 5506, MCOM 5507, MCOM 5508, MCOM 5509, MCOM 5605

Music

MUSI 5001, MUSI 5005, MUSI 5100, MUSI 5101, MUSI 5102, MUSI 5105

Political Science

PSCI 4000 Topics in Canadian Government and Politics
PSCI 4002 Policy Seminar: Problems of Northern Development
PSCI 4003 Politics and the Media
PSCI 4005 Stability, Justice and Federalism
PSCI 4006 Legislative Process in Canada
PSCI 4008 National Security and Intelligence in the Modern State
PSCI 4009 Quebec Politics
PSCI 4106 Labour and the Canadian State
PSCI 4107 Political Participation in Canada
PSCI 4108 Canadian Provincial Government and Politics
PSCI 4109 The Politics of the Canadian Charter of Rights and Freedoms
PSCI 4204 Elections
PSCI 4205 Identity Politics
PSCI 4206 Indigenous Politics of North America
PSCI 5008 The Politics of Climate Change
PSCI 5003, PSCI 5000, PSCI 5006, PSCI 5007, PSCI 5009, PSCI 5100, PSCI 5101, PSCI 5200, PSCI 5201, PSCI 5306, PSCI 5401, PSCI 5507, PSCI 5601, PSCI 6000, PSCI 6001

Public Administration

PADM 5000, PADM 5004, PADM 5006, PADM 5008, PADM 5009, PADM 5106, PADM 5109, PADM 5205, PADM 5306, PADM 5308, PADM 5600, PADM 5604, PADM 5607, PADM 5701, PADM 5704, PADM 5804, PADM 5806, PADM 5809

Social Work

SOWK 4102 Aboriginal Peoples and Social Policy
SOWK 4103 Practice and Policy in Immigration
SOWK 4203 Social Work Practice from an Aboriginal Perspective
SOWK 4204 Social Work and Aging

SOWK 5100, SOWK 5101, SOWK 5102, SOWK 5105, SOWK 5106, SOWK 5108, SOWK 5207, SOWK 5301, SOWK 5302, SOWK 5704

Sociology

SOCI 5205, SOCI 5302, SOCI 5308,
SOCI 5400, SOCI 5405, SOCI 5608

Women's Studies

WOMN 4901 Selected Topics in Women's Studies I
WOMN 4902 Selected Topics in Women's Studies II
WOMN 5000, WOMN 5001

Chemistry

203 Steacie Building
Telephone: 613-520-2600 ext. 3523
Fax: 613-520-3749

The Ottawa-Carleton Chemistry Institute

Director of the Institute: P.R. Sundararajan
Associate Director of the Institute: D. Richeson

The Ottawa-Carleton Chemistry Institute, established in 1981, is a joint program of graduate studies and research in chemistry for Carleton University and the University of Ottawa. The Institute combines the research strengths and resources of the Departments of Chemistry at both campuses. Research facilities are shared and include: a major mass spectrometry centre, X-ray spectrometer, several modern NMR spectrometers, a pico-second laser facility, an ultratrace analysis laboratory, and an electrochemical research centre. In addition, the resources of many federal departments are available to graduate students, including the National Research Council and its library, the National Science Library (CISTI), and departments of Health and Welfare and Agriculture.

The Institute offers the M.Sc. and Ph.D. degrees in all areas of chemistry, including biochemistry, analytical, inorganic, organic, physical and theoretical chemistry. All thesis, seminar and examination requirements may be met in either English or French. Students will be enrolled at the campus where the research supervisor is located. Several graduate students also conduct their research off campus under the supervision of one of the Institute's adjunct professors.

Application forms and further information may be obtained by writing to the director of the Institute.

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

The Departments of Chemistry and Biology at Carleton University and the University of Ottawa provide a collaborative program in chemical and environmental toxicology at the M.Sc. level. For further details, see the Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology's section of this Calendar.

Members of the Institute

- Howard Alper, *Organometallic and organic chemistry*
- T. Avis*, Food science and nutrition*
- Louis Barriault, *Organic chemistry, synthesis of natural products and methodology*
- S. Barry, *Inorganic Materials Chemistry*
- A.D.O. Bawagan, *Chemical physics*
- R. Ben, *Synthetic organic and bioorganic chemistry, asymmetric synthesis*
- D.M. Bishop, *Theoretical chemistry*
- G.W. Buchanan, *Applications of NMR spectroscopy*
- *P.H. Buist, Bio-organic chemistry*
- R.C. Burk, *Environmental and analytical chemistry*
- A.J. Carty, *Organometallic and inorganic chemistry (Adjunct)*
- C.L. Chakrabarti, *Environmental chemistry, analytical chemistry*
- R.J. Crutchley, *Physical inorganic chemistry*
- M. DeRosa, *Inorganic, bioinorganic, nucleic acids chemistry*
- Christian Detellier, *Supramolecular chemistry*

- Tony Durst, *Synthetic and medicinal organic and natural products chemistry*
- K. Fagnou, *Synthetic organic chemistry, transition metal catalysis*
- A.G. Fallis, *Synthetic, medicinal, functional chemistry*
- D.E. Fogg, *Organometallic, polymer and materials chemistry*
- Sandro Gambarotta, *Inorganic and organometallic chemistry*
- J. B. Giorgi, *Fuel cells, catalysis, surface science*
- N. Goto, *NMR, protein structure, membrane proteins*
- J.L. Holmes, *Gas phase reactions and ion chemistry, mass spectroscopy*
- A.I. Ianoul, *Biophysical chemistry*
- K.U. Ingold, *Physical organic chemistry, free radicals (Adjunct)*
- Harvey Kaplan, *Protein chemistry and enzymology*
- E.P.C. Lai, *Analytical chemistry*
- J. Manthorpe, *Synthetic organic chemistry*
- Paul M. Mayer, *Gas phase ion chemistry*, *analytical mass spectroscopy*
- D. Miller, *Environmental chemistry*
- W. Ogilvie, *Synthetic and medicinal organic chemistry, combinatorial chemistry*
- Arya Prabhat, *Organic and bio-organic chemistry, synthetic and medicinal chemistry (Adjunct)*
- D.S. Richeson, *Inorganic chemistry*
- J.A. Ripmeester, *Supramolecular materials, NMR spectroscopy (Adjunct)*
- A. Sayari, *Inorganic materials, heterogeneous catalysis*
- J.C. Scaiano, *Physical organic chemistry, photochemistry and photobiology, supramolecular chemistry*
- J. Smith, *Analytical chemistry*
- Alain St.-Amant, *Theoretical and computational chemistry*
- K.B. Storey, *Enzyme biochemistry and molecular genetics*
- P. (Sundar) Sundararajan, *Morphology of polymers and smart materials*
- Heshel Teitelbaum, *Microscopic reaction kinetics*
- A. Tsopmo, *Food science and nutrition*
- Z.Y. Wang, *Synthetic polymer chemistry and organic chemistry*
- D. Wayner, *Surface science, surface patterning, electrochemistry*
- William G. Willmore, *Biochemistry, biotechnology*
- B. Wolkow, *Atomic-level chemical physics of surfaces*
- J.S. Wright, *Theoretical chemistry*

Master of Science

Admission Requirements

The requirement for admission to the program is an Honours B.Sc. degree in Chemistry, with a B+ average in the last two years and a B average overall. Applicants who do not meet this requirement, or whose undergraduate degree is in another, closely related field, may be accepted into the program, but may be assigned extra courses.

Program Requirements

1. A research thesis defended at an oral examination (3.0 credits)

2. One credit of graduate courses (made up of any combination of 0.5 credit and 0.25 credit courses)

3. CHEM 5801 (1.0 credit)

Guidelines for Completion of Master's Degree

Full-time students in the master's program will normally complete the degree requirements in two years. Part-time students will normally complete the degree requirements in four years.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a B.Sc. or M.Sc. degree in Chemistry.

Program Requirements (from B.Sc.)

1. A research thesis defended before an examination board which includes an external examiner (11.0 credits)

2. A two-part comprehensive examination in chemistry. The first part consists of a research proposal examination. The proposal topic can be in the same research area as that of the student's thesis supervisor,but should be significantly different from the student's thesis research project and any research being conducted by any faculty member of the Ottawa-Carleton Chemistry Institute. The second part of the examination will consist of either a) a short presentation given by the student to an examining committee on a topic in his/ her research area, or b) a series of five two-hour examinations from a library of examinations. (No credit. Graded Pass or Fail.) Students admitted to the graduate program in Chemistry at Carleton University prior to May 1, 2003 may follow the Comprehensive Examination requirement published in the 2002-2003 Graduate Calendar. Students who fail to complete the comprehensive examination by the end of the third year in the graduate chemistry program will be withdrawn from the program.

3. Two credits of graduate courses (made up of any combination of 0.5 credit and 0.25 credit courses)
4. CHEM 5801 (1.0 credit) and CHEM 5802 (1.0 credit)

Program Requirements (from M.Sc.)

Same as above, except that under exceptional circumstances only one seminar course will be required and credit for up to 1.0 credit of graduate courses may be given to reduce the requirement for graduate course credit from two to one. Students must complete their comprehensive examination within two years or be withdrawn from the program.

Orientation Examinations

Students coming from outside Canada or the United States must write orientation examinations at approximately the third-year university level. Each student will be informed of this requirement upon admission. The examinations will be given in the first week of the term in September and January. Students can choose from any three examination modules in: organic, physical, inorganic/analytical and biochemistry.

In examination areas where the student shows unsatisfactory performance or deficiency, the Graduate Supervisor will assign undergraduate-level remedial courses. To be eligible to continue in the graduate program, the student must achieve a minimum grade of A- in each remedial course.

Qualifying Year

Applicants who do not qualify for direct admission to the Master's program may be admitted to a qualifying-year program (see 2.3 under General Regulations).

5.0 credits must be completed within two consecutive fall and winter terms, including a 1.0 credit Research Project and Seminar course (CHEM 4908), and 4.0 credits in 0.5- and 0.25-credit courses, as assigned by the Graduate Supervisor. An average grade of A- over these five credits, with a minimum grade of B in each course must be presented to be considered for admission to the M.Sc. program.

Residence Requirements

For the M.Sc. degree:

- At least one year of full-time study

For the Ph.D. degree (from B.Sc.)

- At least three years of full-time study

For the Ph.D. degree (from M.Sc.)

- At least two years of full-time study

Thesis Advisory Committee

Within four months of initial registration in the M.Sc. or Ph.D. program, a Thesis Advisory Committee (TAC) will be appointed for each student. Committee membership will be formally approved by the departmental chairs and OCCI directors at Carleton and the University of Ottawa. The committee will consist of a minimum of three members, including the thesis supervisor, and where practicable, at least one member will be from the other campus of OCCI. Committee membership may include adjunct faculty members of the Faculty of Graduate and Postdoctoral Studies (FGPS) at the University of Ottawa or the Faculty of Graduate Studies and Research at Carleton.

Once a year, the student will prepare a formal Thesis Progress Report. The report is not to exceed four pages and will outline the problem, methodology used, results achieved, and aims for future research. The TAC will evaluate the report and indicate whether the student has made satisfactory progress. No meeting with the student will be required if progress is deemed by the TAC to be satisfactory. A meeting to discuss the student's progress may be held at any time at the request of either the student or the committee.

Guidelines for Completion of Doctoral Degree

Full-time students in the doctoral program normally will complete the degree requirements in three years. Part-time students will normally complete the degree requirements in six years.

Full-time students who enter the doctoral program directly from the B.Sc. program normally will complete the degree requirements in four and one-half years. Part-time students normally will complete the degree requirements in nine years.

Graduate Courses

University of Ottawa course numbers (in parentheses) follow the Carleton course number and credit information.

The complete list of courses available through the Ottawa-Carleton Chemistry Institute is provided in the Institute's section of this calendar. The following courses are offered by the Department of Chemistry.

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings or to determine the term of offering, consult **central.carleton.ca** . Students may also wish to consult the Institute's Web site at: **carleton.ca/occi**.

CHEM 5002 [0.25 credit] (CHM 8301)
Multinuclear Magnetic Resonance Spectroscopy
Principles of Nuclear Magnetic Resonance (NMR). NMR parameters to be studied are: chemical shift, spin-spin coupling, electric quadrupole coupling, spin-spin and spin-lattice relaxation rates. NMR and the periodic table. Dynamic NMR. Applications in chemistry and biochemistry. The Fourier Transform technique. Pulse sequences. Basic principles and applications of two-dimensional NMR.

CHEM 5003 [0.25 credit] (CHM 8325)
Solid State NMR Spectroscopy
Brief introduction to solid state NMR spectroscopy. Topics include dipolar coupling interactions, chemical shielding anisotropy, the quadrupolar interaction and averaging techniques such as magic angle spinning.

CHEM 5102 [0.25 credit] (CHM 8346)
Supercritical Fluids
Fundamental and practical aspects of the uses of supercritical fluids in the chemistry laboratory. Thermodynamic treatment of high pressure multicomponent phase equilibria, transport properties, solubilities, supercritical fluid extraction and chromatography for analytical purposes, reactions in supercritical fluids, equipment considerations, new developments.

CHEM 5108 [0.5 credit] (CHM 8302)
Surface Chemistry and Nanostructures
Surface structure, thermodynamics and kinetics, specifically regarding adsorption/desorption and high vacuum models. Nanoscale structures and their formation, reactivity and characterization. Thin films, carbon nanotubes, self-assembled monolayers and supramolecular aggregates.
Also offered at the undergraduate level, with different requirements, as CHEM 4103, for which additional credit is precluded.

CHEM 5206 [0.5 credit]
Physical Methods of Nanotechnology
An overview of methods used in nanotechnology. Principles of scanning probe techniques ranging from surface physics to biology. State of the art methods to create nanostructures for future applications in areas such as nanolithography, nanoelectronics, nano-optics, data storage and bio-analytical nanosystems.

CHEM 5304 [0.25 credit] (CHM 8349)
Free Radicals in Chemistry and Biology
Oxidative stress induced by free radicals plays a significant role in fatal and chronic diseases. The chemistry of bio-radicals will be described and related to pathobiological processes such as lipid peroxidation and atherosclerosis, protein nitration and cross linking, and DNA scission.

CHEM 5305 [0.25 credit] (CHM 8356)
Physical Methods in Inorganic Chemistry
Characterization of inorganic materials and coordination complexes by electronic absorption and electron paramagnetic spectroscopies, temperature and field dependent magnetic susceptibilities, and crystallography.

CHEM 5309 [0.25 credit] (CHM 8347)

Electron Transfer: Theory and Experiment

The development of classical, semi-classical and quantum mechanical electron transfer models is described. In addition, the course will examine recent experimental results and the application of electron transfer theory to biological systems.

CHEM 5406 [0.5 credit] (CHM 8164)

Organic Polymer Chemistry

Basic principles of industrial and synthetic polymers. Polymerization and polymer characterization. Topics to cover some important polymers with emphasis on synthesis, commodity plastics, engineering thermoplastics and specialty polymers. Also offered at the undergraduate level, as CHEM 4204, for which additional credit is precluded.
Prerequisites: CHEM 3201 and CHEM 3202 and/or CHEM 4203 or the equivalent. Students should have a basic knowledge of organic reaction mechanisms and stereochemistry.

CHEM 5407 [0.5 credit] (CHM 8134)

Spectroscopy for Organic Chemists

Analysis of proton NMR spectra. Fourier transform 13C NMR, strategies for structure elucidation, relaxation times, two-dimensional NMR. Aspects of mass spectrometry. Also offered at the undergraduate level, with different requirements, as CHEM 4202, for which additional credit is precluded.

CHEM 5408 [0.25 credit] (CHM 8350)

Introduction to Polymer Structure and Morphology

Flexible and rigid rod polymers: effect of molecular constitution and conformation; examples of polymer architectures and function; the amorphous state and glass transition; the crystalline state: typical crystal structures of polymers; polymorphism; crystallinity and long spacing. Thermal and solvent-induced crystallization; Lamellar and Spherulitic morphology.

CHEM 5409 [0.25 credit] (CHM 8351)

Morphology of Polymers and Composites

Liquid crystalline state of polymers; morphology of block copolymers and polymer blends; plasticizers and fillers for tailoring properties; depression of glass transition and melting temperature; phase stability of polymer composites; mechanical properties; self assembled systems; polymer nano-composites for electronic devices; common experimental techniques.

CHEM 5500 [0.25 credit] (CHM 8348)

Analytical Instrumentation

Principles of modern electronics, devices and instruments. Measurement of photonic and electrochemical signals. Conditioning of signals for feedback control and microcomputer interfacing. Computational data analysis techniques such as simplex optimization. Applications in chemical analysis include amperometric detector for capillary electrophoresis, and surface plasmon resonance immunosensor.

CHEM 5501 [0.25 credit] (CHM 8352)

Analytical Approach to Chemical Problems

Case study of analytical approach to various chemical problems in agricultural, biochemical, environmental, food processing, industrial, pharmaceutical and material sciences. Analytical methods include capillary electrophoresis, chemiluminescence, Fourier transform infrared spectroscopy, inductively coupled plasma emission spectroscopy, mass spectrometry, biochemical sensors, and fibre optics for remote sensing.

CHEM 5503 [0.5 credit] (CHM 8354)

Chemical Speciation in the Natural Environment

Metal-organic interactions in the aquatic environment. Evaluation of analytical techniques and their capability for quantitative determination of chemical species (as opposed to total element-determination) in the natural environment. Electrochemical techniques for determination of chemical speciation of nutrient and toxicant elements present in the natural environment.

CHEM 5705 [0.5 credit] (CHM 9109)

Ecotoxicology

Concepts of ecotoxicology, emphasizing whole ecosystem response to hazardous contaminants. Impacts of chronic and acute exposure of ecosystems to toxicants, the methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues. (Also listed as BIOL 6403 [BIO 9104].)
Prerequisite: BIOL 6402 (BIO 9101)/CHEM 5708 (CHM 8156).

CHEM 5708 [0.5 credit] (CHM 8156)

Principles of Toxicology

Basic theorems of toxicology with examples of current research problems. Toxic risk is defined as the product of intensive hazard and research problems. Each factor is assessed in scientific and social contexts and illustrated with many types of experimental material. (Also listed as BIOL 6402 [BIO 9101].)

CHEM 5709 [0.5 credit] (CHM 8157)

Chemical Toxicology

Introduction to modeling chemical hazards and exposures at the cellular level. The properties of toxic substances are compared to the responses of enzymatic systems. These interactions are defined as Quantitative Structure-Activity Relationships and used to interpret hazardous materials under regulations such as WHMIS. (Also listed as BIOL 5709 [BIO 8113].)
Prerequisite: BIOL 6402/CHEM 5708 (BIO 9101/CHM 8156).

CHEM 5801 [1.0 credit] (CHM 8256)

Seminar I

A seminar course in which students are required to present a seminar on a topic not related to their research program. In addition, students are required to attend the seminars of their fellow classmates and actively participate in the discussion following the seminar.

CHEM 5802 [1.0 credit] (CHM 8257S)

Seminar II

A seminar course in which students are required to present a seminar on their Ph.D. research topic in their research program. In addition, students are required to attend the seminars of their fellow classmates and actively participate in the discussion following the seminar.

CHEM 5805 [1.0 credit] (CHM 8167)

Seminar in Toxicology

This course introduces the seminar format and involves student, faculty and invited seminar speakers. The student will present a seminar and submit a report on a current topic in toxicology. (Also listed as BIOL 6405.)

CHEM 5900 [0.5 credit] (CHM 8158)

Directed Special Studies

Under unusual circumstances and with the recommendation of the research supervisor, it is possible to engage in directed study on a topic of particular value to the student. This may also be used for credit if there are insufficient course offerings in a particular field.

CHEM 5901 [0.25 credit] (CHM 8304)

Advanced Topics in Organic Chemistry

Topics of current interest in organic chemistry. The content of this course may vary from year to year.

CHEM 5902 [0.25 credit] (CHM 8302)

Advanced Topics in Inorganic Chemistry

Topics of current interest inorganic chemistry. The content of this course may vary from year to year.

CHEM 5903 [0.25 credit] (CHM 8309)

Advanced Topics in Physical/Theoretical Chemistry

Topics of current interest in physical/theoretical chemistry. The content of this course may vary from year to year.

CHEM 5904 [0.5 credit] (CHM 8104)

Scientific Data Processing and Evaluation

Optimization of scientific measurements, calibration, uni-variate and multi-variate analysis of scientific data, “intelligent” spreadsheets for scientific data processing and presentation, noise reduction using spreadsheets, correction for signal drifts; examples from chemistry, spectroscopy and other scientific disciplines.

Prerequisites: CHEM 4301, or permission from the Department. Also offered at the undergraduate level, with different requirements, as CHEM 4303 for which additional credit is precluded.

CHEM 5905 [0.5 credit] (CHM 5105)

Radiochemistry

A study of nuclear stability and decay; chemical studies of nuclear phenomena. Applications of radioactivity.

Also offered at the undergraduate level, with different requirements, as CHEM 4502 for which additional credit is precluded.

Prerequisite: permission of the Department.

CHEM 5909 (CHM 7999)

M.Sc. Thesis

CHEM 6909 (CHM 9999)

Ph.D. Thesis

Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology

Room 316 Nesbitt Building
Telephone: 613-520-2600 ext. 1211
Fax: 613-520-3539

The Program

Coordinator: W. Willmore
Department of Chemistry, Carleton University

Associate Coordinator: J. Blais
Department of Biology, University of Ottawa

Toxicology is the study of effects of toxic substances on living systems. These toxic substances can either be organic or inorganic, synthetic or natural materials. As a field of research, it crosses traditional disciplinary boundaries such as chemistry, biology, and the environmental sciences. Environmental toxicology further extends to aspects of chemical transport, fate, persistence and biological accumulation of toxic substances and their effects at the population and community levels. While individual researchers usually specialize in a particular area, toxicologists today must be able to appreciate significant research in other fields and therefore require an understanding of the basic principles of other disciplines. To meet this challenge the University of Ottawa and Carleton University offer a Collaborative Program in the supporting Institutes leading to a Master of Science degree or Ph.D. with Specialization in Chemical and Environmental Toxicology.

Supporting Institutes

The Collaborative Program is intended to augment the research and training that the student receives through one of the Institutes participating in the program. The primary degree granting units are:

1. The Ottawa-Carleton Institute of Biology, the joint graduate program of the departments of Biology at the University of Ottawa and Carleton University.
2. The Ottawa-Carleton Institute of Chemistry, the joint graduate program of the departments of Chemistry at the University of Ottawa and Carleton University.
3. The Ottawa-Carleton Geoscience Centre, the joint graduate program of the departments of Earth Sciences at the University of Ottawa and Carleton University.

The Collaborative Program is managed by a committee of representatives from the supporting Institutes. The committee is responsible for admitting students into the Collaborative Program and managing the Program. A coordinator and an associate coordinator administer the Program.

Members of the Collaborative Program

- J. T. Arnason, *Plant secondary chemicals, plant-insect Interactions*, Ottawa-Carleton Institute of Biology, University of Ottawa
- A.D.O. Bawagan, *Physical chemistry*, Ottawa-Carleton Chemistry Institute, Carleton University
- J. Blais, *Environmental toxicology*, Ottawa-Carleton Institute of Biology
- R. Burk, *Environmental analytical chemistry*, Ottawa-Carleton Chemistry Institute, Carleton University
- C.L. Chakrabarti, *Environmental toxicology*, Ottawa-Carleton Chemistry Institute, Carleton University (Distinguished Research Professor)

- C. Charest, *Plant eco-physiology*, Ottawa-Carleton Institute of Biology, University of Ottawa
- C.S. Findlay, *Modeling of toxicant transport*, Ottawa-Carleton Institute of Biology, University of Ottawa
- B.R. Hollebone, *Chemical toxicology*, Ottawa-Carleton Chemistry Institute, Carleton University
- S.W. Kennedy, *Environmental toxicology*, Ottawa-Carleton Institute of Biology, University of Ottawa (Adjunct)
- E.P.C. Lai, *Analytical chemistry*, Ottawa-Carleton Chemistry Institute, Carleton University
- I.B. Lambert, *Genetic toxicology, biochemistry*, Ottawa-Carleton Institute of Biology, Carleton University
- D.R.S. Lean, *NSERC Industrial Chair in Ecotoxicology*, Ottawa-Carleton Institute of Biology, University of Ottawa
- J.D. Miller, *Environmental toxicology of natural toxins*, Ottawa-Carleton Chemistry Institute, Carleton University
- P. Mineau, *Wildlife and Pesticide Toxicology*, Ottawa-Carleton Institute of Biology, Carleton University (Adjunct)
- R.E.J. Mitchel, *Radiation toxicology*, Ottawa-Carleton Institute of Biology, University of Ottawa (Adjunct)
- T.W. Moon, *Comparative physiology, biochemistry*, Ottawa-Carleton Institute of Biology, University of Ottawa
- B.J.R. Philogene, *Insect physiology, chemical ecology*, Ottawa-Carleton Institute of Biology, University of Ottawa
- F.R. Pick, *Aquatic sciences, microbial ecology*, Ottawa-Carleton Institute of Biology, University of Ottawa
- J.C. Scaiano, *Physical organic chemistry, photochemistry*, Ottawa-Carleton Chemistry Institute, University of Ottawa
- S.L. Scott, *Surface chemistry, kinetics*, Ottawa-Carleton Chemistry Institute, University of Ottawa
- K.B. Storey, *Comparative physiology, biochemistry, and molecular biology*, Ottawa-Carleton Institute of Biology and Ottawa-Carleton Chemistry Institute, Carleton University
- V.L. Trudeau,*Physiology and toxicology of reproduction*, Ottawa-Carleton Institute of Biology, University of Ottawa
- D.C. Wigfield,*Chemical toxicology*, Ottawa-Carleton Chemistry Institute, Carleton University
- C. Yauk, *Global genomic reponse of mammals to toxic chemicals encountered in the environment, with emphasis on reproductive toxicology and germline mutation*, Carleton University

Master's Program

Application to the Program

Applications should be directed to the primary participating unit that is the most appropriate to the student's research interests. Once sponsored and accepted into one of the Institutes, students must be sponsored into the Collaborative Program in Chemical and Environmental Toxicology by a faculty member involved in the program. This will normally be the student's supervisor.

Application forms and further information can be obtained by writing directly to any of the participating institutes or departments or to the program coordinator.

Admission Requirements

The requirements for admission to the Master's in the Collaborative Program in Chemical and Environmental Toxicology are as follows:

1. Prior admission to the master's program in one of the supporting Institutes participating in the program.
2. Completion of a relevant introductory course in toxicology, either:
    i. prior to admission to the Collaborative Program in Chemical and Environmental Toxicology, or
    ii. by taking one of the two introductory courses, 'Principles of Toxicology' (BIOL 6402/BIO 9101 - CHEM 5708/CHM 8156) or 'Ecotoxicology' (BIOL 6403/BIO 9104 - CHEM 5705/CHM 9109), while registered in the Collaborative Program.

The suitability of any introductory toxicology courses as a prerequisite for the Collaborative Program will be decided by the executive committee. It may be the student's responsibility to provide justification for an exemption.

3. A letter of recommendation from the participating faculty member of the collaborative program, which both recommends admission and indicates the willingness of the faculty member to supervise the candidate's research program in Chemical and/or Environmental Toxicology.

Degree Requirements

The student is responsible for fulfilling both the Institute and departmental requirements for the Master's degree, and the requirements of the Collaborative Program.

The minimum requirements of the Collaborative Program include completing at least three courses, which include:

(i) the introductory course (if required);

(ii) additional courses required by the Master's Program and approved by the Collaborative Program;

(iii) the 'Seminar in Toxicology' (BIOL 6405/BIO 9105 - CHEM 5805/CHM 8167).

In addition, the student's Institute Committee or Advisory Committee may direct the student to take or audit further courses to complement the student's background and research program.

Other courses offered in the programs of the primary academic units of biology or chemistry may be taken as options, with the permission of the student's supervisory committee, in addition to the basic requirements of Collaborative Program in Chemical and Environmental Toxicology.

Thesis Requirement

A research thesis on a topic in toxicology supervised by a faculty member of the Collaborative Program in Chemical and Environmental Toxicology.

Doctor of Philosophy

Application to the Program

Applications should be directed to the primary participating unit that is the most appropriate to the student's research interests. Once accepted and registered in one of the Institutes, students must be sponsored into the Collaborative Program in Chemical and Environmental Toxicology by a faculty member involved in the program; this will normally be the student's thesis supervisor. Application forms and further information can be obtained by writing directly to any of the participating Institutes or Departments or to the program Coordinator.

Admission Requirements

The requirements for admission to the Collaborative Program in Chemical and Environmental Toxicology at the Ph.D. level are as follows:

1. Prior admission to the Ph.D. program in one of the supporting Institutes participating in the program.

2. Completion of a relevant introductory course in toxicology, either

(i) prior to admission to the Collaborative Program in Chemical and Environmental toxicology;

or

(ii) by taking one of the two introductory courses, Principles of Toxicology (BIOL 6402/BIO 9101/CHEM 5708/CHM 8156/ TOXI 5708 [0.5 credit] (TOX 8156)) or Ecotoxicology BIOL 6403/BIO 9104/CHEM 5705/CHM 9109/ TOXI 6403 [0.5 credit] (TOX 9104), while registered in the Collaborative Program. If the student wishes to be exempted from any introductory toxicology courses, it is the student's responsibility to provide justification. The suitability of any introductory toxicology courses as a prerequisite for the Collaborative Program will be decided by the Program Committee of the Program.

3. A letter of recommendation from a participating faculty member who is a member of the Collaborative Program, which both recommends admission and indicates the willingness of the professor to supervise the candidate's research program in Chemical and Environmental Toxicology.

Degree Requirements

Students are responsible for fulfilling both the Institute and Departmental requirements for the Ph.D. degree, and the requirements of the Collaborative Program.

The requirements of the Collaborative Program are as follows:

1. All courses required by the primary program and approved by the Collaborative Program. If an introductory course (either Principles of Toxicology (BIOL 6402/BIO 9101/CHEM 5708/CHM 8156/ TOXI 5708 [0.5 credit] (TOX 8156) or Ecotoxicology (BIOL 6403/BIO 9104/CHEM 5705/CHM 9109/ TOXI 6403 [0.5 credit] (TOX 9104), or an approved alternative) has not been completed prior to admission, it must be included among these courses.

2. The Seminar in Toxicology (BIOL 6405/BIO 9105 - CHEM 5805/CHM 8167/TOXI 6405 [0.5 credit] (TOX 9105).*

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*If the student completed this course for the master's specialization, this requirement does not apply.

In addition, students may be directed by their Institute Committee or Advisory Committee to take or audit further courses to complement their background and research program. A list of approved electives is provided under 'Graduate Courses'.

Thesis Requirements

A research thesis on a topic in toxicology supervised by a faculty member of the Collaborative Program in Chemical and Environmental Toxicology.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Course numbers refer to University of Ottawa and Carleton University listings of the primary academic units. All courses are offered over one session and carry 3.0 credits at the University of Ottawa and the equivalent 0.5 credits at Carleton University.

University of Ottawa course numbers (in parentheses) follow the Carleton course number and credit information.

Other courses listed in the calendar under the primary academic units of psychology, biology, or chemistry may be taken, with the approval of the student's supervisory committee, as options in addition to the basic requirements of the degree in chemical and environmental toxicology.

BIOL 6402 [0.5 credit] (BIO 9101)
CHEM 5708 [0.5 credit] (CHM 8156)
TOXI 5708 [0.5 credit] (TOX 8156)

Principles of Toxicology
The basic theorems of toxicology with examples of current research problems. Concepts of exposure, hazard and risk assessment will be defined and illustrated with experimental material from some of the more dynamic areas of research.

BIOL 6403 [0.5 credit](BIO 9104)
CHEM 5705 [0.5 credit) (CHM 9109)
TOXI 6403 [0.5 credit] (TOX 9104)

Ecotoxicology
Selected topics and advances in ecotoxicology with emphasis on the biological effects of contaminants, such as the potential for biotic perturbance resulting from chronic and acute exposure of ecosystems to selected toxicants, the methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues.

BIOL 6405 [0.5 credit] (BIO 9105)
CHEM 5805 [0.5 credit] (CHM 8167)
TOXI 6405 [0.5 credit] (TOX 9105)

Seminar in Toxicology
Current topics in toxicology are highlighted, with presentations by students, faculty and invited speakers. Students will present a seminar and submit a report on the topic.

BIOL 5709 [0.5 credit] (BIO 8113)
CHEM 5709 [0.5 credit] (CHM 8157)
TOXI 5709 [0.5 credit] (TOX 8157)

Chemical Toxicology
Overview of empirical data relating to the toxicity of various classes of chemicals for test organisms, followed by study of toxicity at the cellular level, including studies of interactions between toxic substances and enzymatic systems.

Civil and Environmental Engineering

Mackenzie Building Room 3432
Telephone: 613-520-5784
Fax: 613-520-3951
Web site: cee.carleton.ca

The Department

Chair of the Department: A.O. Abd El Halim
Associate Chair, Graduate: S. Sivathayalan

In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations of this Calendar.

The Department of Civil and Environmental Engineering offers programs of study and research leading to the Master's and Ph.D. degrees in Civil Engineering and Environmental Engineering. The M.A.Sc. degree is awarded for a Master's degree by thesis and the M.Eng. degree is awarded for Master's degree by project and coursework. Civil Engineering degrees or offered through the Ottawa-Carleton Institute for Civil Engineering (www.ocice.ca), which is jointly administered by the Department of Civil and Environmental Engineering at Carleton University and the Department of Civil Engineering at the University of Ottawa. Environmental Engineering degrees are offered through the Ottawa-Carleton Institute for Environmental Engineering (www.ociene.ca), which is jointly administered by the Department of Civil and Environmental Engineering at Carleton University, the Department of Civil Engineering at the University of Ottawa, and the Department of Chemical Engineering at the University of Ottawa.

The admission and program requirements for the degrees offered by the Department are provided in the Calendar section for the Ottawa-Carleton Institute for Civil Engineering, and the Ottawa-Carleton Institute for Environmental Engineering.

The Department conducts research and has developed graduate programs in the following areas:

Environmental Engineering
The program in environmental engineering offers opportunities for research in a wide range of topics. Current graduate research in environmental engineering is primarily directed towards the following areas:

Air Pollution
Air quality issues in microenvironments, emissions from mobile sources, receptor modeling, transport and fate of vapours and particulates, dispersion modeling, indoor air quality, innovative treatment technologies for contaminated air streams.

Environmental Impact Assessment
Environmental impact assessment, risk assessment, identification and quantification of contaminant exposure pathways, uncertainty related to these processes, technical issues and the important contributions of environmental engineers to this complex multi-disciplinary process.

Management of Solid, Hazardous, and Radioactive Waste, and Pollution Prevention
Reduction of waste streams through improved manufacturing processes and waste diversion programs, minimization of the impact of long-term disposal of solid hazardous and radioactive wastes, waste disposal alternatives, landfill design and landfill leachate and gas management strategies.

Water and Wastewater Treatment
Study of existing and emerging water and wastewater treatment technologies, fate and persistence of pathogens and chemicals during treatment processes; fouling rates of the bioreactor membrane systems; removal of endocrine disrupters, pharmaceuticals and recalcitrant compounds; ultraviolet disinfection and advanced oxidation processes; and treatment and disposal of biosolids.

Water Resources Management, Groundwater Management and Contaminant Transport
Quantification and protection of existing water resources, hydrogeology, processes impacting contaminant migration, natural attenuation of contaminants in groundwater impacted by landfill leachate, petroleum hydrocarbons and chlorinated solvents, unsaturated and multiphase environments, site characterization and remediation.

Geotechnical Engineering

The graduate program in geotechnical engineering places an emphasis on both theoretical and applied problems related to soil and rock mechanics, soil dynamics and foundation engineering. These generally include the study of mechanical properties of soil and rock materials, stability of natural slopes and earth embankments, soil-foundation-structure interaction, and problems in foundation design and geomechanics. Broader programs in geotechnical engineering may be arranged by making use of courses offered in the Department of Geography at Carleton University and in the Department of Civil Engineering at the University of Ottawa. Graduate research in geotechnical engineering is primarily directed towards the following areas:

Bearing Capacity and Settlement
Problems related to design of bridge abutments and footings located on sloped granular fill, experimental and field studies.

Design and Analysis of Pipelines in Permafrost Regions
Development and use of advanced finite element techniques in the study of frost heave and its effect on the stresses and deformations of chilled gas pipelines buried in discontinuous permafrost.

Earth Retaining Structures
Experimental and analytical studies of anchored and braced excavations, flexible and rigid retaining walls, soil reinforcement, tunnels and conduits, field behaviour.

In-Situ Testing of Soils
The use of devices such as the pressuremeter, the screw plate test, the borehole shear device, and borehole dilatometer in the assessment of geotechnical properties of soils.

Mechanical Behaviour
Development of constitutive relations for soils and rock masses with yield and creep characteristics, advanced laboratory testing to assess stress path effects, numerical modeling and applications to foundation engineering.

Performance of Anchors
Theoretical and experimental analysis of deep and shallow anchors in soil, rock and concrete; group action; creep effects; prestress loss.

Reinforced Soil Systems
Characterization of the material properties and reinforcement-soil interaction problems comprising geogrids and geotextiles. Extensive facilities for tension, creep, pull-out and interface shear testing of geosynthetics are available.

Soil-Foundation Interaction
Elastic and consolidation effects of soil-foundation interaction; soil-frame interaction; contact stress measurement; performance of rigid and flexible foundations; buried pipelines.

Soil Dynamics and Liquefaction
Evaluation of the dynamic response of soils and liquefaction susceptibility. Laboratory and field measurements, Seismic slope stability and seismic forces on retaining walls.

Structural Engineering

The graduate program in structural engineering embodies a broad spectrum of topics involving material behaviour, structural mechanics and analysis, and the behaviour and design of buildings, bridges, and other types of structures, including liquid storage tanks, dams, and buried pipe systems, etc. These topics are in the following fields: computer applications in structural analysis; structural dynamics, seismic analysis, earthquake engineering; finite element analysis; structural systems and design optimization; behaviour and design of steel, concrete, composite, timber and masonry structures; construction economics; and bridge engineering. Graduate research in structural engineering is primarily directed towards the following areas:

Behaviour and Design of Steel, Concrete and Composite Structures
Analytical and experimental studies of structural members, substructures, and connections for buildings, bridges, and offshore structures. Development of the corresponding limit states design format design rules.

Bridge Engineering
Analysis and design of concrete and steel bridges against traffic, wind and earthquake loads; bridge planning and management; innovative numerical modeling and techniques for static and dynamic analysis of complex and long-span bridges; seismic reliability and performance assessment of bridges; seismic retrofit of bridge structures; 3D dynamic analysis of vehicle bridge deck interaction.

Computer Applications in Structural Design
Development of knowledge-based systems for the analysis, design, detailing, fabrication, and erection of buildings and bridges. Includes graphic interfaces, pre- and post-processing of frame analysis, load determination, and finite element analysis packages.

Fibre Reinforced Polymers (FRP)
Analysis and laboratory testing of structural members and systems reinforced, retrofitted or repaired with FRP. Development of design rules and code provisions for FRP reinforced/repaired structures. The research encompasses all aspects of FRP applications in structures, including bridges, buildings, pipes and tanks. Advanced numerical modeling and large scale testing are integral components of the research program.

Fire Safety Engineering

Fire Safety Engineering offers opportunities for research in various areas of fire safety including fire modeling, fire risk analysis, smoke movement, fire resistance and occupant response and evacuation.

Fire modeling
Modeling fire development in compartments. Characterization of design fires, heat release rate and production of toxic gases, development of fire related properties of materials.

Smoke movement
Development of two zone models for calculating movement of smoke through a building. Full-scale experiments to study impact of smoke control and smoke management techniques.

Fire risk analysis
Development of tools to calculate risk from fires to building occupants. Frequency evaluation and consequence of fire scenarios. Reliability and uncertainty analysis.

Fire resistance
Evaluating the impact of fire attack on building elements through computer modeling and full-scale testing. Development of probabilities of failure of building elements when subjected to realistic fires.

Occupant response and evacuation
Studies aimed at characterizing occupant characteristics, occupant response to emergencies, and occupant evacuation.

Masonry Behaviour and Design
Study of strength and serviceability issues by means of theoretical approaches, testing, and fieldwork.

Materials Durability
Research on the durability of concrete, masonry, FRP and reinforcing steel. Both laboratory experimentation and numerical techniques are used to develop predictive models for practical applications.

Monitoring and Evaluation of Structures
Behaviour and performance of bridges, buildings, and other structures; field and laboratory monitoring techniques; instrumentation; data processing and interpretation.

Numerical Modeling of Buildings and Bridges
Advanced analytical modeling of reinforced and prestressed concrete, steel, and composite concrete-steel buildings and bridges. Material and geometric non-linearities, bond-slip, the advent and propagation of cracks, tension stiffening, and shear-connectors behaviour are modeled to predict the full response of structures up to failure.

Seismic Analysis and Design
Seismic response of buildings; computer analyses of linear and nonlinear structural response; design of buildings for seismic forces; development of code provisions for seismic design; seismic behaviour of liquid storage tanks and dams; fluid structures interaction problems.

Timber Structures
Analysis, design, and performance evaluation of wood-structured systems and components; structural reliability.

Transportation Planning and Technology

The graduate program in transportation planning and technology deals with problems of policy, planning, economics, design, and operations in all modes of transportation. In the area of transportation planning, the focus is on the design of transport systems, including terminals, modeling and simulation, urban and regional studies, traffic engineering and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise, materials and pavement design. Graduate research in transportation is currently focused on the following areas:

Asphalt Concrete
Research on asphalt concrete, including compaction, rutting, thermal stresses, stripping, and reinforced asphalt systems. Novel compaction techniques and equipment, and in-situ asphalt testing equipment have been developed and patented.

Geometric Design
Modeling of roadway alignments; three-dimensional analysis; computer animation and simulation; vehicle characteristics and capabilities; effect of driver perception and behaviour.

Planning and Design Methodology
Development and application of models for optimization of transport supply; transportation system management.

Traffic Safety
Areas of high collision risk; reducing collision risk through better design and consideration of human factors; design consistency and relation to traffic safety.

Transport Policy
Assessment and impact analysis of national, regional, and urban transportation policies.

Transportation Terminals
Airport planning, air terminal design; bus, rail, subway terminal design, layout methods, pedestrian traffic.

Transportation Technology Development and Assessment
Modernization of passenger and freight rail services; soil properties; pavement design, multi-layered systems, low temperature cracking of pavements, thermo-mechanical modeling of fracture processes in pavements; highway design, energy and emissions.

Travel and Traffic Analysis
Behavioural theories of passenger travel, goods movement; empirical traffic studies.

Winter Maintenance
Controlling snow and ice accumulation on the roadway surface; criteria for quality of maintenance activities; anti-icing practice; environmental impacts; effect of deicing chemicals on pavements; new technologies and materials.

Departmental Facilities

The structures laboratory facility includes an 11 m x 27 m strong floor with a clear height of 11 m; a strong pit, measuring 3 m x 3.7 m x 6.6 m for geotechnical and highway material testing; a 400,000 lb. universal testing machine with auxiliary equipment for load and displacement control; numerous hydraulic actuators; test frames; specialized equipment for torsion and impact studies; and a wide selection of measurement devices (strain gauges, LVDTs, pressure transducers, load cells, thermocouples) and several data acquisition systems for testing structural materials and components. The concrete laboratory has facilities for the casting, curing, and testing of reinforced concrete members. Laboratory facilities in geotechnical engineering include both large scale and conventional tri-axial testing, consolidation testing, pore water pressure measurements, and model studies of contact stress measurements. The soil dynamics and highway materials laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate and bituminous mixtures, reinforced soil systems and geosynthetics.

The environmental engineering laboratories comprise a total space of 170 square meters with excellent facilities for bench scale chemical and biochemical experiments. Analytical equipment and sensors are available for air, water and soil sample testing and analyses. A laboratory specially equipped with four fume hoods is available for conducting research involving volatile and hazardous substances.

Computer-related equipment within the department comprises networks of SUN workstations and PC-based workstations and related peripherals. The computing centre of the University provides access to additional computing resources such as mainframe computers and multi-processor SUN workstations. A library of computer programs in structural, geotechnical, transportation, and environmental engineering provides a significant resource for advanced study and research.

Graduate Courses

Not all of the following courses are offered in a given year. Consult the Ottawa-Carleton Joint Institute for Civil Engineering (OCICE) www.ocice.ca and the Ottawa-Carleton Joint Institute for Environmental Engineering (OCIENE) www.ociene.ca websites for course and timetable information.

University of Ottawa course numbers (in parentheses) follow the Carleton course number and credit information.

All courses listed are one-term courses and may be offered in either fall or winter with the exception of projects and theses.

Civil Engineering Courses

CIVE 5101 [0.5 credit](CVG 7120)
Introductory Elasticity
Stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations, generalized Hooke's Law, bounds for elastic constant: strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems in rectangular Cartesian and curvilinear coordinates, Airy-Mitchell stress functions and Fourier solutions.

CIVE 5102 [0.5 credit] (CVG 7121)
Advanced Elasticity
Continuation of topics introduced in CIVE 5101. Complex variable solutions: torsional and thermal stresses; axially symmetric three-dimensional problems, Love's strain potential, Boussinesq-Galerkian stress functions; problems related to infinite and semi-infinite domains. Introduction to numerical methods of stress analysis, comparison of solutions.
Prerequisite: CIVE 5101 or permission of the Department.

CIVE 5103 [0.5 credit] (CVG 7122)
Finite Element Analysis 1
Stress-strain and strain-displacement relationships from elasticity. Plane stress and plane strain finite elements. Lagrange interpolation and Lagrange based element families. Theory of thin plates; overview of plate bending elements. Theory of shells; practical shell elements. Finite element methods formulation. Also offered at the undergraduate level, with different requirements, as CIVE 4201, for which additional credit is precluded.

CIVE 5104 [0.5 credit] (CVG 7123)
Earthquake Engineering
Advanced vibration analysis techniques; Rayleigh-Ritz procedure; subspace iteration; derived Ritz coordinates; proportional and non-proportional damping; introduction to seismology; earthquake response analysis via time and frequency domain; response spectrum approach;

multiple input excitations; design considerations and code requirements; other advanced topics in earthquake engineering.
Prerequisite: CIVE 5106 or permission of the Department.

CIVE 5105 [0.5 credit] (CVG 7124)

Finite Element Analysis 2

Variational and Galerkin formulations: assumed displacement, assumed stress and hybrid elements; plate bending: convergence, completeness and conformity, patch test, Kirchhoff and Mindlin plate theories, nonlinear elasticity and plasticity; geometric non-linearity, Eulerian and Lagrangian formulations; incremental and iterative schemes, finite elements in dynamics.
Prerequisite: CIVE 5103 or permission of the Department.

CIVE 5106 [0.5 credit] (CVG 7137)

Dynamics of Structures

Structural dynamics, single and multi-degree-of-freedom systems, formulation of equations of motion, methods of analytical mechanics, free and forced vibrations, normal mode analysis, numerical methods for the response analyses of single and multiple-degree-of-freedom systems.

CIVE 5200 [0.5 credit] (CVG 7138)

Masonry Behaviour and Design

Properties of masonry materials and assemblages. Behaviour and design of walls, columns and lintels. Treatment of specialized design and construction topics. Design of lowrise and highrise structures. Discussion of masonry problems. Emphasis on a practice-oriented approach.
Also offered at the undergraduate level, with different requirements, as CIVE 4403, for which additional credit is precluded.

CIVE 5203 [0.5 credit] (CVG 7125)

Theory of Structural Stability

Elastic and inelastic behaviour of beam-columns; elastic and inelastic buckling of frames; application of energy methods to buckling problems; lateral-torsional buckling of columns and beams; buckling of plates; local buckling of columns and beams.
Prerequisite: CIVE 5205 or equivalent.

CIVE 5204 [0.5 credit] (CVG 7126)

Advanced Steel Structures

Limit states design philosophy; material behaviour; tension members; plate buckling; torsion; lateral torsional buckling; beams, axially loaded columns and beam-column behaviour; brittle fracture and fatigue; frame stability and second order effects.

CIVE 5205 [0.5 credit] (CVG 7127)

Advanced Structural Analysis

Matrix structural analysis; force and displacement method of analysis for planar and space structures; symmetric and anti-symmetric structures; analysis of nonlinear structures: geometric and material nonlinearities; large displacement theory and iteration strategy.

CIVE 5206 [0.5 credit] (CVG 7128)

Prestressed Concrete

Prestressed concrete materials; working stress design for flexure; ultimate strength design for flexure, shear, and torsion; prestress losses; deflection and camber; slabs; indeterminate beams and frames; introduction to prestressed bridges and circular tanks.

CIVE 5208 [0.5 credit] (CVG 7130)

Advanced Reinforced Concrete

The research background, development, and limitations in current building code provisions for reinforced concrete; yield line theory of slabs; safety and limit state design; computer design of concrete structures.

CIVE 5209 [0.5 credit] (CVG 7100)

Geotechnical Case Studies

The critical study of case histories relating to current procedures of design and construction in geotechnical engineering. The importance of instrumentation and monitoring field behaviour will be stressed. In-situ testing.

CIVE 5300 [0.5 credit] (CVG 7101)

Advanced Soil Mechanics

Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils; failure and yield criteria.

CIVE 5303 [0.5 credit] (CVG 7103)

Pavements and Materials

An analysis of the interaction of materials, traffic, and climate in the planning, design construction, evaluation, maintenance, and rehabilitation of highway and airport pavements.

CIVE 5304 [0.5 credit] (CVG 7150)

Intercity Transportation

Current modal and intermodal issues, including energy. Framework and process of intercity transport planning and management. Recent trends and system development. Passenger and freight demand and service characteristics. Future prospects and possibilities.

CIVE 5305 [0.5 credit] (CVG 7151)

Traffic Engineering

Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed, and delay studies. Traffic stream characteristics and queuing theory. Capacity analysis of roads and intersections. Safety.

CIVE 5306 [0.5 credit] (CVG 7152)

Highway Materials

Materials characterization and strength evaluation of soils, stabilized soils, aggregates, and asphalt concrete. Effects of low temperatures and frost on materials behaviour.

CIVE 5307 [0.5 credit] (CVG 7153)

Urban Transportation

Urban transportation systems, planning and management. Urban development models, an introduction. Urban transportation policy.

CIVE 5308 [0.5 credit] (CVG 7154)

Highway Geometric Design

Principles of highway geometric design. Components of the highway system, their interrelationships, abilities, limitations, and their relations with the design elements. Safety and human factors, and their interaction with the highway elements. New and evolving concepts.

CIVE 5309 [0.5 credit] (CVG 7155)

Transportation Supply

Advanced treatment of transportation planning and management concepts and techniques: transport supply issues, capacity and costs, evaluation of system improvements and extensions, transportation and development, policy impact analysis.

CIVE 5401 [0.5 credit] (CVG 7156)

Transportation Economics

Transportation, economic analysis framework. Transport industry output. Carrier operations. Issue of resource utilization, measurement, economics, supply of infrastructure, pricing; subsidies, externalities. Transport policy in Canada.

CIVE 5402 [0.5 credit] (CVG 7159)

Transportation Terminals

Framework for passenger terminal planning and design. Theory: the transfer function and network modeling; pedestrian flow characteristics; capacity of corridors, stairs, escalators, and elevators; layout planning. Practical applications: air, rail, metro, bus, ferry, and multi-modal terminals.

CIVE 5403 [0.5 credit] (CVG 7158)

Airport Planning

Framework for airport planning and design. Aircraft characteristics; demand forecasting; airport site selection; noise, airside capacity; geometric design; the passenger terminal complex; cargo area; general aviation; ground transportation; land use planning.

CIVE 5500 [0.5 credit] (CVG 7104)

Earth Retaining Structures

Approaches to the theoretical and semi-empirical analysis of earth retaining structures. Review of the earth pressure theories. Analysis and design methods for rigid and flexible retaining walls, braced excavations, and tunnels. Instrumentation and performance studies.

CIVE 5501 [0.5 credit] (CVG 7105)

Foundation Engineering

Review of methods of estimating compression and shear strength of soils. Bearing capacity of shallow and deep foundations. Foundations in slopes. Pile groups. Use of in-situ testing for design purposes.

CIVE 5502 [0.5 credit] (CVG 7106)

In-Situ Geotechnique

Subsurface exploration program. Soil and rock sampling. Geo-physical methods. Mechanical and hydraulic properties of soil and rock. Determination of strength and deformability. Critical evaluation of vane, pressuremeter, screw plate, dilatometer, borehole shear and plate load tests. Pumping, recharge and packer tests. In-situ stress measurements.

CIVE 5503 [0.5 credit] (CVG 7107)

Numerical Methods in Geomechanics

Advanced theories of soil and rock behaviour. Plasticity models. Generalized failure criteria. Critical state and cap models. Dilatancy effects. Associative and non-associative flow rules. Hardening rules. Consolidation, visco-elasticity, creep behaviour. Finite element formulation. Iterative schemes. Time marching schemes. Solution of typical boundary value problems. Prerequisite: CIVE 5101, CIVE 5103, or permission of the Department.

CIVE 5504 [0.5 credit] (CVG 7108)

Seepage through Soils

Surface-subsurface water relations. Steady flow. Flownet techniques. Numerical techniques. Seepage analogy models. Anisotropic and layered soils. Water retaining structures. Safety against erosion and piping. Filter design. Steady and non-steady flow towards wells. Multiple well systems. Subsidence due to ground water pumping.
Precludes additional credit for ENVE 5301.

CIVE 5505 [0.5 credit] (CVG 7109)

Geotechnical Earthquake Engineering

Seismic hazards, earthquakes and ground motion, wave propagation, ground response analysis, soil properties for dynamic analysis: laboratory tests, in-situ tests, modulus and damping curves, liquefaction susceptibility, post liquefaction response, seismic effects on slope stability, retaining structures.
Precludes additional credit for CIVE 5801 (2001-2003).

CIVE 5600 [0.5 credit] (CVG 7131)

Project Management

Managing building development, design, and construction including interrelationships among owners, developers, financing sources, designers, contractors, and users; project manager

role and tasks; project objectives; feasibility analyses; budgets and financing; government regulations; environmental and social constraints; cost, time, and content quality controls and processes; human factors.

CIVE 5601 [0.5 credit] (CVG 7140)

Engineering, Statistics, and Probabilities

Review of basic concepts in statistics and probabilities. Bayes' Theorem. Distributions. Parameter estimation. Goodness-of-fit. Regression and correlation. OC curves. Monte Carlo simulation. ANOVA. Probability-based design criteria. System reliability. Selected applications in structures, transportation and geomechanics. Use of computer software. Emphasis on problem solving.

CIVE 5602 [0.5 credit] (CVG 7141)

Advanced Computer-Aided Design

Representation and processing of design constraints (such as building codes and other design rules); decision tables; constraint satisfaction. Automatic integrity and consistency maintenance of design databases; integrated CAD systems. Introduction to geometric modeling. Introduction to artificial intelligence. Also offered at the undergraduate level, with different requirements, as CIVE 4500, for which additional credit is precluded.

CIVE 5605 [0.5 credit] (CVG 7143)

Design of Steel Bridges

Basic features of steel bridges, design of slab-on-girder, box girder and truss bridges. Composite and non-composite design. Introduction to long span suspension and cable-stayed bridges. Discussion of relevant codes and specifications.

CIVE 5606 [0.5 credit] (CVG 7144)

Design of Concrete Bridges

Concrete and reinforcing steel properties, basic features of concrete bridges, design of superstructure in reinforced concrete slab, slab-on-girder and box girder bridges, an introduction to prestressed concrete bridges, design of bridge piers and abutments. In all cases the relevant provisions of Canadian bridge codes are discussed.

CIVE 5607 [0.5 credit] (CVG 7145)

Introduction to Bridge Design

Limit states design of highway bridges; methods of analysis, design and evaluation procedures of superstructure components; design codes; design loads and load factors; concrete deck design; load distributions; computer analysis; impact and dynamics; fatigue and brittle fracture; construction bracing; load capacity rating of existing bridges.

CIVE 5609 [0.5 credit] (CVG 7170)

Fundamentals of Fire Safety Engineering

The fire safety system, including social, economic and environmental issues; description of the fire safety regulatory system and the governing building codes and standards. This includes the global fire safety system in a facility and active fire protection systems; detection, suppression, smoke management. Precludes additional credit for CIVE 5707 (2001-2002).

CIVE 5610 [0.5 credit] (CVG 7171)

Fire Dynamics I

Fundamentals of combustion including material and energy balances, chemical thermodynamics, kinetics, premixed and diffusive burning. Advanced topics in the theory of combustion, flame propagation, efficiency of combustion, and the physico-chemical properties of combustible material.
Precludes additional credit for CIVE 5705 (2001-2003).

CIVE 5611 [0.5 credit] (CVG 7173)

People in Fires

Review of the work presented by the founders in the field of human behaviour in fire. Introduction to the basic notions of perception, cognition, information processing, decision-

making and problem solving. Behavioural concepts such as panic, commitment, affiliation, familiarity and role are discussed.
Precludes additional credit for CIVE 5708 (2001-2003).

CIVE 5612 [0.5 credit] (CVG 7174)

Fire Modeling

Fire modeling and its role in fire safety engineering. Review of the main modeling techniques used in Fire Safety Engineering: network, zone and Computational Fluid Dynamics (CFD).
Precludes additional credit for CIVE 5802 (2002-2003).

CIVE 5613 [0.5 credit] (CVG 7172)

Fire Dynamics II

Fire dynamics from ignition through heat transfer to growth and spread of fires and their suppression. Factors such as containment and its role in the dynamics of fires and explosions are covered.
Precludes additional credit for CIVE 5803 (2002-2003).
Prerequisite: CIVE 5610 Fire Dynamics I.

CIVE 5614 [0.5 credit] (CVG 7175)

Design for Fire Resistance

Behaviour of materials and structures at elevated temperatures; fire-resistance tests; fire-resistance ratings; building code requirements; real-world fires; assessing the fire resistance of steel, concrete and wood building assemblies.
Precludes additional credit for CIVE 5709 (2001-2003).

CIVE 5705-CIVE 5709 [0.5 credit]
(CVG 7300-7304)

Topics in Structures

Courses in special topics related to building design and construction, not covered by other graduate courses; details will be available some months prior to registration.

CIVE 5800-CIVE 5804 [0.5 credit]
(CVG 7305-7309)

Topics in Geotechnique

Courses in special topics in geotechnical engineering, not covered by other graduate courses; details will be available some months prior to registration.

CIVE 5805-CIVE 5809 [0.5 credit]
(CVG 7310 - 7314)

Topics in Transportation

Courses in special topics in transportation engineering, not covered by other graduate courses; details will be available some months prior to registration.

CIVE 5900 [1.5 credit]

Civil Engineering Project

Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis, or design project under the general supervision of a member of the Department.

CIVE 5906 [0.5 credit]
Directed Studies 1

CIVE 5907 [0.5 credit]
Directed Studies 2

CIVE 5909 [3.0 credits]
M.A.Sc. Thesis

CIVE 6909 [7.5 credits]
Ph.D. Thesis

Environmental Engineering Courses

ENVE 5001 [0.5 credit] (CVG 7160)
Biofilm Processes
Physical, chemical properties, microbial ecology of biofilms. Biofilm processes, attachment, growth, sloughing. Transport and interfacial transfer phenomena; mass transfer models, mass transport in biofilms, deposition of solids. Modeling biofilm systems; species models, mass balance equations, boundary conditions, moving boundary problem, analytical and numerical solutions.

ENVE 5101 [0.5 credit] (EVG 7101)
Air Pollution Control
Air quality and pollution; definitions, measurement and monitoring methods. Criteria pollutants, air toxics, particulate matter, secondary pollutants. Pollutant formation mechanisms. Major sources and control methods. Meteorology and principles of dispersion modeling. Principles of receptor modeling. Indoor air quality.
Also offered at the undergraduate level, with different requirements, as ENVE 4003, for which additional credit is precluded.

ENVE 5102 [0.5 credit] (CVG 7161)
Traffic-Related Air Pollution
Pollutant formation, emission characterization, emission control technology and emission modeling from motor vehicles. Dispersion and receptor modeling for conservative pollutants in urban microenvironments. Personal exposure and health risk assessment.

ENVE 5103 [0.5 credit] (CVG 7162)
Air Quality Modeling
Dispersion modeling for simple and complex sources and complex terrain. Physical and chemical transformations for pollutants in the atmosphere. Urban and regional air pollution modeling for reactive pollutants. The urban air shed model. Regional air quality modeling case studies.

ENVE 5104 [0.5 credit] (EVG 7104)
Indoor Air Quality
Indoor air quality as a component of the indoor environment; physical and chemical parameters for characterization. Types and sources of indoor air pollution, measurement techniques. Heating, ventilation, and air conditioning practices and issues. The human factor in identifying and controlling indoor air pollution.

ENVE 5201 [0.5 credit] (EVG 7201)
Geo-Environmental Engineering
Landfill design; hydrogeologic principles, water budget, landfill liners, geosynthetics, landfill covers, quality control and quality assurance, clay/leachate interaction, composite liner design and leachate collection systems. Landfill operation, maintenance and monitoring. Design of environmental control and containment systems; slurry walls, grout curtains, Case studies.
Also offered at the undergraduate level, with different requirements, as ENVE 4002, for which additional credit is precluded.

ENVE 5202 [0.5 credit] (EVG 7202)

Contaminant Fate Mechanisms

Mechanisms and chemical properties influencing the fate of toxic contaminants in environmental systems; liquid-gas partitioning and mass transfer, liquid-solid partitioning, abiotic and biotic degradation of toxics. Fate of toxics in wastewater collection and treatment systems. Treatment of residual streams; sludges, air streams. Mechanisms influencing the fate of toxic contaminants in aquatic and subsurface environments.

ENVE 5203 [0.5 credit] (EVG 5203)

Hazardous & Radioactive Wastes

Classification of hazardous, radioactive and mixed wastes, hazardous waste treatment processes, wastes generated in the nuclear fuel cycle, radioactive waste classification, radioactive waste treatment and management of residuals, engineered systems for long-term isolation and disposal, mixed waste management.

Also offered at the undergraduate level, with different requirements, as ENVE 4101, for which additional credit is precluded.

ENVE 5301 [0.5 credit] (EVG 7301)

Contaminant Hydrogeology

Theory of flow through porous media; soil characterization, soil properties, anisotropy, heterogeneity. Contaminant transport. Well hydraulics and pump tests. Introduction to numerical modeling; finite difference, finite elements, conceptual model, boundary conditions. Site remediation and remediation technologies.

Also offered at the undergraduate level, with different requirements, as ENVE 4006, for which additional credit is precluded.

ENVE 5302 [0.5 credit] (CVG 7163)

Case Studies in Hydrogeology

Development of a conceptual model; chemistry, geology and hydrology, site characterization, initial and boundary conditions. Application of industry-recognized computer codes to model flow and contaminant transport at a particular site. Evaluation of remedial alternatives at a site. Modeling of the more common remediation technologies (soil vapour extraction, air sparging, pump and treat, biodegradation).

ENVE 5303 [0.5 credit] (EVG 7303)

Multiphase Flow in Soils

Theory of unsaturated flow and multiphase flow; capillary pressure-saturation relationships, relative permeability relationships, wettability, hysteresis, fluid entrapment, residual saturations, governing equations for flow and transport. Richard's Equation for unsaturated flow. Modeling of multiphase flow.

ENVE 5401 [0.5 credit] (EVG 7401)

Env. Impacts of Major Projects

Regulatory framework and impact assessment requirements for project approvals, survey of the components of the EIA process and methodology, the review process, public participation in environmental decision-making, preparation of the EIA document, case studies of major engineering projects.

ENVE 5402 [0.5 credit] (EVG 7402)

Finite Elements in Field Problems

Use of Galerkin and Ritz finite element formulations to solve one and two dimensional field problems. Steady state and time-dependent phenomena involving heat transfer, fluid flow, diffusion, and dispersion with emphasis on practical applications. Basic knowledge of third year-level undergraduate engineering mathematics and physics required.

ENVE 5701 - ENVE 5705 [0.5 credit] (EVG 7301 - EVG 7305)

Topics in Environmental Engineering

Courses in special topics in environmental engineering not covered by other graduate courses; details will be available some months prior to registration.

ENVE 5800 [0.0 credit]
Master's Seminar
The series consists of presentations by graduate students or external speakers. Graduate students in the Environmental Engineering program are required to participate in these seminar series by attending all seminars and making at least one presentation during their graduate studies.

ENVE 5900 [1.0 credit]
Environmental Engineering Project
Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis, or design project under the general supervision of a member of the Department.

ENVE 5906 [0.5 credit] (EVG 6108)
Directed Studies 1
Precludes additional credit for CIVE 5906.

ENVE 5907 [0.5 credit] (EVG 6109)
Directed Studies 2
Precludes additional credit for CIVE 5907.

ENVE 5909 [3.0 credits]
Master's Thesis

ENVE 6909 [8.5 credits]
Ph.D. Thesis

ENVE 7800 [0.0 credit]
Ph.D. Seminar
The series consists of presentations by graduate students or external speakers. Graduate students in the Environmental Engineering program are required to participate in these seminar series by attending all seminars and making at least one presentation during their graduate studies.

Other Courses of Particular Interest

Mechanical and Aerospace Engineering
MECH 5104, MECH 5107, MECH 5201, MECH 5500, MECH 5601, MECH 5602, MECH 5608
Systems and Computer Engineering
SYSC 5001
Geography
GEOG 5302, GEOG 5303, GEOG 5304
Public Administration
PADM 5100, PADM 5101

Ottawa-Carleton Institute for Civil Engineering

Carleton University
Minto 3090, 1125 Colonel By Drive
Ottawa, ON, Canada K1S 5B6
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The Institute

Director of the Institute: D. Lau
Associate Director of the Institute: S. Vanapalli

Established in 1984, the Institute combines the research strengths and resources of the Departments of Civil and Environmental Engineering at Carleton University and the Department of Civil Engineering at the University of Ottawa. Programs leading to a Master of Engineering, a Master of Applied Science, and Ph.D. degrees are available through the Institute in a wide range of fields of civil engineering. Programs in transportation engineering, and in water resources engineering are centred at Carleton University and the University of Ottawa, respectively. Programs in environmental, geotechnical, and structural engineering are available at both universities. Graduate students may pursue their research on either university campus, depending upon the choice of program and supervisor. Registration will be at the university to which the student's supervisor is affiliated. Requests for admission may be sent to the Director of the Institute. Graduate studies in Environmental Engineering are also available through the Ottawa-Carleton Institute for Environmental Engineering, which offers graduate degrees in Environmental Engineering, Please refer to the Institute's section of this Calendar.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Civil and Environmental Engineering at Carleton University and (O) for the Department of Civil Engineering at the University of Ottawa.

- A.O. Abd El Halim, *Transportation management, airport design and planning, engineering economics, management pavements and materials* (C)
- K. Adamowski, *Hydrology, stochastic and statistical analyses (O-Adjunct)*
- A. Baskaran, *Building science (O - Adjunct)*
- O. Basu, *Water and wastewater treatment, bioreactor/membrane systems, process optimization (C)*
- J.J. Beaudoin, *Cement chemistry, strength of composite materials (O - Adjunct)*
- D. Bell, *Transportation engineering (C-Adjunct)*
- N. Benichou, *Fire safety (C-Adjunct)*
- P. Champagne, *Environmental engineering, passive treatment systems, acid mine drainage (AMD) mitigation, composting and solid waste management (C - Adjunct)*
- M.S. Cheung, *Finite element analysis, bridge engineering (C/O - Adjunct)*
- A. Cornett, *Water resources (O-Adjunct)*
- E. Contestabile, *Explosives (C-Adjunct)*
- B. Daneshfar, *Water resources (O-Adjunct)*
- R.L. Droste, *Environmental engineering, water and wastewater treatment (O)*
- S.M. Easa, *Highway geometry, reliability concept, planning (C - Adjunct)*
- E. Evgin, *Geotechnical engineering, ground plasticity, finite element analysis (O - Adjunct)*
- M. Fall, *Geotechnical engineering, hazards, mine base, GIS, finite element analysis (O)*

- G.Y. Felio, *Performance and rehabilitation of urban infrastructure, water distribution system (C - Adjunct)*
- L. Fernandes, *Environmental engineering, solid wastewater treatment, solid waste management, agricultural waste management (O)*
- S. Foo, *Seismic risk assessment and management (O - Adjunct)*
- N.J. Gardner, *Structures, reinforced concrete, earthquake engineering, construction loads (O)*
- V.K. Garga, *Geotechnical engineering, dam engineering, soil dynamics, (O-Adjunct)*
- A. Garib, *(C-Adjunct)*
- L. Graham, *Environmental engineering, mobile and stationary source emissions (C - Adjunct)*
- G.V. Hadjisophocleous, *Fire safety engineering, fire risk analysis, fire modeling (C)*
- A. Hakami, *Environmental engineering (C)*
- G.A. Hartley, *Structural analysis, finite elements, boundary elements (C)*
- Y. Hassan, *Transportation planning and technology, geometric design, traffic safety, winter maintenance (C)*
- N.M. Holtz, *Computer-aided structural engineering (C)*
- J.L. Humar, *Structures, earthquake engineering, computer-aided design (C)*
- B.O. Isgor, *Structures, computer-aided design, advanced composite materials, service life prediction (C)*
- W.F. Johnson, *Urban transportation planning and management (C-Adjunct)*
- D. Karman, *Environmental engineering, motor vehicle emissions and urban air quality (C)*
- K.J. Kennedy, *Environmental engineering, water and waste water treatment (O)*
- A.M. Khan, *Transportation, systems planning, engineering and management (C)*
- H.-A. Khoo, *Behaviour of pipelines, structural steel connections, constitutive relationships of material properties, composite materials (C)*
- G.L. Larose, *Wind engineering, industrial aerodynamics (O-Adjunct)*
- D.T. Lau, *Earthquake engineering, experimental and numerical methods for modeling of structures, performance assessment and field monitoring of bridges, liquid storage tank design (C)*
- K.T. Law, *Geotechnical engineering, landslide study, in-situ testing, geoseismic hazards (C)*
- B. Martin-Perez, *Structural engineering, durability of reinforced concrete structures (O*)
- J.R. Mehaffey, *Fire protection engineering (C - Adjunct)*
- E.H.H. Mohamed, *Transportation engineering, pavement and materials (C - Adjunct)*
- M.E. Mohareb, *Structural engineering, steel structures, finite elements, behaviour of oil and gas pipelines (O)*
- T. Murty, *Water resources (O-Adjunct)*
- R.M. Narbaitz, *Environmental engineering, water treatment (O)*
- N. Naumoski, *Earthquake engineering (O - Adjunct)*
- L. Newton, *Infrastructure engineering and management (C-Adjunct)*
- I. Nistor, *Hydraulic engineering, coastal engineering (O)*
- B. Ormeci, *Water and wastewater treatment, biosolids treatment and disposal, fate and survival of pathogens (C)*
- S. Ousmane, *Water resources, hydrology (O)*
- D. Palermo, *Reinforced concrete structures, finite element analysis of reinforced concrete, post-damage retrofitting of concrete structures (O)*
- W.J. Parker, *Environmental engineering, waste water treatment, fate of contaminants in engineered and natural systems, biological processes (C - Adjunct)*
- M. Partl, *Transportation engineering (C-Adjunct)*
- G.G. Patry, *Water resources and environmental engineering (O)*
- G. Proulx, *(C-Adjunct)*
- A.G. Razaqpur, *Concrete, finite elements, fibre reinforced polymers, bridges (C - Adjunct)*
- C. Rennie, *River and environmental hydraulics, sediment transport, fluid mechanics, water resources, environmental engineering (O)*
- M. Saatcioglu, *Building structures, reinforced concrete, earthquake analysis and design (O)*

- J.J. Salinas, *Building structures, wood engineering, structural reliability (C)*
- A. Sarkar, *Structures, probabilistic risk and reliability assessment, transport in random heterogeneous media: poroelasticity, structural acoustics (C)*
- P.H. Simms, *Geoenvironmental engineering, mine waste management, unsaturated soil mechanics (C)*
- S. Sivathayalan, *Geotechnical earthquake engineering, constitutive relations, liquefaction, laboratory testing, geofoams and geotextiles, static and dynamic behaviour of soils (C)*
- Y. Soucy, *Structural dynamics, modal testing and vibration-based health monitoring (C - Adjunct)*
- T.S. Sridhar, *Environmental impact assessment, wastewater treatment, hazardous and radioactive waste, pollution control (C-Adjunct)*
- H. Tanaka, *Wind engineering, structural dynamics (O-Adjunct)*
- D.R. Townsend, *Water resources, open-channel hydraulics, hydraulic structures (O)*
- S.K. Vanapalli, *Unsaturated soil mechanics, geotechnical engineering (O)*
- P.J. Van Geel, *Environmental engineering, groundwater flow and contaminant transport, waste disposal (C)*
- B. Wang, *Geotechnical engineering, rock mechanics, northern engineering, numerical analyses (O-Adjunct)*
- M.A. Warith, *Environmental engineering, solid waste management (O - Adjunct)*
- E. Zalok, *Fire safety (C)*

Master's Degree

Admission Requirements

The normal requirement for admission to a master's program is a bachelor's degree with at least high honours standing in civil engineering.

1. Graduates from engineering programs other than civil engineering, or Honours science programs with a mathematics content equivalent to the civil engineering program will have to take a minimum of four qualifying undergraduate civil engineering courses in their area of graduate specialty.

2. Graduates from other science programs will have to take all the core engineering undergraduate mathematics courses in addition to the requirements specified in (1) above.

The undergraduate courses required will be specified in the Certificate of Admission.

Undergraduate civil engineering courses will not be accepted towards a graduate degree. Graduate students may still be required to take undergraduate courses for credit to fulfil the admission requirements.

No more than one half of the program credit requirements or that stipulated in the regulations of the university in which the student is registered, whichever is less, can be transferred at admission. At least one half of the course work must be taken at the Institute.

Program Requirements

Study at the master's level can be pursued through either a thesis leading to a M.A.Sc., a project option leading to a M.Eng., or a course work option leading to a M.Eng. At Carleton University, 1.0 credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. At the University of Ottawa, 1.0 credit is one hour of instruction per week for one term.

Requirements are stated in terms of Carleton University credits.

Master's degree by thesis (M.A.Sc.):

- 3.0 course credits
- Thesis equivalent to 3.0 course credits
- Participation in the civil engineering seminar series
- Successful oral defence of the thesis

Master's degree by project (M.Eng.):

- 4.5 course credits
- A project equivalent to 1.5 course credits

Master's degree by course work (M.Eng.):

- 6.0 course credits

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in civil engineering. Students who have been admitted to a master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

Program Requirements

At Carleton University, 1.0 credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. At the University of Ottawa, 1.0 credit is one hour of instruction per week for one term.

Requirements are stated in terms of Carleton University credits.

- A minimum of 2.5 course credits
- Participation in the civil engineering seminar series
- Successful completion of written and oral comprehensive examinations in subject areas determined by the student's advisory committee
- Successful completion of a thesis proposal examination
- Thesis
- Successful oral defence of the thesis. The examination board for all theses will include an external examiner, and, when possible, professors from both departments.
- Subject to approval of his/her advisory committee, a Ph.D. student may take, or be required to take, courses in other disciplines.

Students who have been permitted to transfer into the Ph.D. program from a master's program without having completed the master's degree will require 5.0 course credits for the Ph.D. degree which include transfer of credits from the incomplete master's program.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. Graduate courses are listed below, grouped by subject area. Course descriptions may be found in the departmental section of the calendar concerned. All courses are of one term duration. The codes given in parentheses are those used by the University of Ottawa. Courses beginning with "CIVE" and 'ENVE' are offered at Carleton University and those beginning with "CIVJ" and 'ENVJ' are offered at the University of Ottawa. Not all courses listed are necessarily given during one academic year.

Geotechnical and Soils

- CIVE 5209 (CVG 7100) Geotechnical Case Studies
- CIVE 5300 (CVG 7101) Advanced Soil Mechanics
- CIVE 5500 (CVG 7104) Earth Retaining Structures
- CIVE 5501 (CVG 7105) Foundation Engineering
- CIVE 5502 (CVG 7106) In-situ Geotechnique
- CIVE 5503 (CVG 7107) Num. Methods in Geomechanics
- CIVE 5504 (CVG 7108) Seepage through Soils
- CIVE 5505 (CVG 7109) Geotechnical Earthquake Engineering
- CIVE 5800 - CIVE 5804 (CVG 7305 - CVG 7309) Topics in Geotechnique
- (CVG 5100) CIVJ 5000 Deep Foundations
- (CVG 5103) CIVJ 5003 Dam Engineering
- (CVG 5106) CIVJ 5006 Site Improvements
- (CVG 5108) CIVJ 5008 Pile Dynamics
- (CVG 5161) CIVJ 5106 Mechanics of Unsaturated Soils
- (CVG 5171) CIVJ 5102 Strength and Deformation Behaviour of Soil and Rock
- (CVG 5174) CIVJ 5104 Soil Plasticity
- (CVG 5175) CIVJ 5105 Numerical Methods for Geotechnical Engineers
- (CVG 5177) CIVJ 5107 Offshore Geotechnique
- (CVG 5178) CIVJ 5108 Ice Mechanics

Structural Engineering

- CIVE 5101 (CVG 7120) Introductory Elasticity
- CIVE 5102 (CVG 7121) Advanced Elasticity
- CIVE 5103 (CVG 7122) Finite Element Analysis 1
- CIVE 5104 (CVG 7123) Earthquake Engineering
- CIVE 5105 (CVG 7124) Finite Element Analysis 2
- CIVE 5106 (CVG 7137) Dynamics of Structures
- CIVE 5200 (CVG 7138) Masonry Behaviour and Design
- CIVE 5203 (CVG 7125) Theory of Structural Stability
- CIVE 5204 (CVG 7126) Advanced Steel Structures
- CIVE 5205 (CVG 7127) Advanced Structural Analysis
- CIVE 5206 (CVG 7128) Prestressed Concrete
- CIVE 5208 (CVG 7130) Advanced Reinforced Concrete
- CIVE 5600 (CVG 7131) Project Management
- CIVE 5601 (CVG 7140) Eng. Stats. and Probabilities
- CIVE 5602 (CVG 7141) Advanced Computer-Aided Design
- CIVE 5605 (CVG 7143) Design of Steel Bridges
- CIVE 5606 (CVG 7144) Design of Concrete Bridges
- CIVE 5607 (CVG 7145) Introduction to Bridge Design
- CIVE 5609 (CVG 7170) Fundamentals of Fire Safety Engineering
- CIVE 5610 (CVG 7171) Fire Dynamics I
- CIVE 5611 (CVG 7173) People in Fires
- CIVE 5612 (CVG 7174) Fire Modeling
- CIVE 5613 (CVG 7172) Fire Dynamics II
- CIVE 5614 (CVG 7175) Design for Fire Resistance

CIVE 5705 - CIVE 5709 (CVG 7300-7304) Topics in Structures
(CVG 5142) CIVJ 5201 Advanced Structural Dynamics
(CVG 5143) CIVJ 5202 Advanced Structural Steel Design
(CVG 5144) CIVJ 5300 Advanced Reinforced Concrete Design
(CVG 5145) CIVJ 5203 Theory of Elasticity
(CVG 5146) CIVJ 5302 Numerical Methods of Structural Analysis
(CVG 5147) CIVJ 5204 Theory of Plates and Shells
(CVG 5148) CIVJ 5305 Prestressed Concrete Design
(CVG 5149) CIVJ 5304 Structural Stability
(CVG 5150) CIVJ 5206 Advanced Concrete Technology
(CVG 5153) CIVJ 5209 Wind Engineering
(CVG 5155) CIVJ 5306 Earthquake Engineering
(CVG 5156) CIVJ 5301 Finite Element Methods I
(CVG 5157) CIVJ 5303 Finite Element Methods II
(CVG 5158) CIVJ 5307 Elements of Bridge Engineering
(CVG 5154) CIVJ 5308 Random Vibrations
(CVG 5159) CIVJ 5309 Long Span Structures

Transportation

CIVE 5303 (CVG 7103) Pavements and Materials
CIVE 5304 (CVG 7150) Intercity Transportation
CIVE 5305 (CVG 7151) Traffic Engineering
CIVE 5306 (CVG 7152) Highway Materials
CIVE 5307 (CVG 7153) Urban Transportation
CIVE 5308 (CVG 7154) Highway Geometric Design
CIVE 5309 (CVG 7155) Transportation Supply
CIVE 5401 (CVG 7156) Transportation Economics
CIVE 5402 (CVG 7159) Transportation Terminals
CIVE 5403 (CVG 7158) Airport Planning
CIVE 5805 - CIVE 5809
(CVG 7310 - 7314) Topics in Transportation

Water Resources

(CVG 5111) CIVJ 5501 Hydraulic Structures
(CVG 5112) CIVJ 5502 Numerical Modeling in Water Resources
(CVG 5119) CIVJ 5803 Computational Hydraulics
(CVG 5120) CIVJ 5506 Water Resources Systems
(CVG 5122) CIVJ 5508 Groundwater and Seepage
(CVG 5123) CIVJ 5509 Advanced Topics in Hydrology
(CVG 5124) CIVJ 5605 Coastal Engineering
(CVG 5125) CIVJ 5601 Statistical Methods in Hydrology
(CVG 5126) CIVJ 5602 Stochastic Hydrology
(CVG 5127) CIVJ 5603 Hydrologic Systems Analysis
(CVG 5128) CIVJ 5604 Water Resources Planning and Policy
(CVG 5131) CIVJ 5606 River Engineering
(CVG 5140) CIVJ 5607 Irrigation and Drainage
(CVG 5160) CIVJ 5503 Sediment Transport
(CVG 5162) CIVJ 5504 River Hydraulics

Environmental

ENVE 5001 (CVG 7160) Biofilm Processes
ENVE 5101 (EVG 7101) Air Pollution Control
ENVE 5102 (CVG 7161) Traffic-Related Air Pollution
ENVE 5103 (CVG 7162) Air Quality Modeling
ENVE 5104 (EVG 7104) Indoor Air Quality
ENVE 5201 (EVG 7201) Geo-Environmental Engineering
ENVE 5202 (EVG 7202) Contaminant Fate Mechanisms
ENVE 5203 (CVG 7164) Hazardous & Radioactive Wastes
ENVE 5301 (EVG 7301) Contaminant Hydrogeology

ENVE 5302 (CVG 7163) Case Studies in Hydrogeology
ENVE 5303 (EVG 7303) Multiphase Flow in Soils
ENVE 5401 (EVG 7401) Env. Impacts of Major Projects
ENVE 5402 (EVG 7402) Finite Elements in Field Problems
(CVG 5130) ENVJ 5900 Wastewater Treatment Process Design
(CVG 5132) ENVJ 5901 Unit Operations of Water Treatment
(CVG 5133) ENVJ 5906 Solid Waste Disposal
(CVG 5134) ENVJ 5907 Chemistry for Environmental Engineering
(CVG 5137) ENVJ 5905 Water and Wastewater Treatment Process Analysis
(CVG 5139) ENVJ 5700 Environmental Assessment of Civil Engineering Projects
(CVG 5138) ENVJ 5902 Advanced Water Treatment
(CVG 5179) ENVJ 5908 Anaerobic Digestion
(CVG 5180) ENVJ 5909 Biological Nutrient Removal
(CVG 5232) ENVJ 5911 Unit Operation of Water Treatment Lab [0.25 Credit]
(CVG 5238) ENVJ 5912 Advanced Water Treatment Processes Lab [0.25 credit]
(CVG 5331) ENVJ 5902 Sludge Utilization and Disposal

Directed Studies and Seminars

CIVE 5906 (CVG 6108) Directed Studies 1
CIVE 5907 (CVG 6109) Directed Studies 2
CIVJ 6000 - CIVJ 6020 (CVG 6300 - CVG 6320) Special Topics
ENVE 5701-ENVE 5705
(EVG 7301- EVG 7305) Topics in Environmental Engineering

Projects and Theses

CIVE 5900 Civil Engineering Project
CIVE 5909 M.A.Sc. Thesis
CIVE 6909 Ph.D. Thesis
(CVG 6000) Civil Engineering Report
(CVG 7999) M.A.Sc.Thesis
(CVG 9998) Comprehensive Exam (Ph.D.)
(CVG 9999) Ph.D. Thesis

Cognitive Science

Institute of Cognitive Science
Dunton Tower 2201
Telephone: 613-520-2368
Fax: 613-520-3985
carleton.ca/ics

The Institute

Director of the Institute: John Logan (Acting)
Director of the Cognitive Science Doctoral Program: John Logan (Acting)

The Institute of Cognitive Science offers a program of study and research leading to the degree of Doctor of Philosophy in Cognitive Science.

The Schools of Computer Science and Linguistics and Applied Language Studies, and the Departments of Psychology and Philosophy participate in the doctoral program.

Cognitive Science is an interdisciplinary approach to the study of human and artificial cognition. It integrates research from experimental psychology, theoretical and computational linguistics, artificial intelligence, philosophy of mind, and other related areas to address questions about learning, knowing, and thinking. Students in the Cognitive Science Ph.D. program are expected to draw on work from at least three of the contributing disciplines. The researchers who are involved in Carleton's program in Cognitive Science have strengths in areas such as consciousness, cognitive development, mathematical cognition, cognitive and computational modeling, human performance, applied cognition, syntax, semantics, pragmatics, philosophy of mind and language, intelligent information systems, knowledge representation, natural language understanding, swarm and collective intelligence, evolutionary computing, and some areas of experimental and computational neuroscience. The program also involves researchers from industry, government agencies, and other post-secondary institutions.

Members of the Cognitive Science Doctoral Program

- Ash Asudeh, *Syntax, semantics, linguistic applications of logic and proof theory, computational linguistics*
- R. Balasubramanian, *Cognitive neuroscience of perception/action (Ottawa Adjunct)*
- Leopoldo Bertossi, *Database systems, intelligent information systems, knowledge representation, logic programming*
- Andrew Brook, *Philosophy of mind and language, Kant, history of cognitive science*
- Murray Clarke, *Philosophy of mind (Concordia - Adjunct)*
- Eros Corazza, *Philosophy of mind, philosophy of language*
- Jean-Pierre Corriveau, *Natural language processing, time-constrained memory and text comprehension*
- Jim Davies, *Visual representations, analogy, case-based reasoning*
- Bruno Emond, *Artificial intelligence (NRC - Adjunct)*
- Babak Esfandiari, *Agent-based systems, symbolic machine learning, algorithms and heuristics*
- Leo Ferres, *Language engineering, mathematical models of dialogue and computational linguistics, dialogue architecture (Adjunct)*
- Chris Herdman, *Human attention and performance, aviation psychology, human factors*
- Marie-Odile Junker, *Cognitive semantics, aboriginal languages*
- Deepthi Kamawar, *Children's representational development*
- J.B. Kelly, *Sensory neuroscience and related issues in the biological foundations of cognition*

- Verner Knott, *Neurophysiology (Ottawa-Adjunct)*
- Ann Laubstein, *Speech-production models, phonology, speech recognition algorithms*
- Jo-Anne LeFevre, *Mathematical cognition, development of numeracy and literacy*
- John Logan, *Spoken language perception, non-native speech perception, word recognition*
- Mark MacLeod, *Philosophy of mind, metaphysics*
- Heidi Maibom, *Theory of mind, psychopathology, moral psychology, tacit knowledge, nature of theories, emotions*
- Stephen Marsh, *Distributed artificial intelligence (NRC - Adjunct)*
- Joel Martin, *Computational linguistics (Adjunct)*
- Stanislas Matwin, *Symbolic machine learning (0ttawa - Adjunct)*
- Kumiko Murasugi, *Syntax, morphology, Inuit languages, neurolinguistics*
- Franz Oppacher, *Genetic approaches to cognition, genetic algorithms, natural language and knowledge-based systems, machine learning, computational linguistics*
- Charles Reiss, *Linguistics, phonology, and phonetics (Concordia - Adjunct)*
- Maria Louisa Rivero, *Theoretical linguistics, syntax, diachronic and contrastive linguistics (Adjunct)*
- Monique Sénéchal, *Literacy acquisition and language development*
- Robert Stainton, *Philosophy of language and linguistics, pragmatics and semantics (University of Western Ontario - Adjunct)*
- Danijela Stojanovic, *Language acquisition, sentence processing, language impairment, syntax*
- Stanislas Szpakowicz, *Computational linguistics, knowledge acquisition, decision support systems (Ottawa - Adjunct)*
- Ida Toivonen, *Syntax and its relation to morphology and semantics*
- Andre Vellino, *Artificial intelligence (NRC Adjunct)*
- Robert West, *Cognitive modeling, human-computer interface*
- Tony White, *Principles of self-organization and information processing in biological systems*
- Helmut Zobl, *Knowledge representation, second-language acquisition and processing*

Admission Requirements

The requirements for admission into the Ph.D. program is a master's degree (or the equivalent) from one of the participating disciplines, an Honours degree from a participating discipline, a combined Honours degree (or the equivalent) from two of the participating disciplines or an Honours degree in cognitive science. Students with an Honours bachelor's degree from another discipline with a significant focus on cognition may also apply. An average of at least A- in courses in cognition is normally required.

Applicants with a master's degree are normally admitted to a 10.0-credit program while applicants with a bachelor's degree are admitted to a 15.0 credit program.

Students eligible for admission to the 10.0 -credit program but with deficiencies may be required to take additional courses. In some circumstances, these students will be admitted to the 15.0-credit program. Students admitted to the 15.0-credit program may have some requirements waived based on courses in cognition already completed.

Applicants whose first language is not English must demonstrate a fluent knowledge of English. This is normally satisfied by passing a TOEFL test with a score of 580 or better, or 70 on the CAEL. (See the Proficiency in English section in the General Regulations of this Calendar.)

To be admitted, a candidate must submit a description of his or her proposed area of thesis research and a member of the core faculty must indicate in writing that he or she is willing to supervise the student.

Program Requirements

Program requirements for the Ph.D. degree are outlined in the General Regulations section of this Calendar.

The requirements of the doctoral program are:

- CGSC 6001 Theory and Methods of Cognitive Science (0.5 credit)
- CGSC 6800 Proseminar (1.0 credit)
- CGSC 6905 Methodology Rotation (1.0 credit)
- CGSC 6909 Prospectus and Thesis (equivalent to 5.0 credits).
  The prospectus must be defended at an oral comprehensive examination on the subject-matter of the thesis. The thesis must also be defended at an oral examination.
- 2.5 credits in cognition from three different cognitive disciplines, including at least 0.5 credit in neuroscience if not already completed.
- Preparation in first year of a research paper for presentation at the Cognitive Science Ph.D Conference (see below). Usually prepared as an assignment for one of a student's graduate courses in cognition.
- Preparation in second year of a research paper for presentation at the Cognitive Science Ph.D. Conference (see below). Usually prepared as an assignment for one of a student's graduate courses in cognition.

Program to be selected in consultation with the Director of Graduate Studies.

Each year in April or May a student Cognitive Science Ph.D. Conference takes place. The Conference is devoted to new student research done during the year. All 1st and 2nd year students must present. Other students may present if they have new research and there is room on the program.

In addition, students in the 15.0-credit doctoral program in cognitive science must successfully complete:

- CGSC 5001, CGSC 5002, CGSC 5003 and CGSC 5004 (2.0 credits);
- A course in neuroscience (0.5 credit);
- 2.5 credits in courses on cognition offered by at least three different participating academic units.

Students with a strong background in any of these required areas may apply to be exempted.

Any student planning a dissertation with an applied cognitive emphasis is required to work for at least one term at a facility approved by the student's research supervisor and the Director of the Cognitive Science Program. Such a facility may include any institution, governmental laboratory, corporation, hospital or educational centre conducting research in the area of the student's specialization. Students should complete this work while registered in either the Methodology Rotation (CGSC 6905) or the Ph.D. Thesis (CGSC 6909).

Methodology Rotation

The methodology rotation consists of three parts. Students spend one term each in three laboratories or other research venues using three different methods for studying cognition (behavioural, linguistic-theoretic, computational, conceptual, neuroscientific).

The purpose of the methodology rotation is to give students sufficient background in three different approaches to cognition to allow the student to use work from these approaches in his or her own research.

Assignments will be as specified by each rotation supervisor. Each rotation will be graded separately by the supervisor, Passed with Distinction (PWD)/Satisfactory(S)/Unsatisfactory (U). The grade for the course will be the most frequent passing grade. In the event of a grade of U the student may repeat a rotation only once.

Prospectus, Comprehensive Examination, Thesis and Defense

When a student is ready to begin work on a thesis (dissertation), the Director of Graduate Studies appoints a dissertation committee which must have at least three members from two different approaches to cognition, including the advisor or co-advisors plus the Director of the Cognitive Science doctoral program ex officio. Preparation of the thesis has two stages. First the student prepares a prospectus, which is examined at a comprehensive examination on the subject matter of the thesis. Then the student prepares the thesis, which is defended at a public oral examination. Specifically:

Prospectus
: The prospectus must describe the proposed research and review the relevant literature in the field of the research. The research proposal must be sufficiently detailed to allow the examining committee to judge the likelihood of a successful dissertation ensuing from it. Preparation of the prospectus will follow the practices common in the advisor's area of research. The committee may add further requirements.

Comprehensive Examination
: The prospectus is examined orally by a board consisting of the members of the dissertation committee. The committee may add further examiners. The examination is a comprehensive examination of the thesis subject matter, to ensure that the student has a sound understanding of the context of his or her proposed research, and of appropriate methods, ethical considerations, and so on. The examining board will also consider the research that the student is proposing, which must be of sufficiently high quality and described in sufficient detail to allow the committee to judge whether, if completed successfully, it would be likely that the student would be awarded the degree. Should a student fail the comprehensive exam or his or her prospectus is unacceptable, the student may resubmit the prospectus and be reexamined once.

Thesis
: The completed thesis is examined orally by an examining board consisting at minimum of the dissertation committee, an examiner at arm's length to the project from within Carleton (the 'internal external') and an examiner from another university who is at arm's length to the student and the committee and who is a recognized expert in the area of the dissertation. All university regulations apply.

Residence Requirement

All Ph.D. candidates must be registered full-time in a minimum of six terms to satisfy the residence requirement (nine terms in the case of a 15.0- credit program).

Language Requirement

A second language is required when relevant to the student's program of research. Whether a second language is required and the level of proficiency expected is determined at the time of admission, based on the student's description of his or her proposed area of thesis research.

Guidelines for Completion of the Ph.D. Degree

Whether in the 15.0-credit or 10.0-credit program, students admitted in the same year enrol in CGSC 6800 Proseminar and CGSC 6001 Theories and Methods of Cognitive Science together in their first year. The research requirements in first and second year apply to all students. Students in the 10.0-credit program must make substantial progress on the methodology rotations in their second year, students in the 15.0-credit program in their third year. Students should allow two to three years to prepare their dissertation after all course work and the methodology rotations are complete. Thus, students in the 10.0-credit program can expect to take five years to finish, students in the 15.0-credit program, six years.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

Area Seminars

The purpose of an area seminar is to offer an advanced survey of one of the four participating disciplines.

CGSC 5001 [0.5 credit]
Cognition and Artificial Cognitive Systems
An introduction to the contribution of artificial intelligence and computer modeling of cognitive processes to cognitive science.

CGSC 5002 [0.5 credit]
Experimental Research in Cognition
An introduction to the contribution of experimental psychology and neuroscience to cognitive science.

CGSC 5003 [0.5 credit]
Cognition and Language
An introduction to the contribution of theoretical linguistics and linguistic research to cognitive science.

CGSC 5004 [0.5 credit]
Cognition and Conceptual Issues
An introduction to the contribution of philosophy of mind, philosophy of language, and other conceptual investigations to cognitive science.

CGSC 5900 [0.5 credit]
Special Topics in Cognitive Science
Seminar course on a topic of interest to students in Cognitive Science. The topics of this course will vary from year to year.
Lectures three hours per week.

Core Seminars

CGSC 6001 [0.5 credit]
Theory and Methods of Cognitive Science
Introduction to the main epistemological issues in cognitive science and to the diverse methods that researchers use to study cognition.

CGSC 6501 [0.5 credit]
Special Topics in Cognitive Science
Seminar course on a topic of interest to students in Cognitive Science. The topics of this course will vary from year to year.
Lectures three hours per week.

CGSC 6800 [1.0 credit]
Proseminar in Cognitive Science
An intensive survey of the central problems and issues of natural and artificial cognition and a brief examination of contemporary neuroscience. Compulsory in the first year of registration.

CGSC 6901 [0.5 credit]
Directed Studies in Cognitive Science I

CGSC 6902 [0.5 credit]
Directed Studies in Cognitive Science II

CGSC 6905 [1.0 credit]
Methodology Rotation
Students spend one term each in three laboratories or other research venues using three different methods for studying cognition (behavioural, linguistic-theoretic, computational, conceptual, neuroscientific). Assignments will be as specified by each rotation supervisor. Each rotation will be graded separately by the supervisor.

CGSC 6909
Ph.D. Thesis

Selection of Courses in Related Disciplines

Students may register in courses in the area of cognition offered by any of the participating departments, including Computer Science, Psychology, Linguistics, and Philosophy. Students may also register in courses offered by the University of Ottawa, subject to the General Regulations. Please note that not all courses are offered every year and some courses have limited enrolment. Students are advised to consult the Institute for scheduling details.

Courses with a four-letter prefix are Carleton University courses; those with a three-letter prefix are University of Ottawa courses.

Computer Science
COMP 5002 (CSI 5128)
COMP 5005 (CSI 5390)
COMP 5006 (CSI 5306)
COMP 5100 (CSI 5180)
COMP 5107 (CSI 5185)
COMP 5206 (CSI 5183)
COMP 5307 (CSI 5101)
COMP 5807 (CSI 5104)
COMP 6604 (CSI 7162)
COMP 6901 (CSI 7901)
COMP 5101 (CSI 5101) Formal Models of Computational Systems
CSI 5181 (COMP 5705) Artificial Intelligence in Software Engineering
CSI 5184 (COMP 5804) Logic Programming
CSI 5304 (COMP 5602) Knowledge Engineering
CSI 5386 (COMP 5505) Natural Language Processing
CSI 5387 (COMP 5706) Data Mining and Concept Learning
CSI 5388 (COMP 5801) Topics in Machine Learning
Psychology

Cognitive Psychology
PSYC 5106, PSYC 5300, PSYC 5301, PSYC 5407, PSYC 5700, PSYC 5703, PSYC 5704, PSYC 6601, PSYC 6602, PSYC 6603, PSYC 6700
Neuroscience
PSYC 5200, PSYC 6200, PSYC 6204, PSYC 6604

Linguistics and Applied Language Studies
LALS 5405, LALS 5601, LALS 5604, LALS 5701, LALS 5902, LALS 5907
LIN 5915 Phonology I
LIN 5917 Syntax I
LIN 5918 Semantics
LIN 6915 Phonology II
LIN 6917 Syntax II: Verb Syntax, Cases and Clitics
LIN 7901 Psycholinguistics I LIN 7951 Topics in Applied Linguistics

Philosophy
PHIL 5200, PHIL 5104, PHIL 5105, PHIL 5204, PHIL 5205, PHIL 5304, PHIL 5305

Comparative Literary Studies

201 St. Patrick's Building
Telephone: 613-520-2177
Fax: 613-520-2564
carleton.ca/icslac

The Institute

Director of the Institute: Paul Théberge

The Institute for Comparative Studies in Literature, Art, and Culture offers a program of graduate study leading to the Doctor of Philosophy in Comparative Literary Studies.

The purpose of the program in comparative literature is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies, such as the various literatures, philosophy, psychology, sociology, the visual arts, and history, comparatists view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory, and consideration of the less well known literatures of the world are some of the objects of comparative literary studies.

Doctor of Philosophy

Admission Requirements

Please note: admission to the Ph.D. program in Comparative Literary Studies has been suspended.

The normal requirement for admission to the Ph.D. program is an M.A. degree in literary studies (or in related subjects approved by Comparative Literary Studies) with at least high honours standing, normally with no grade below B-.

Each applicant must supply proof, by means of a research effort that has resulted in an extensive essay, that he or she is capable of producing a publishable paper. Such proof will be submitted at the time of application to the program.

Students admitted into the program with a master's degree earned in another department or institution will be required to make up any deficiencies in course work as required by Comparative Literary Studies.

In exceptional cases, an outstanding student who has completed the B.A. Honours degree and who meets the language requirements outlined below, may be admitted directly to the doctoral program. The program requirement for these students is normally 15.0 credits.

A student who transfers from the master's program in Comparative Literary Studies must meet the language requirements on admission and those listed under program requirements.

Applicants must demonstrate a capacity to work at the graduate level in at least two languages other than English. The two languages must be approved by Comparative Literary Studies. Normally, one of

the two languages must be French. Applicants must also be proficient in English. Students whose native tongue is not English may be required to pass the TOEFL test with a minimum score of 600.

Program Requirements

- 3.0 credits at the 6000-level to be chosen from courses offered by the discipline. (0.5 credit may be at the 5000-level.)
- 0.5 credit at either the 5000- or 6000-level in the social sciences to be approved by the graduate adviser.
- 0.5 credit at the 6000-level outside the area of specialization of the student to be chosen from the courses offered by the discipline.
- A 1.0-credit comprehensive examination, both oral and written parts to be taken prior to the approval of the Ph.D. thesis prospectus.
- A thesis equivalent to 5.0 credits.

Comprehensive Examinations

The comprehensive examination is designed to test the candidate's competence both in comparative literary theory and in the chosen area of specialization. The comprehensive examination is to be completed after course requirements for the Ph.D. have been completed.

Students admitted to the program who have a master's degree in the area of literary studies (or in related subjects approved by Comparative Literary Studies) must normally satisfy the comprehensive examination requirement by the end of the third term in the program.

Those students either admitted directly into the program from the B.A. Honours program or transferring from the master's to the doctoral program must satisfy the comprehensive examination requirement no later than the end of the third year or ninth term of study.

Normally the comprehensive examination must be completed no later than four years or twelve terms after the initial part-time registration following the M.A. (or equivalent).

Students admitted directly from the B.A. Honours program or transferring from the master's to the doctoral program must earn 15.0 credits beyond the B.A. honours and most of the master's program in Comparative Literary Studies, with the exception of the comprehensive examination which may be replaced by course work equivalent to 1.0 credit.

Thesis

The Institute appoints a thesis supervisor and an advisory committee for each doctoral candidate. A minimum of two faculty members will constitute the thesis advisory committee and one of the two members will be from outside Comparative Literary Studies. Both the thesis supervisor and the advisory committee determine when a thesis proposal may proceed to the graduate committee of Comparative Literary Studies for approval.

Specialization Requirements

Each candidate must demonstrate competence in an area of specialization chosen from the following list: postmodernism, post-colonialism, feminism, gender and literature, the Hebrew Bible, intellectual history, Latin American literature, literary history, literary theory, literature and historical studies, literature and linguistics, literature and religious studies, literature of the Francophonie, literature written in English, language and social sciences, medieval and early renaissance Hispanic literature, modern theatre and dramatic literature, nineteenth- and twentieth-century French literature,

nineteenth- and twentieth-century German literature, nineteenth- and twentieth-century Italian literature.

Candidates who enter the Ph.D. program with a master's degree in a special area or discipline, and who wish to either continue in that area or discipline or choose another specialization in their doctoral program, will be tested in their chosen area in the specialization portion of the comprehensive examination.

Candidates admitted directly from a B.A. Honours program or transferring from the master's to the doctoral program will be required to take the equivalent of 3.0 credits in the area of specialization, and will be tested in this area in the specialization portion of their comprehensive examination.

Language Requirement

Doctoral students must acquire a reading knowledge in a third language, to be approved by Comparative Literary Studies, before beginning the comprehensive examination. Candidates must successfully complete either 0.5 credit at the master's level in the literature(s) of that language (extra-to-the-degree) or a reading proficiency test administered by Comparative Literary Studies.

Academic Standing

All candidates are required to maintain a GPA of B-.

Of the 10.0 credits required beyond the master's level, no more than 1.0 credit may be at the 5000-level.

Guidelines for Completion of Doctoral Degree

Students admitted with a B.A. (Honours) degree and registered full-time must normally complete the comprehensive examination requirement by the end of the third year or ninth term of full-time study. The thesis proposal must normally be presented after three and one-half years or ten terms of study.

Students admitted with a master's degree and registered full-time must normally complete the comprehensive examination requirement by the end of the third term of study. The thesis proposal must normally be presented no later than the fourth term of study.

Students admitted with a B.A. (Honours) degree and registered part-time must normally complete the comprehensive examination requirement by the end of the ninth year or after twenty-seven terms of study after their initial part-time registration. The thesis proposal must normally be presented no later than ten years or thirty terms of study following the initial part-time registration.

Students admitted with a master's degree and registered part-time must normally complete the comprehensive examination requirement by the end of the fourth year or after twelve terms of study after the initial part-time registration. The thesis proposal must normally be presented no later than five years or fifteen terms of study after the initial part-time registration.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

A prerequisite for all graduate-level courses is appropriate linguistic ability and approval of Comparative Literary Studies.

A student will not receive credit for both a 0.5 credit course and a 1.0 credit course which bears the same topic title.

CLST 6001 [0.5 credit]
Doctoral Seminar I: Literature and Other Discourses
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6002 [0.5 credit]
Doctoral Seminar II: Literature and Other Discourses
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6003 [0.5 credit]
Modernism
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6004 [0.5 credit]
Postmodernism
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6100 [0.5 credit]
Narrative and Non-Fiction
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6200 [0.5 credit]
Literary History
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6205 [0.5 credit]
Hermeneutics and Aesthetic Experiences of Literature
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6300 [0.5 credit]
Text Theory
Topic may vary from year to year. (Also listed as ENGL 5000.)
Prerequisite: permission of Comparative Literary Studies.

CLST 6305 [0.5 credit]
Translation Studies: Theory and Practice
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6400 [0.5 credit]
Gender and Literature
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6500 [0.5 credit]
Rhetoric and Literature
Topic may vary from year to year.
Prerequisite: permission of Comparative Literary Studies.

CLST 6505 [0.5 credit]
Iconicity and Medieval and Early Renaissance Literature
Topic may vary from year to year.
Prerequisite: permission of Comparative Literary Studies.

CLST 6600 [0.5 credit]
Sign, Language and Society
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6803 [0.5 credit]
Seminar in Comparative Literary Studies
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6804 [0.5 credit]
Seminar in Comparative Literary Studies
Topic may vary from year to year. Students should consult Comparative Literary Studies regarding the topic offered.

CLST 6903 [1.0 credit]
Comprehensives

CLST 6909
Ph.D. Thesis

Computer Science

Herzberg Building 5302
Telephone: 613-520-4333
Fax: 613-520-4334
scs.carleton.ca

The School

Director of the School: Douglas Howe
Supervisor of Graduate Studies: Jean-Pierre Corriveau

The School of Computer Science offers degrees leading to a Master of Computer Science or a Ph.D. in Computer Science through the Ottawa-Carleton Institute for Computer Science. The Institute is jointly administered by the School and the School of Information Technology and Engineering at the University of Ottawa. For further information, including admission and program requirements, see the Institute's section of this Calendar.

A program leading to the M.Sc. in Information and Systems Science is offered in cooperation with the School of Mathematics and Statistics and the Department of Systems and Computer Engineering. For further information see the Information and Systems Science section in this Calendar.

A program leading to the M.A.Sc. in Biomedical Engineering is offered in cooperation with the Department of Mechanical and Aerospace Engineering, the Department of Systems and Computer Engineering and the Department of Physics. For further information, see the Biomedical Engineering section in this Calendar.

The research expertise of the School's faculty is concentrated in the following areas:

Algorithms and Complexity
: Computational geometry and algebra, combinatorial optimization, distributed and parallel algorithms, multi-dimensional data structures, stochastic automata, graph theory, partial orders, randomized algorithms, routing in networks, network algorithms, online algorithms, network security, authentication, cryptography.

Knowledge-Based and Intelligent Systems
: Evolutionary computation (genetic algorithms, genetic programming, artificial life), logic programming, knowledge representation, natural language understanding and cognitive science, learning systems, robotics, pattern recognition, swarm and collective intelligence.

Software Engineering
: Automated reasoning, formal methods in software engineering, Web technologies, electronic commerce, databases, telecommunications software and distributed systems, mobile and wireless networks, satellite communications, software and agent patterns, object-oriented systems and modeling, scenario modeling, generative modeling, programming and quality engineering.

Parallel and Distributed Systems
: Communication networks, interconnection networks. Parallel processing, coarse-grained parallel computing, parallel geometric computing, parallel data mining, parallel biochemistry applications, performance evaluation, mobile agents, peer-to-peer computing.

Information Systems Security and Applied Cryptography
: Authentication, software security, network security, applied cryptography, software protection, security infrastructures, operating system security, intrusion detection.

In addition to its undergraduate laboratories, the School maintains a number of state-of-the-art research laboratories all integrated via a department and campus area network.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at **central.carleton.ca**

Course Designation System

The complete list of courses available through the Ottawa-Carleton Institute for Computer Science is provided in the Institute's section of this Calendar. The following courses are offered by the School of Computer Science.

COMP 5001 [0.5 credit] (CSI 5113)
Foundations of Programming Languages
Advanced study of programming paradigms from a practical perspective. Paradigms may include functional, imperative, concurrent, distributed, generative, aspect- and object-oriented, and logic programming. Emphasis on underlying principles. Topics may include: types, modules, inheritance, semantics, continuations, abstraction and reflection.
Prerequisite: COMP 3007 or the equivalent.

COMP 5002 [0.5 credit] (CSI 5128)
Swarm Intelligence
Collective computation, collective action, and principles of self-organization in social agent systems. Algorithms for combinatorial optimization problems, division of labour, task allocation, task switching, and task sequencing with applications in security, routing, wireless and ad hoc networks and distributed manufacturing.

COMP 5003 [0.5 credit] (CSI 5308)
Principles of Distributed Computing
Formal models; semantics of distributed computations; theoretical issues in design of distributed algorithms; computational complexity; reducibility and equivalence of distributed problems. Related topics: systolic systems and computations, oligarchical systems and control mechanisms.

COMP 5005 [0.5 credit] (CSI 5390)
Learning Systems for Random Environments
Computerized adaptive learning for random environments and its applications. Topics include a mathematical review, learning automata which are deterministic/stochastic, with fixed/variable structures, of continuous/discretized design, with ergodic/absorbing properties and of estimator families.
Prerequisite: MATH 2600 or MATH 3500, or SYSC 5503 or equivalent.

COMP 5008 [0.5 credit] (CSI 5164)
Computational Geometry
Study of design and analysis of algorithms to solve geometric problems; emphasis on applications such as robotics, graphics, and pattern recognition. Topics include: visibility problems, hidden line and surface removal, path planning amidst obstacles, convex hulls, polygon triangulation, point location.
Prerequisite: COMP 3804 or equivalent.

COMP 5009 [0.5 credit] (CSI 5141)
Associative Data Structures and Advanced Databases
Concepts and advanced topics in the design, implementation and analysis of physical storage schemes with emphasis on their application to specialized database and information retrieval systems. Topics include: associative searching techniques; multidimensional storage

structures; algorithms for spatial data modeling; formulation and optimization of database queries.
Prerequisites: COMP 3005 and COMP 3804, or the equivalent.

COMP 5100 [0.5 credit] (CSI 5180)
Topics in Artificial Intelligence
Areas in knowledge-based systems including recent approaches to machine learning and data mining, inference methods, knowledge-based and fuzzy systems, heuristic search, and natural language processing.
Precludes additional credit for COMP 4106.
Prerequisite: COMP 3007 or equivalent.

COMP 5101 [0.5 credit] (CSI 5311)
Distributed Databases and Transaction Processing Systems
Principles in the design and implementation of distributed databases and distributed transaction processing systems. Topics include: distributed computing concepts, computing networks, distributed and multi-database system architectures and models, atomicity, synchronization and distributed concurrency control algorithms, data replication, recovery techniques, reliability in distributed databases.
Precludes additional credit for COMP 4101.
Prerequisites: COMP 3005, COMP 4001, and COMP 4003 or equivalent.

COMP 5102 [0.5 credit] (CSI 5312)
Distributed Operating Systems
Design issues of advanced multiprocessor distributed operating systems: multiprocessor system architectures; process and object models; synchronization and message passing primitives; memory architectures and management; distributed file systems; protection and security; distributed concurrency control; deadlock; recovery; remote tasking; dynamic reconfiguration; performance measurement, modeling, and system tuning.
Prerequisite: COMP 3000 and COMP 3203 or equivalent.

COMP 5104 [0.5 credit] (CSI 5314)
Object-Oriented Software Development
Issues in modeling and verifying quality and variability in object-oriented systems. Testable models in model-driven and test-driven approaches. System family engineering. Functional conformance: scenario modeling and verification, design by contract. Conformance to non functional requirements: goals, forces and tradeoffs, metrics.
Prerequisite: COMP 2004 or equivalent.

COMP 5106 [0.5 credit] (CSI 5123)
Languages for Parallel Computing
Survey of major language paradigms for parallel computing: sequential imperative, parallel imperative, logic, functional (reduction and dataflow), object and message-passing based languages; communicating sequential processes; and massive data-level parallelism. Topics include detection, determinism, data partitioning, task scheduling, task granularity, synchronization methods, resource management, and debugging.
Prerequisite: COMP 5001.

COMP 5107 [0.5 credit] (CSI 5185)
Statistical and Syntactic Pattern Recognition
Topics include a mathematical review, Bayes decision theory, maximum likelihood and Bayesian learning for parametric pattern recognition, non-parametric methods including nearest neighbor and linear discriminants. Syntactic recognition of strings, substrings, subsequences and tree structures. Applications include speech, shape and character recognition.
Prerequisite: permission of the School.

COMP 5203 [0.5 credit] (CSI 5173)

Data Networks

Mathematical and practical aspects of design and analysis of communication networks. Topics include: basic concepts, layering, delay models, multi-access communication, queuing theory, routing, fault-tolerance, and advanced topics on high-speed networks, ATM, mobile wireless networks, and optical networks.
Prerequisite: COMP 4804 or permission of the School.

COMP 5204 [0.5 credit] (CSI 5124)

Computational Aspects of Geographic Information Systems

Computational perspective of geographic information systems (GIS). Data representations and their operations on raster and vector devices: e.g., quadtrees, grid files, digital elevation models, triangular irregular network models. Analysis and design of efficient algorithms for solving GIS problems: visibility queries, point location, facility location.
Prerequisite: COMP 3804 or the equivalent.

COMP 5206 [0.5 credit] (CSI 5183)

Evolutionary Computation and Artificial Life

Study of algorithms based upon biological theories of evolution, applications to machine learning and optimization problems. Possible topics: Genetic Algorithms, Classifier Systems, and Genetic Programming. Recent work in the fields of Artificial Life (swarm intelligence, distributed agents, behavior-based AI) and of connectionism.
Prerequisites: COMP 3007 or the equivalent.
Precludes: COMP 4107 or the equivalent.

COMP 5305 [0.5 credit] (CSI 5129)

Advanced Database Systems

In-depth study on developments in database systems shaping the future of information systems, including complex object, object-oriented, object-relational, and semi-structured databases. Data structures, query languages, implementation and applications.
Prerequisites: COMP 3005 or the equivalent.

COMP 5306 [0.5 credit] (CSI 5100)

Data Integration

Materialized and virtual approaches to integration of heterogeneous and independent data sources. Emphasis on data models, architectures, logic-based techniques for query processing, metadata and consistency management, the role of XML and ontologies in data integration; connections to schema mapping, data exchange, and P2P systems.
Prerequisites: COMP 3005 or equivalent.
Precludes additional credit for COMP 5900 section 'G' offered fall term 2002 and 2004.

COMP 5307 [0.5 credit] (CSI 5101)

Knowledge Representation

KR is concerned with representing knowledge and using it in computers. Emphasis on logic-based languages for KR, and automated reasoning techniques and systems; important applications of this traditional area of AI to ontologies and semantic web.
Prerequisites: COMP 1805 and COMP 3005, or equivalents.
Precludes additional credit for COMP 5900 section 'X' offered in winter term from 2003-2004 to 2005-2006 inclusive.

COMP 5308 [0.5 credit] (CSI 5102)

Topics in Medical Computing

Introductory course on data structures, algorithms, techniques, and software development related to medical computing (in particular spatial modeling). Topics may include: computational geometry algorithms for cancer treatment, medical imaging, spatial data compression algorithms, dynamic programming for DNA analysis.
Prerequisite: COMP 3804 or equivalent. Precludes additional credit for COMP 5900 section 'Y' offered 2001-2002 to 2005-2006 inclusive.

COMP 5400 [0.5 credit] (CSI 5310)

Software Patterns

Current developments in software patterns, three-part rules expressing relations between software contexts, problems and solutions. Pattern categories discussed include architectural, design, analysis, refactoring, general-purpose, anti-patterns, and idioms. Students are required to apply existing patterns and to develop and defend new ones.
Prerequisites: COMP 3004 or equivalent.

COMP 5401 [0.5 credit] (CSI 5389)

Electronic Commerce Technologies

Introduction to business models and technologies. Search engines. Cryptography. Web services and agents. Secure electronic transactions. Value added e-commerce technologies. Advanced research questions.
Prerequisites: COMP 2005 and COMP 4104, or CSI 4128 and CSI 3140, or equivalent..

COMP 5402 [0.5 credit] (CSI 5142)

Protocols for Mobile and Wireless Networks

Link and network layer protocols of wireless networks; applications of wireless networks may be discussed. Topics may include: protocol implementation, mobile IP, resource discovery, wireless LANs/PANs, and Spreadspectrum.
Precludes additional credit for SYSC 5306.
Prerequisite: COMP 3203 or equivalent.

COMP 5404 [0.5 credit] (CSI 5144)

Computer-Aided Program Verification

Automatic verification techniques for concurrent, reactive, and real-time programs. Topics may include temporal logics, the basic model-checking algorithm, symbolic model checking, compositional techniques, exploiting abstraction and symmetry, models based on partial orders, model-checking for the mu-calculus, applications to communication protocols, computer security and digital circuits.
Prerequisite: COMP 4004 or equivalent.

COMP 5406 [0.5 credit] (CSI 5105)

Network Security and Cryptography

Advanced methodologies selected from symmetric and public key cryptography, network security protocols and infrastructure, identification, secret-sharing, anonymity, intrusion detection, firewalls, defending network attacks and performance in communication networks.
Prerequisites: COMP 3203 and COMP 4109, or equivalent, or permission of the instructor.

COMP 5407 [0.5 credit] (CSI 5116)

Authentication and Software Security

Specialized topics in security including advanced authentication techniques, user interface aspects, electronic and digital signatures, security infrastructures and protocols, software vulnerabilities affecting security, untrusted software and hosts, protecting software and digital content.
Prerequisites: COMP 3000 and COMP 4108, or equivalent; or permission of the instructor.

COMP 5408 [0.5 credit] (CSI 5121)

Advanced Data Structures

Simple methods of data structure design and analysis that lead to efficient data structures for several problems. Topics include randomized binary search trees, persistence, fractional cascading, self-adjusting data structures, van Emde Boas trees, tries, randomized heaps, and lowest common ancestor queries.
Prerequisite: COMP 4804 or equivalent.

COMP 5409 [0.5 credit] (CSI 5127)

Applied Computational Geometry

Computer-based representation and manipulation of geometric objects. Design and analysis of efficient algorithms for solving geometric problems in applied fields such as Computer-

Aided Design and Manufacturing, Cartography, Materials Science, and Geometric Network Design.
Prerequisite: COMP 4804 or equivalent.

COMP 5703 [0.5 credit] (CSI 5163)
Algorithm Analysis and Design
Topics of current interest in the analysis and design of sequential and parallel algorithms for non-numerical, algebraic and graph computations. Lower bounds on efficiency of algorithms. Complexity classes.
Prerequisite: permission of the School.

COMP 5704 [0.5 credit] (CSI 5131)
Parallel Algorithms and Applications in Bioinformatics
Multiprocessor architectures from an application programmer's perspective: programming models, processor clusters and multi-core processors, algorithmic paradigms, efficient parallel problem solving, limits of parallelism, software scalability and portability. Projects with an emphasis on high performance computing in bioinformatics. Programming experience on parallel processing equipment.
Prerequisite: COMP 3804 or the equivalent.

COMP 5802 [0.5 credit]
Introduction to Information and Systems Science
An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as MATH 5802, SYSC 5802, ISYS 5802.)

COMP 5807 [0.5 credit] (CSI 5104)
Formal Language and Syntax Analysis
Computability, unsolvable and NP-hard problems. Formal languages, classes of languages, automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR (O), LR(k), SLR, LL(k); syntax directed translation. (Also listed as MATH 5807.)
Prerequisite: COMP 3002, or MATH 4805 or MATH 5605, or the equivalent.

COMP 5900 [0.5 credit] (CSI 5140)
Selected Topics in Computer Science
Selected topics, not covered by other graduate courses. Details will be available from the School at the time of registration.

COMP 5901 [0.5 credit] (CSI 5901)
Directed Studies (M.C.S.)
A course of independent study under the supervision of a member of the School of Computer Science.

COMP 5902 [0.5 credit] (CSI 5900)
Graduate Project (M.C.S./M.Sc. [ISS])

COMP 5903 [1.0 credit] (CSI 6900)
Intensive Graduate Project (M.C.S.)
A one- or two-session course. For M.C.S. non-thesis option students only. Not to be combined for credit with COMP 5902.

COMP 5904 [0.0 credit] (CSI 5902)
Master's Seminar
To complete this course, the student must attend 5 graduate seminars at Carleton, and 5 at SITE within a year. The student must also make one presentation in the context of this graduate seminar.

COMP 5905 [2.5 credits] (CSI 7999)
M.C.S. Thesis

COMP 5906 (CSI 6901) [0.0 credit]
Master's Co-operative Workterm 1
Prerequisites: registration in the Co-operative Education option of the Master of Computer Science program and permission of the School.

COMP 5907 (CSI 6902) [0.0 credit]
Master's Co-operative Workterm 2
Prerequisites: registration in the Co-operative Education option of the Master of Computer Science program and permission of the School.

MATH /SYSC/ COMP 5908 [1.5 credits]
M.Sc. Thesis in Information and Systems Science

COMP 6100 [0.5 credit] (CSI 7131)
Advanced Parallel and Systolic Algorithms
Continuation of COMP 5704.
Prerequisite: COMP 5704.

COMP 6104 [0.5 credit] (CSI 7314)
Advanced Topics in Object-Oriented Systems
Advanced object-oriented software engineering, in particular the issues of reuse and testing. Sample topics include: interaction modeling; class and cluster testing; traceability; design patterns and testing; the C++ standard template library. Students will carry out research.
Prerequisite: COMP 5104 or permission of instructor.

COMP 6601 [0.5 credit] (CSI 7160)
Advanced Topics in the Theory of Computing

COMP 6602 [0.5 credit] (CSI 7170)
Advanced Topics in Distributed Computing

COMP 6603 [0.5 credit] (CSI 7161)
Advanced Topics in Programming Systems and Languages

COMP 6604 [0.5 credit] (CSI 7162)
Advanced Topics in Computer Applications

COMP 6605 [0.5 credit] (CSI 7163)
Advanced Topics in Computer Systems

COMP 6901 [0.5 credit] (CSI 7901)
Directed Studies (Ph.D.)

COMP 6902 [0.5 credit] (CSI 7900)
Graduate Project (Ph.D.)

COMP 6907 [0.0 credit] (CSI 9998)
Doctoral Comprehensive
A committee must be assembled and approve at least 3 topics for written examination: typically, a major and two minor areas. An oral examination occurs if the written exam is passed. Both elements must take place within the first 4 terms following initial registration in the program.
The comprehensive may be failed, passed conditionally (i.e., with extra course requirements) or passed unconditionally. If failed this course may be retaken at most one time.

COMP 6908 [0.0 credit] (CSI 9997)
Doctoral Proposal
Within 8 terms following initial registration in the program, a document generally defining the problem addressed, relating it to the literature, and outlining the hypotheses, goals, research

methodology, initial results and validation approach must be submitted to an examination committee and successfully defended.

COMP 6909 [8.5 credits] (CSI 9999)
Ph.D. Thesis

Ottawa-Carleton Institute for Computer Science

Herzberg Building 5302
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scs.carleton.ca

The Institute

Director of the Institute: Jean-Pierre Corriveau
Associate Director of the Institute: Iluju Kiringa

Students who wish to pursue studies in computer science leading to an M.C.S. or a Ph.D. degree can do so in a joint program offered by the School of Information Technology and Engineering at the University of Ottawa and the School of Computer Science at Carleton University under the auspices of the Ottawa-Carleton Institute for Computer Science. The Institute is responsible for supervising the program and for providing a framework for interaction between the two departments at the research level. In addition to the faculty members from the two computer science departments, the Institute also has members with computer science expertise from other departments.

The M.C.S. is also available as part of ConGESE (Consortium for Graduate Education in Software Engineering), a collaborative program offering a specialization in software engineering. This program is geared towards software professionals working for participating industrial partners. The ConGESE program imposes further regulations and requirements on the existing program. The degree will in each case specify the discipline of the participating unit with Specialization in Software Engineering. Additional information is available from the graduate supervisor and on the Web (by searching for Congese).

Requests for information, and completed applications, should be sent to the graduate supervisor of the academic unit in which the candidate expects to find a supervisor.

Members of the Institute

The "home" department of each member is indicated by (SITE) for the School of Information Technology and Engineering, University of Ottawa; (ADM) for Faculty of Administration, University of Ottawa; (MCG) for the Department of Mechanical Engineering, University of Ottawa; (SCS) for the School of Computer Science, Carleton University; (MATC) for the School of Mathematics and Statistics, Carleton University; (MATO) for the Department of Mathematics, University of Ottawa; (SCE) for the Department of Systems and Computer Engineering, Carleton University; (C) for the Department of Civil and Environmental Engineering, Carleton University; (BUS) for the School of Business, Carleton University.

- C. Adams, *Cryptography, network security, privacy (SITE)*
- A. Adler, *Medical image processing, physiological monitoring (SCE)*
- S. Ajila, *Software maintenance, software process and product lines (SCE)*
- D. Amyot, *Software engineering, requirements engineering, feature interactions (SITE)*
- A. Arya, *Interactive multimedia systems, computer grahics and animation, virtual characters and virtual worlds, new media and digital art (SCE)*
- M. Barbeau, *Telecommunications software, distributed systems, mobile and wireless networks (SCS)*
- C. Barrière, *Natural language processing, lexical knowledge bases, computational lexicography, knowledge acquisition and representation (SITE - Adjunct)*
- M. Benyoucef, *Software engineering, Internet technologies, e-business, e-commerce (ADM)*

- L. Bertossi, *Database systems, intelligent information systems, knowledge representation (SCS)*
- R. Biddle, *Human-Computer Interaction, Software Engineering (SCS)*
- G. von Bochmann, *Communication protocols, software engineering, formal specifications, verification and validation, distributed applications and systems management, multimedia, high-speed networks, real-time systems (SITE)*
- F. Bordeleau, *Object-oriented system design, real-time and distributed systems, software engineering (SCS - Adjunct)*
- P. K. Bose, *Applied geometric computing, computational geometry, data structures, algorithm design and analysis, randomized algorithms, graph theory (SCS)*
- M. Bouchard, *Signal processing, adaptive filtering, neural networks and control, applied to speech, acoustics and audio (SITE)*
- A. Boukerche, *Large-scale distributed interactive simulations and mobile computing and networking (SITE)*
- S. Boyd, *Combinatorial optimization, algorithm design and analysis, graph theory, polyhedral combinatorics (SITE)*
- L. Briand, *Software verification and validation, software design for testability and maintainability, software quality assurance and measurement (SCE)*
- J. Chinneck, *Applied optimization, automated formulation and 'debugging' of mathematical programs, data classification (SCE)*
- J.-P. Corriveau, *Object-oriented and generative modeling, programming and quality engineering; cognitive science; natural language understanding; CASE and knowledge-based tools for software engineering (SCS)*
- J. Czyzowicz, *Computational geometry (SITE/SCS - Adjunct)*
- F. Dehne, *Computational complexity, design and analysis of algorithms, computational geometry, parallel and systolic algorithms (SCS)*
- D. Deugo, *Large-scale distributed object computing, evolutionary computation (genetic algorithms, genetic programming, artificial life) and object-oriented systems (SCS)*
- J.D. Dixon, *Algorithms in algebra and number theory, complexity theory, group theory and representation (MATC)*
- S. Dobrev, *Design and analysis of algorithms, distributed algorithms, combinatorial algorithms, fault tolerance, mobile computing, interconnection networks, structural information in distributed computing (SITE)*
- C. Drummond*, Artficial Intelligence, (SITE- Adjunct)*
- E. Dubois, *Digital signal processing, multidimensional signal processing, data compression, source coding, image/video processing and coding (SITE)*
- M. Dumontier, *Bioinformatics, semantic web, cell simulation and visualization, personalized medicine, reconfigurable hardware (SCS)*
- M. Elhadef, *Distributed and parallel computing, fault tolerance and fault diagnosis, artificial intelligence, genetic algorithms, artificial immunite systems (SITE)*
- A. El Saddik, *Multimedia communications (SITE)*
- B. Esfandiari, *Agent-based systems, network management and supervision, object-oriented design and languages, symbolic machine learning (SCE)*
- A.E.F. Fahim, *Nonlinear optimization, computer aided design and manufacturing (CAD/CAM) methodology and software, flexible manufacturing cell (FMC) control environment, robot control, expert systems for design and manufacturing (MCG)*
- F. Famili, *Data mining, machine learning, bioinformatics (SITE - adjunct)*
- A.P. Felty, *Theorem proving, automated deduction, formal methods in software engineering, computational logic (SITE)*
- P. Flocchini, *Distributed computing, distributed algorithms, sense of direction, compact routing, cellular automata, discrete chaos (SITE)*
- G. Franks, *Computer systems performance analysis, operating systems and Internet protocol routing (SCE)*

- M. Frize, *Biomedical instrumentation, clinical engineering, infrared imaging, decision-support systems in medicine, ethics in engineering and human experimentation (SITE - SCE)*
- N.D. Georganas, *Multimedia broadband communications, computer-communications (SITE)*
- R. Goubran*, Audio signal processing, digital systems design, adaptive systems (SCE)*
- J. Green*, Bioinformatics, machine learning, prediction of protein function and structure from sequence, applications of nonlinear system identification (SCE)*
- V. Groza, *Real-time embedded systems, reconfigurable computing (SITE)*
- W. Gueaieb, *Intelligent mechatronics, control and automation, machine intelligence and learning, robotics, computational intelligence-based systems (fuzzy logic, neural networks and genetic algorithms), autonomous systems (SITE)*
- D.J. Howe, *Automated reasoning, applied logic, formal methods in software engineering, programming languages (SCS)*
- D. Inkpen, *Computational linguistics, intelligent agents for the semantic Web (SITE)*
- D.I.-A. Ionescu, *Computers, artificial intelligence, image processing, discrete event and real-time systems (SITE)*
- N. Japkowicz, *Artificial Intelligence, machine learning (SITE)*
- C. Joslin*, Media adaptation/streaming, mobile computing, virtual reality/collaborative environments, human animation, image/video processing, 3D spatial sound, video/audio/graphics coding, real-time 3D graphics & animation (SCE)*
- G.-V. Jourdan, *Distributed systems, software verification, validation and testing, partially ordered sets, data visualization (SITE)*
- M. Just, *Cryptography and security (SCS - Adjunct)*
- A. Karmouch, *Multimedia communications, multimedia real-time distributed information systems and databases (SITE)*
- G.E. Kersten, *Expert systems, decision support systems (SITE - Adjunct)*
- I. Kiringa, *Knowledge Representation using logic-based methods, active databases, peer-to-peer databases, database transactions (SITE)*
- E. Kranakis, *Cryptography, combinatorial analysis, computational geometry, distributed computing, distributed and data networks (SCS)*
- D. Krizanc, *Parallel and distributed computing, analysis of algorithms and use of randomization in computation (SCS - Adjunct)*
- T. Kunz, *Wireless and mobile computing, load balancing in distributed systems, distributed programming environments for parallel and distributed systems, distributed systems management, parallel and distributed debugging, program understanding* (SCE)
- Y. Labiche, *Verification and validation, object-oriented system testing, software maintenance and evolution (SCE)*
- R. Laganière, *Computer vision, image processing (SITE)*
- W.R. Lalonde, *Symbolic processing languages, fifth generation machines, learning systems, compilers, artificial intelligence (SCS)*
- J. Lang, *Computer graphics, computer vision, data acquisition, robotics, computer animation (SITE)*
- M. Lanthier, *Behaviour-based robotics, artificial life, computational geometry, shortest path computations, GIS applications, parallel and distributed computing applications (SCS)*
- W. Lee, *Computer animation, human-computer interaction and face recognition, computer graphics and vision, medical imaging (SITE)*
- E. Lemaire, *Computer applications for physical rehabilitation, multimedia clinical motion analysis, e-learning (MED)*
- T. Lethbridge, *Human-computer interaction/user interfaces, software engineering, software visualization, software reverse engineering, knowledge representation (SITE)*
- R. Liscano, *Spontaneous networking, ad hoc communications, ubiquitous and pervasive computing, policy languages, networks sensor (SITE)*
- M. Liu, *Database systems, Web query and inference technologies, object-oriented programming, and logic programming (SCS)*
- P.X. Liu*, Wireless sensor networks, robotics, biomedical engineering (SITE)*

- L. Logrippo, *Telecommunications software engineering, software specification and verification with emphasis on distributed software (SITE - Adjunct)*
- C.-H. Lung, *Software engineering, network traffic engineering, distributed and parallel computing (SCE)*
- A. Maheshwari, *Data structures and algorithms, parallel computation, computational geometry, graph algorithms (SCS)*
- S.A. Mahmoud, *Wireless communication systems, protocols for high-speed networks, speech processing and computer network design (SCE)*
- S. Majumdar, *Parallel and distributed systems, performance evaluation, operating systems (SCE)*
- D. Makrakis, *Computer networks: architectures, protocols, management, broadband applications (SITE)*
- Y. Mao, *Probabilistic graphical modes, statistical inference, bioinformatics, broadband applications (SITE)*
- M. Marchand, *Machine learning pattern recognition, artificial neural networks, support vector machines and Kernel methods, learning theory (SITE)*
- S.J. Matwin, *Artificial intelligence, knowledge-based systems, machine learning, software reuse (SITE)*
- D. R. McDonald, *Applied probability, rare events in queueing networks, applications to telecommunications (SITE)*
- W. Michalowski, *Clinical decision support, ontological modeling, data mining for clinical applications, operations research (MED)*
- A. Miri, *Information and coding theory, cryptography (SITE)*
- P. Morin, *Computational geometry, parallel algorithms, network algorithms and crypto-graphy (SCS)*
- B.C. Mortimer, *Error-correcting codes, combinatorics, algorithm design and analysis, group theory (MATC)*
- H. Mouftah, *Optical networks, ad hoc networks (SITE)*
- L. Moura, *Combinatorial algorithms, combinatorial designs and their applications, combinatorial optimization (SITE)*
- A. Nayak, *Fault-tolerant computing, distributed systems (SITE)*
- D. Nussbaum, *Computational geometry, medical computing, parallel and distributed computing, geographic information systems, robotics and machine vision, data structures and algorithms (SCS)*
- J. Oommen, *Learning systems, stochastic automata, pattern recognition, image processing, adaptive data structures (SCS)*
- F. Oppacher, *Artificial intelligence, genetic algorithms, evolutionary computing, machine learning (SCS)*
- B. Pagurek, *Communications network management, artificial intelligence and fault management, knowledge-based software debugging (SCE)*
- D. Panario, *Computer algebra, analytic combinatorics, analysis of algorithms, cryptography, analytic, computational and combinatorial number theory (MAT)*
- E. Paquet, *Proteomics, 3-D anthropometry, visualization, content-based indexing and retrieval of images and 3-D objects (SITE-Adjunct)*
- P. Payeur, *3-D modeling for robotics, computer vision, autonomous systems (SITE)*
- A. Pelc, *Algorithms, fault tolerant communication in networks (SCS - Adjunct)*
- D. C. Petriu, *Performance evaluation, software engineering (SCE)*
- E.M. Petriu, *Robotic sensing and perception, neural networks (SITE)*
- L. Peyton, *Software engineering, e-commerce, business process automation (SITE)*
- R.L. Probert, *Quality engineering of communications protocols and communications software, accelerated techniques for software engineering (SITE)*
- B. Raahemi, *Information systems, data mining, data communications networks and services, business intelligence (SITE and BUS)*

- G. Roth, *Computer vision, image processing, evolutionary algorithms, virtual reality and multi-media, computer graphics (SCS - Adjunct)*
- J.-R. Sack, *Algorithms and complexity, computational geometry, graphics, pattern recognition, robotics (SCS)*
- N. Samaan, *Mobile and wireless networks, autonomic computing, network management, m-commerce (SITE)*
- D. Sankoff, *Mathematical genomics, bioinformatics, mathematics of evolution and phylogeny (MATO)*
- N. Santoro, *Distributed computing, fault tolerance, discrete chaos, reactive environments (SCS)*
- P. Scott, *Logic, theoretical computer science, category theory (SITE)*
- B. Selic, *Software engineering, real-time systems, object-oriented modeling, quality of service (SCS - Adjunct)*
- P. Selinger, *Programming language theory, semantics, logic (MATO)*
- S. Shirmohammadi, *Multimedia communications, collaborative virtual environments, web telecollaboration applications, tele-haptics (SITE)*
- J. Sidney, *Combinatorial optimization, job shop scheduling (ADM)*
- J. Singer, *Software engineering, empirical software engineering, human computer interaction, cooperative and human aspects of software engineering (SITE - Adjunct)*
- M. Smid, *Computational geometry, data structures, geometric networks, randomized algorithms, applications of computational geometry in manufacturing and in the analysis of terrains (SCS)*
- A. Somayaji, *Operating system security, intrusion detection, complex adaptive systems, artificial life (SCS)*
- S. Somé, *Software engineering, requirements engineering, reverse engineering (SITE)*
- B. Stevens, *Combinatorics (MAT)*
- I. Stojmenovic, *Wireless networks and mobile computing, algorithms (SITE)*
- S. Szpakowicz, *Computational linguistics, knowledge acquisition, decision support systems (SITE)*
- *T. Tran, Artificial Intelligence, electronic commerce, intelligent agents, multi-agent systems, reinforcement learning, trust and reputation modeling, agent negotiation, mechanism design, applications of AI, and recommender systems (SITE)*
- M. Turcotte, *Bioinformatics, algorithm design, applications of machine learning (SITE)*
- P. Turney, *Computational linguistics, language processing, machine learning, natural language processing (SITE - Adjunct)*
- H. Ural, *Software reliability, verification and testing, communication protocols, distributed computing (SITE)*
- R. Vaillancourt, *Differential equations, numerical and applied mathematics, scientific computation, image compression (JPEG, MPEG), wavelets, chirplets (MATO)*
- P. Van Oorschot, *Authentication, network security, software security, software protection, cryptography and cryptographic protocols, digital signatures, public key infrastructure (PKI) and key management, software tamper resistance, automated obfuscation, encryption (SCS)*
- M. Vigder, *Component software engineering (SCS - Adjunct)*
- H.L. Viktor, *Data mining, information fusion and data warehousing (SITE)*
- G.A. Wainer, *DEVS formalism, Real-Time modeling, cellular models, modeling and simulation methodologies and tools, parallel/distributed/Web-based simulation, Real-Time operating systems (SCE)*
- M. Weiss, *Electronic commerce, network communities, agent patterns (SCE)*
- G. White, *Office automation, computer communications, scheduling and timetabling (SITE)*
- T. White, *Mobile agents, swarm and collective intelligence, evolutionary computing, Internet applications, peer-to-peer computing (SCS)*
- A. Whitehead, *Video processing, computational video, image processing, computer vision, entertainment technologies and graphics, video games, inspection systems, television and movie special effects, animation systems (SCE)*

- A.W. Williams, *Software testing, multi-platform software development, software engineering (SITE)*
- C.M. Woodside, *Performance modeling, performance of distributed software, software design, queueing theory (SCE)*
- D.J. Wright, *Voice over packet networks, business case for broadband networks, electronic commerce, telelearning (ADM)*
- M.C.E. Yagoub, *Artificial neural networks for communication systems, optimization methods (SITE)*
- O. W. Yang, *Computer communications network and protocol design, modeling, performance evaluation, queueing theory internetworking, photonic and IP networks (SITE)*
- T.H. Yeap, *Wireless security, medical information systems, software engineering (SITE)*
- N. Zaguia, *Order optimization, graph algorithms (SITE)*
- J. Zhao, *Image and video processing, multimedia communications (SITE)*
- R. Zuccherato, *Cryptography, information security, communications security, security infrastructures, applied number theory (SITE - Adjunct)*

Master of Computer Science

Admission Requirements

Applicants should have an Honours bachelor's degree in computer science or the equivalent, with at least high honours standing. By equivalent is meant an Honours degree in a program that includes at least twelve computer science half-credits, two of which must be at the 4000-level, and eight half-credits in mathematics, one of which must be at the 3000- or 4000-level. These courses must include the topics indicated below:

Computer Science
: Data structures/file management, operating systems, computer architecture, algorithm design and analysis, assembly language and two high-level languages

Mathematics
: Calculus, linear algebra, algebraic structures or discrete mathematics, probability and statistics, numerical analysis. Applicants who have a general (3-year) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the General Regulations section of this Calendar for regulations governing the qualifying year.

Program Requirements

The program includes graduate study and research in four areas:

- Software Engineering
- Theory of Computing
- Computer Applications
- Computer Systems

Within these areas, the program emphasizes problems of current practical significance and has close links to the scientific and industrial communities.

Normally, students in the program will be expected to complete a thesis; however, students who have substantial relevant work experience may be permitted to take the non-thesis option, which must include a graduate research project course. Each candidate submitting a thesis will be required to undertake an oral defence of the thesis.

Students in the thesis option must take 2.5 credits, fulfil the graduate seminar requirement, and complete a thesis. Students in the non-thesis option must take 4.0 credits, plus a graduate project (a project is equal to 1.0 credit and may be completed in one or two terms), and fulfil the graduate seminar requirement. The course selections must be approved by the student's academic adviser, and must include at least:

- 0.5 credit in software engineering
- 0.5 credit in the theory of computing
- 0.5 credit in either computer applications or computer systems

The graduate seminar requirement includes a seminar presentation and participation in at least ten sessions in the joint graduate student seminar series.

Both course and thesis work may be completed either by full-time or part-time study.

A candidate may be permitted to carry out thesis work off campus provided suitable arrangements are made for supervision and experimental work, and prior approval is given by the Institute.

Co-operative Option

A co-operative option is also available to full-time students in the Masters of Computer Science. Co-operative education is based on the principle that academic studies combined with work experience is desirable for effective professional preparation.

In addition to all other requirements for the degree, students admitted to the co-operative option must satisfactorily complete two work terms placements with a suitable employer in order to graduate with a co-op designation on their transcripts and diplomas. It is desirable that the work placements be related to the student's research. Placements are subject to the approval of the Supervisor of Graduate Studies and of the student's research supervisor. These work terms are four months in duration and students will conduct job searches through the university's co-op office. During a work term, students will register in one of the co-op work term courses: COMP 5906 (CSI 6901) or COMP 5907 (CSI 6902). While on a work term, students in this option are limited to taking one additional 0.5-credit course, or registering in their thesis.

Guidelines for Completion of Master's Degree

The following completion times are estimates only, based on full-time study, and are intended to provide guidance only.

Students are urged to check with the supervisor of graduate studies to determine the exact requirements of the degree program and other related information. Part-time students should calculate the completion times requirement by doubling the time estimates given below.

Students should complete the course work within the first two terms.

Selection of courses should be done in consultation with the student's faculty advisor. Approval from the Graduate Supervisor of the Institute is only required for courses not listed as valid OCICS courses. Subject to the approval of the Graduate Supervisor, M.C.S. students may take courses in other relevant disciplines. At least half of the course credits of an M.C.S. student must be valid OCICS courses. At most, two Fourth Year undergraduate courses may be taken with the permission of the Graduate Supervisor. A thesis supervisor and thesis topic must be selected by the end of the second term. The supervisor of graduate studies should be formally notified of this selection. The expected

completion time for the M.C.S. degree is four to six terms of full-time study depending on the type of thesis and the area of research.

Students wishing to pursue the co-op option normally apply for admission to the co-operative option during their first academic term. This option requires an initial study period of two academic terms, typically followed by two work terms and a final academic period to complete the remaining requirements of the degree. The student must submit a work term report or make a formal oral presentation upon the completion of each work placement, and receive a grade of Satisfactory in order to meet the requirements for the successful completion of that work term's requirement.

Doctor of Philosophy

Admission Requirements

Admission to the Ph.D. in Computer Science requires a Masters in Computer Science with thesis, or equivalent including demonstrated significant research ability. In exceptional cases, students who are currently in the M.C.S. program and who have completed all course requirements with a grade of no less than A in each course may be permitted to transfer into the Ph.D. program.

Program Requirements

A minimum of 1.5 credits at the graduate level in at least three different research areas (see OCICS course grouping by area). The admission committee and the student's advisory committee may impose additional program requirements according to the student's background and research topic. The thesis weight will be of 8.5 credits.

Presentation of at least two seminars in the Ottawa-Carleton Institute for Computer Science seminar series: Minimally, the student must make one presentation for the graduate seminar, and one presentation for the departmental seminar.

A comprehensive examination (COMP 6907) involving breadth and depth components.

A written thesis proposal (COMP 6908) defended at an oral examination.

A research thesis (COMP 6909) defended at an oral examination.

Guidelines for Completion of Doctoral Degree

The following completion times are estimates based on full-time study.

During the first term, the student and his or her faculty adviser should select graduate courses related to their area(s) of research and interests. Approval from the Graduate Supervisor of the Institute is only required for courses not listed as valid OCICS courses. Subject to the approval of the Graduate Supervisor, Ph.D. students may take courses in other relevant disciplines. At least half of the course credits of a Ph.D. student must be valid OCICS courses. An advisory committee comprised of three to five faculty members must be established before the student registers in the comprehensive examination. The committee is responsible for the comprehensive examination, the thesis proposal, and for guiding the student's research. The advisory committee must include at least one representative from SITE. The advisory committee must be approved by the director or associate director of the Institute. Comprehensive examinations (see COMP 6907) must be taken within the first 4 terms. All course requirements must be completed within the first 6 terms. Within the first 8 terms, the student must submit a written thesis proposal and defend it in an oral examination (see COMP 6908). The expected completion time for the Ph.D. program is approximately twelve terms depending

on the type of thesis and the area of research. Before the completion of the program, the student is expected to present at least two seminars in the Ottawa-Carleton Institute for Computer Science seminar series.

Residence Requirement

Students must fulfil a residence requirement of at least four terms of full-time study.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings or to determine the term of offering, consult central.carleton.ca

Subject to the approval of the Graduate Supervisor, M.C.S. and Ph.D. students may take courses in other relevant disciplines. The courses in the following list are offered by the two departments forming OCICS.

Carleton University
- COMP School of Computer Science

University of Ottawa
- CSI School of Information Technology and Engineering

Software Engineering
- COMP 5001 (CSI 5113)
- COMP 5104 (CSI 5314)
- COMP 5106 (CSI 5123)
- COMP 5400 (CSI 5310)
- COMP 6104 (CSI 7314)
- COMP 6603 (CSI 7161)
- CSI 5107 (COMP 5609) Program Construction and Fault Tolerance
- CSI 5109 (COMP 5701) Specification Methods for Distributed Systems
- CSI 5111 (COMP 5501) Software Quality Engineering
- CSI 5112 (COMP 5207) Software Engineering
- CSI 5115 (COMP 5503) Database Analysis and Design
- CSI 5118 (COMP 5302) Automated Verification and Validation of Software
- CSI 5122 (COMP 5301) Software Usability
- CSI 5134 (COMP 5004) Fault Tolerance
- CSI 5184 (COMP 5804) Logic Programming
- CSI 5507(COMP 5609) Les programmes : construction et tolérance aux fautes
- CSI 5509 (COMP 5701) Méthodes pour la spécification de systèmes répartis
- CSI 5584 (COMP 5804 Programmation logique

Theory of Computing
- COMP 5003 (CSI 5308)
- COMP 5005 (CSI 5390)
- COMP 5008 (CSI 5164)
- COMP 5107 (CSI 5185)
- COMP 5203 (CSI 5173)
- COMP 5306 (CSI 5100)
- COMP 5307 (CSI 5101)
- COMP 5308 (CSI 5102)
- COMP 5404 (CSI 5144)
- COMP 5408 (CSI 5121)
- COMP 5409 (CSI 5127)
- COMP 5703 (CSI 5163)
- COMP/MATH 5807 (CSI 5104)

COMP 6601 (CSI 7160)
COMP 6602 (CSI 7170)
CSI 5107 (COMP 5609) Program Construction and Fault Tolerance
CSI 5108 (COMP 5700) Software Specification and Verification
CSI 5110 (COMP 5707) Principles of Formal Software Development
CSI 5126 (COMP5108) Algorithms in Bioinformatics
CSI 5148 (COMP 5103) Wireless Ad Hoc Networking
CSI 5149 (COMP 5007) Graphical Models
CSI 5162 (COMP 5702) Order: Its Algorithms and Graphical Data Structures
CSI 5165 (COMP 5709) Combinatorial Algorithms
CSI 5166 (COMP 5805) Applications of Combinatorial Optimization
CSI 5169 (COMP 5304) Wireless Networks and Mobile Computing
CSI 5174 (COMP 5604) Validation Methods for Distributed Systems
CSI 5367 (COMP 5300) Structure in Complexity Theory
CSI 5507 (COMP 5609) Les programmes : construction et tolérance aux fautes
CSI 5508 (COMP 5700) Spécification et vérification de logiciels
CSI 5510 (COMP 5707) Principes de développement formel de logiciels
CSI 5565 (COMP 5709 Algorithmes combinatoires

Computer Applications

COMP 5002 (CSI 5128)
COMP 5100 (CSI 5180)
COMP 5204 (CSI 5124)
COMP 5206 (CSI 5183)
COMP 5305 (CSI 5129)
COMP 5306 (CSI 5100)
COMP 5307 (CSI 5101)
COMP 5308 (CSI 5102)
COMP 5401 (CSI 5389 and CSI 5789)
COMP 5406 (CSI 5105)
COMP 5407 (CSI 5116)
COMP 6604 (CSI 7162)
CSI 5114 (COMP 5504 Automated Office Systems
CSI 5126 (COMP 5108) Algorithms in Bioinformatics
CSI 5145 (COMP 5109) Statistical Approaches to Natural Language Processing
CSI 5146 (COMP 5202) Computer Graphics
CSI 5147 (COMP 5201) Computer Animation
CSI 5151 (COMP 5205) Virtual Environments
CSI 5161 (COMP 5606) Topics in System Simulation and Optimization
CSI 5162 (COMP 5702) Order: Its Algorithms and Graphical Data Structures
CSI 5168 (COMP 5309) Digital Watermarking
CSI 5304 (COMP 5602) Knowledge Engineering
CSI 5380 (COMP 5405) Systems and Architectures for Electronic Commerce
CSI 5386 (COMP 5505) Natural Language Processing
CSI 5387 (COMP 5706) Data Mining and Concept Learning
CSI 5388 (COMP 5801) Topics in Machine Learning
CSI 5514 (COMP 5504) Bureautique
CSI 5580 (COMP 5100) Sujet en intelligence artificielle
CSI 5780 (COMP 5405) Systèmes et architectures des logiciels pour le commerce électronique
CSI 5787 (COMP 5706) Fouille des données et apprentissage des concepts

Computer Systems

COMP 5003 (CSI 5308)
COMP 5009 (CSI 5141)
COMP 5101 (CSI 5311)
COMP 5102 (CSI 5312)

COMP 5107 (CSI 5185)
COMP 5203 (CSI 5173)
COMP 5305 (CSI 5129)
COMP 5401 (CSI 5389 and CSI 5789)
COMP 5402 (CSI 5142)
COMP 5403 (CSI 5143)
COMP 5406 (CSI 5105)
COMP 5407 (CSI 5116)
COMP 5704 (CSI 5131)
COMP 6100 (CSI 7131)
COMP 6602 (CSI 7170)
COMP 6605 (CSI 7163)
CSI 5109 (COMP 5701) Specification Methods for Distributed Systems
CSI 5114 (COMP 5504) Automated Office Systems
CSI 5133 (COMP 5608) Simulation and Testing of Logic Circuits
CSI 5134 (COMP 5004) Fault Tolerance
CSI 5147 (COMP 5201) Computer Animation
CSI 5148 (COMP 5103) Wireless Ad Hoc Networking
CSI 5168 (COMP 5309) Digital Watermarking
CSI 5169 (COMP 5304) Wireless Networks and Mobile Computing
CSI 5170 (COMP 5800) Distributed Data Processing
CSI 5171 (COMP 5303) Network Architectures, Services, Protocols and Standards
CSI 5174 (COMP 5604) Validation Methods for Distributed Systems
CSI 5380 (COMP 5405) Systems and Architectures for Electronic Commerce
CSI 5509 (COMP 5701) Méthodes pour la spécification de systèmes répartis
CSI 5514 (COMP 5504) Bureautique
CSI 5780 (COMP 5405) Systèmes et architectures des logiciels pour le commerce électronique

Others

COMP 5900 (CSI 5140)
COMP 5901 (CSI 5901)
COMP 5902 (CSI 5900)
COMP 5903 (CSI 6900)
COMP 5904 (CSI 5902)
COMP 5905 (CSI 7999)
COMP 5906 (CSI 6901)
COMP 5907 (CSI 6902)
COMP 6901 (CSI 7901)
COMP 6902 (CSI 7900)
COMP 6907 (CSI 9998)
COMP 6908 (CSI 9997)
COMP 6909 (CSI 9999)

Cultural Mediations

201 St. Patrick's Building
Telephone: 613-520-2177
Fax: 613-520-2564
carleton.ca/icslac

The Institute

Director of the Institute: Paul Théberge (Acting)
Coordinator of Ph.D. Studies: Franny Nudelman

The Institute of Comparative Studies in Literature, Art and Culture offers a program of study and research leading to the Doctor of Philosophy in Cultural Mediations.

The Department of English Language and Literature, the Department of French, the programs in Art History, Film Studies and Music of the School for Studies in Art and Culture participate in the doctoral program.

Doctor of Philosophy

The program is designed to support work in cultural theory of the twentieth century and the analysis of a variety of cultural practices across and between the participating disciplines. The program addresses those issues in cultural theory of the twentieth century that inform interdisciplinary work today in literature, film, music, art and new media: the nature of the text and textuality; the nature of representation, interpretation, meaning and affect; cultural identity and hybridity; the role of technologies of production and reception; the formation of the subject and modes of subjectivity; the functioning of ideology; the meaning and ethics of cultural value. Specific works of literature, film and other cultural practices, including new media, will be studied in relation to questions of theory.

There are four fields of study in the program:

- Literary Studies
- Visual Culture
- Musical Culture
- New Technologies

Admission Requirements

The normal requirement for admission to the Ph.D. program in either a full-time or part-time capacity is an M.A. (or a recognized equivalent) in a discipline appropriate to the interdisciplinary strengths of the program. A GPA of 10.0 (A-) or better is required of course work completed at the Master's level.

Appropriate disciplines might include English or French Literature, Art History, Film Studies, Music, Comparative Literature, Anthropology, Canadian Studies, Communication, Geography, History, Philosophy, Sociology, Gender Studies.

Program Requirements

Students admitted to the Ph.D. program in Cultural Mediations are required to complete a total of 10.0 credits as follows:

- 1.0 compulsory credit, CLMD 6101
- 1.0 credit chosen from CLMD 6102, CLMD 6103, CLMD 6104, CLMD 6105, CLMD 6106
- 0.5 compulsory credit, CLMD 6900
- 1.0 additional credit
- 2.0 comprehensive credits
- 4.5 dissertation credits

Language Requirements

Upon graduation, each student is expected to be proficient in one language (preferably French) in addition to English. Additionally, students will be expected to deal with all material that is their primary object of research in its original language. The graduate coordinator should be consulted about the fulfillment of language requirements.

Comprehensive Examinations

Students are required to pass two written comprehensive examinations. Each comprehensive has a 1.0 credit value:

1. The first comprehensive will be a general examination of the broad range of cultural theory of the twentieth century;
2. The second comprehensive will be a discipline- specific examination from one of the following four areas of specialization chosen by the student:
    - Literary Studies;
    - Visual Culture;
    - Musical Culture;
    - New Technologies.

Thesis

All students are required to complete a thesis in partial fulfillment of the requirements of the degree offered by the program. The thesis must be defended at an oral examination.

All students will be required to prepare, present and defend a thesis proposal before proceeding to the writing of the thesis. The proposal will be discussed and defended before the members of the thesis advisory committee at an oral defense chaired by the graduate supervisor.

The program appoints a doctoral thesis advisory committee, the chair of which shall be the student's thesis supervisor. The committee will consist of at least three members of the university faculty, at least two of whom will be core (or associate) faculty in the program. The advisory committee shall determine when a thesis may go forward for examination.

Academic Standing

Doctoral students are required to obtain a grade of B- or better in each course counted toward the fulfillment of the requirements of the degree.

Guidelines for Completion of the Doctor of Philosophy

Full-time Ph.D. students are expected to complete their requirements within six calendar years. Students who undertake the program by a combination of full-time and part-time study must complete

their degree requirements within an elapsed period of eight calendar years, as set out in the General Regulations section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult class schedule at: central.carleton.ca

CLMD 6101 [1.0 credit]
Perspectives on Interdisciplinarity in Cultural Theory
Theory and practice of interdisciplinary studies of culture. Attention will be paid to those issues in cultural theory of the twentieth century that inform interdisciplinary work today in literature, film, music, art and new media.

CLMD 6102 [0.5 credit]
Issues of Cultural Identity and Hybridity
This course will look at examples of Western and non-Western cultural practice that raise questions about the personal and social consequences of differential cultural relations. Emphasis will be less upon the discreteness of the cultural practices in question and more upon their heterogeneity and hybridization.

CLMD 6103 [0.5 credit]
Issues of Cultural Mediation and Representation
This course will examine how works from different cultures or works in the same or different media from the same culture pose questions about the nature of representation, interpretation, meaning and affect. Emphasis will be upon the relation between social intelligibility and textual features.

CLMD 6104 [0.5 credit]
Issues of Subjectivity and Difference
The theory of the subject and its relations, with examples from specific cultural practices in literary studies, film, music, art, popular culture and new media.

CLMD 6105 [0.5 credit]
Issues in the Technologies of Culture
The role that technology plays in changing models of literacy, visuality and aurality. The technologies of the cultures of print, vision and sound will be discussed through specific examples of cultural practices in various media.

CLMD 6106 [0.5 credit]
Issues in History and Culture
History as an object of representation and a condition of human experience. Historical approaches to print, visual, and auditory culture in relation to theoretical texts and specific periods and genres. Topics may include history and the novel, visual culture in history, and historiography.

CLMD 6900 [0.5 credit]
Interdisciplinary Research Methods
Students will be introduced to a range of methods of inquiry, procedures and practices across related disciplines, using both traditional and electronic research tools, as preparation for the doctoral dissertation, practices of academic publishing, conference presentations, and private and public sector writing and research protocols.

CLMD 6901 [0.5 credit]
Directed Readings in Cultural Mediations
This tutorial is designed to permit students to pursue research on topics chosen in consultation with members of faculty and the graduate supervisor.

CLMD 6902 [0.5 credit]
Special Topic in Cultural Mediations
This in-class course offers selected topics in interdisciplinary studies of culture not available in the regular course offerings.

CLMD 6903 [0.5 credit]
Special Topic in Cultural Mediations
This in-class course offers selected topics in interdisciplinary studies of culture not available in the regular course offerings.

CLMD 6904 [0.5 credit]
Special Topic in Cultural Mediations
This in-class course offers selected topics in interdisciplinary studies of culture not available in the regular course offerings.

CLMD 6907 [1.0 credit]
Comprehensive I
A general examination of the broad range of cultural theory of the twentieth century as it informs interdisciplinary work today and the historical, intellectual and cultural frames of reference that this work invokes.

CLMD 6908 [1.0 credit]
Comprehensive II
A discipline-specific examination in a specialized area of study chosen by the student in consultation with the graduate supervisor. Students will choose from one of the following comprehensive areas: Literary Studies; Visual Culture; Musical Culture; New Technologies.

CLMD 6909
Ph.D. Thesis

Master's Level Courses
Students may take the equivalent of 1.0 credit at the Master's level.

Other Programs
Students may take the equivalent of 0.5 credit in a related program. Students should contact the supervisor of graduate studies for approval.

Earth Sciences

2125 Herzberg Building
Telephone: 613-520-5633
Fax: 613-520-5613
earthsci.carleton.ca/ocgc

Ottawa-Carleton Geoscience Centre

Director of the Centre: R.T. Patterson
Associate Director of the Centre: R.W. Arnott

Established in 1982, the Ottawa-Carleton Geoscience Centre, a joint initiative of Carleton University and the University of Ottawa, offers programs leading to the degrees of M.Sc. and Ph.D. in Earth Sciences. The Centre houses modern instrumental facilities, and research activity includes most areas of the Earth Sciences. The campuses are fifteen minutes apart by complimentary inter-university transport and within a short distance of most federal facilities.

The size of the Centre's research faculty and its location in the nation's capital offer unique opportunities for collaborative research over a broad range of disciplines. Of particular note is the Centre's close collaboration with the Geological Survey of Canada. Graduate students are enrolled in the university where their faculty supervisor holds an appointment. Students draw from a program of courses in English or French and may pursue their research in either language.

Applications for graduate admission are made to the Director of the Centre. The research interests of members of the Centre are listed below.

Members of the Centre

The home department of each member is indicated by (CU) for the Department of Earth Sciences, Carleton University; (UO) for the Department of Earth Sciences, University of Ottawa; (CE) for the Department of Civil Engineering, Carleton University; (PHY) for the Department of Physics, University of Ottawa; (GEOGCU) for the Department of Geography and Environmental Studies at Carleton University; (GEOGUO) for the Department of Geography at the University of Ottawa.

- F.P. Agterberg, Geomathematics, evaluation of non-renewable resources, automated stratigraphic correlation (UO-Adjunct)
- R.W. Arnott, Clastic sedimentology, experimental sedimentology (UO)
- G.M. Atkinson, Engineering seismology, strong ground motion, seismic hazard (CU-Adjunct)
- J. Ayer, Archean greenstone belt evolution, economic geology, geochemistry
- A. Bannari, Remote sensing and geographic information systems (GEOGUO)
- Keith Bell, Isotope studies, petrology of alkaline rocks and carbonatites, geochronology (CU)
- Keith Benn, Structural geology, structural petrology, anisotropy of magnetic susceptibility, basement tectonics (UO)
- R.G. Berman, Metamorphic petrology, experimental petrology (CU-Adjunct)
- John Blenkinsop, Mass spectrometry, geochronology, isotope geochemistry (CU)
- C.R. Burn, Permafrost and ground ice, Yukon and Western Arctic (GEOGCU)
- S.D. Carr, Cordilleran and Grenville tectonics, U-Pb geochronology (CU)
- I.D. Clark, Hydrogeology, environmental isotope geochemistry (UO)
- M. Colpron, Structural geology, tectonics (CU-Adjunct)
- B.L. Cousens, Igneous petrology, isotope geochemistry (CU)
- S.L. Cumbaa, Vertebrate paleontology and paleoecology (CU-Adjunct)

- B. Daneshfar, Applications of geographic information systems (GIS), statistical and geostatistical spatial data analysis, mineral potential mapping, applied geochemistry (exploration, environmental)
- Eric de Kemp, 3-D integration and visualization of structural field data: tools for regional subsurface mapping (UO-Adjunct)
- André Desrochers, Carbonate sedimentology and diagenesis, Canadian Arctic (UO)
- G.R. Dix, Sedimentology and stratigraphy, emphasis on modern and ancient carbonate settings (CU)
- J.A. Donaldson, Precambrian stratigraphy and sedimentology (CU-Adjunct)
- R.M. Easton, Grenville and Proterozoic geology, physical volcanology, geochemistry (CU-Adjunct)
- R. Ernst, Large igneous provinces (LIPS), on Earth and other planets, and links with Ni-Cu-PGE ore deposits and mantle plumes
- D. Fisher, Glaciology, ice cores, past climate change, Martian glaciology and planetary ices (UO-Adjunct)
- D. Fortin, Geomicrobiology, environmental geochemistry (OU)
- A.D. Fowler, Geochemistry, Archean metavolcanic belts, non-linear dynamics (UO)
- Jim Franklin, Base metal sulphide deposits (OU-Adjunct)
- W. K. Fyson, Structural analyses in metamorphic terrains (OU-Adjunct)
- K. Gajewski, Climatology and climatic changes: Quaternary paleoecology (GEOGUO)
- P. Gammon, Marine and terrestrial biogeochemistry, sedimentology, stratigraphy, paleoclimatology, petroleum geology, exploration geochemistry
- M.-A. Geurts, Palynology and geomorphology, travertine (GEOGUO)
- H.J. Gibson, Subaqueous volcanic processes and metallic mineral deposits (CU-Adjunct)
- W.D. Goodfellow, Geochemistry of modern and ancient sediment-hosted deposits, mass extinction (UO-Adjunct)
- M.D. Hannington, Economic geology, mineral deposits (UO)
- K.H. Hattori, Isotope geochemistry, mineral deposits, Archean geology (UO)
- J. Hedenquist, Economic geology (UO-Adjunct)
- R. Herd, Mineralogy and textures of metamorphic rocks and meteorites (CU-Adjunct)
- D. D. Hogarth, Mineralogy, igneous and metamorphic petrology, alkalic rocks (OU-Adjunct)
- P.G. Johnson, Glacial geomorphology, slope mass movements, glacier hydrology (GEOGUO)
- D.J. King, Remote sensing, vegetation damage assessment including geobotanical techniques, geographic information systems (GEOGCU)
- T. Kotzer, Environmental isotope geochemistry, hydrogeology, radioisotopes (OU- Adjunct)
- I. Kjarsgaard, Mineralogy and mineral dhemistry of igneous and metamorphic rocks including base and precious metal ores (CU-Adjunct)
- J. Kukalova-Peck, Paleontology, fossil insects (CU-Adjunct)
- A.E. Lalonde, Petrology and mineralogy of plutonic rocks (UO)
- M. Lamontagne, Intraplate seismicity (CU-Adjunct)
- B. Lauriol, Geomorphology (GEOGUO)
- M.C. Lesher, Economic geology, igneous geochemistry, volcanology (UO-Adjunct)
- A.G. Lewkowicz, Permafrost geomorphology, hydrogeology, effect of global change on Arctic terrain (GEOGUO)
- Y. L'Heureux, Non-linear dynamics, crystal growth modeling (PHY)
- J. Lundberg, Karst, Quaternary studies, geochronology (GEOGCU)
- S. McKinnon, Rock mechanics, Mining engineering (CU-Adjunct)
- Larry Meinert, Terroir for wine production and skarn deposits, mineral deposits in carbonate rocks (UO-Adjunct)
- F.A. Michel, Isotope geochemistry, groundwater and permafrost studies (CU)
- D. Motazedian, Engineering seismology (CU)
- D. Murphy, Structural geology and tectonics, geology of the Canadian Cordillera (CU-Adjunct)

- T. Murty, Climate and ocean-atmosphere interaction; natural hazards risk assessment and natural marine hazards, physical oceanography (OU-Adjunct)
- Dogan Paktunc, Applied mineralogist; mineralogical characterization of metals in ore deposits and mine wastes (OU-Adjunct)
- R.T. Patterson, Micropaleontology specializing in foraminifera (CU)
- J.A. Percival, Igneous and metamorphic petrology, geochemistry, structural geology, geochronology (UO-Adjunct)
- L. Poissant, Atmospheric toxic processes, mercury, pesticides, air-surface gas exchanges, geochemistry
- A. Prokoph, Mathematical geology, quantitative stratigraphy, paleoclimatology (CU-Adjunct)
- R.H. Rainbird, Precambrian sedimentology and stratigraphy (CU-Adjunct)
- G. Ranalli, Rheology of the Earth, geodynamics, plate tectonics (CU)
- D.G. Rancourt, Mössbauer spectrometry, mineralogy, geobarometry, geothermometry, micas (PHY)
- P. Rasmussen, Environmental biochemistry (UO-Adjunct)
- M.R. Robin, Contaminant hydrogeology, geostatistics, geomathematics (UO)
- H. Roe, Quaternary geology (CU-Adjunct)
- N. Rybcznski, Evolution of Mesozoic and Cenozoic terrestrial communities in the Canadian Arctic (CU-Adjunct)
- C. Samson, Applied geophysics (CU)
- C.J. Schröder-Adams, Micropaleontology, biostratigraphy, paleoecology, foraminifera, sequence stratigraphy (CU)
- David Sharpe, Glacial sediments (OU-Adjunct)
- M.W. Smith, Permafrost, microclimate, soil freezing (GEOGCU)
- R. Smith, Applied geophysics, airborne electromagnetic and magnetic methods (CU-Adjunct)
- R.P. Taylor, Mineral deposits, resource studies (CU)
- J.K. Torrance, Soil chemistry, clays, oxide minerals and geotechnical problems (GEOGCU)
- L. Trichtchenko, Investigations of space weather events from their origin on the Sun to their effects on the ground
- J. Veizer, Sedimentary geochemistry, carbonates, diagenesis, ores, Precambrian sedimentology (UO)
- D. White, Crustal geophysics, crustal seismology (CU-Adjunct)

Master of Science

Admission Requirements

The requirement for admission to the program is an Honours B.Sc. degree, with at least high honours standing, in geology or a related discipline.

Program Requirements

- 1.5 credit of course work, 0.5 credit of which may be at the senior undergraduate level
- A research thesis (3.5 credits) defended at an oral examination
- A public lecture, preceding the oral examination, which is based on the thesis research
- Participation in the OCGC Seminar Series (0.0 credit). Participation comprises one lecture (open to all members of the OCGC) describing an aspect of the candidate's research study and must be completed within 12 months of their registration in the M.Sc. program.

Academic Standing

A grade of B- or higher is required for each course counted towards the Master's degree.

Doctor of Philosophy

Admission Requirements

The requirement for admission to the Ph.D. Program is an M.Sc. degree in Earth Sciences or a related discipline.

Program Requirements

- A research thesis (9.0 credits), defended at an oral examination before an examination board that includes an external examiner
- A public lecture, preceding the oral examination, which is based on the thesis research
- A minimum of 1.0 credit of course work at the graduate level. Additional courses may be prescribed by the thesis advisory committee
- A comprehensive examination conducted by the thesis advisory committee. The comprehensive examination includes the presentation of a thesis proposal and involves three areas of geoscience specialization chosen by the student's advisory committee and approved by the Director of the Ottawa-Carleton Geoscience Centre
- Participation in the OCGC Seminar Series (0.0 credit). Participation comprises one lecture (open to all Members of the OCGC) describing an aspect of the candidate's research study and must be completed within 12 months of their registration in the Ph.D. program.

Residence Requirement

The residence requirement for the Ph.D. degree is at least four terms of full-time study.

Graduate Courses

The following course are offered by Carleton University. For information on all courses offered by the Centre, please see the section for the Centre in this Calendar. Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at **central.carleton.ca**. University of Ottawa course numbers appear in parentheses after the Carleton course number and credit information.

ERTH 5001 [0.5 credit] (GEO 5301)
Seminars in Earth Sciences I
One-term modular courses covering a spectrum of Earth Science topics and current research problems, ranging from the geology and geophysics of the solid Earth, to its surface environment and crustal resources. A minimum of four modules offered per term, three must be completed to obtain course credit. Students may not take a module for credit that is offered by their supervisor, but may do so with the permission of the OCGC Director. Choice of modules must be approved by the OCGC Director. Course complements ERTH 5002.

ERTH 5002 [0.5 credit] (GEO 5302)
Seminars in Earth Sciences II
One-term modular courses covering a spectrum of Earth Science topics and current research problems, ranging from the geology and geophysics of the solid Earth, to its surface environment and crustal resources. A minimum of four modules offered per term, three must

be completed to obtain course credit. Students may not take a module for credit that is offered by their supervisor, but may do so with the permission of the OCGC Director. Choice of modules must be approved by the OCGC Director. Course complements ERTH 5001.

ERTH 5202 [0.5 credit] (GEO 5122)

Advanced Igneous Petrology

Integrates physical and chemical processes with the dynamics of magmatic systems to understand igneous processes.

ERTH 5204 [0.5 credit] (GEO 5123)

Geology and Geochemistry of Ore Deposits

Advanced aspects of geology, geochemistry, genesis, and exploration of ore deposits. Laboratory and field examination of different ore deposit types and their host rocks.

ERTH 5305 [0.5 credit] (GEO 5135)

Carbonate Sedimentology

Aspects of modern depositional systems, dynamic facies models, sequence stratigraphy, mineralogy, and diagenesis of carbonate sediments. The practical part of the course will consist of a field-laboratory project that integrates various techniques in carbonate sedimentology (mapping, petrography, staining, cathodoluminescence, fluorescence, SEM).

ERTH 5306 [0.5 credit] (GEO 5136)

Paleobiology

Extinctions, micro- and macro-evolutionary processes, long-term trends and cycles in the Phanerozoic; functional morphology; application of invertebrates to biostratigraphy, paleoceanography and paleolimnology..

ERTH 5403 [0.5 credit] (GEO 5143)

Environmental Isotopes and Groundwater Geochemistry

Stable environmental isotopes (18O, 2H, 13C, 34S, 15N) in studies of groundwater origin and flow, and geothermal studies. Groundwater dating techniques involving tritium and radio-carbon, and exotic radioisotopes (e.g.,36Cl, 39Ar, 85Kr). Low temperature aqueous geochemistry and mineral solubility with emphasis on the carbonate system. Some application to paleoclimatology will be discussed.

ERTH 5406 [0.5 credit] (GEO 5146)

Techniques of Groundwater Resources Evaluation

Governing groundwater flow equations, initial and boundary conditions; simple numerical solutions (spreadsheets); complex numerical solutions (commercial software); and analytical solutions. Applications: aquifer response test analysis, capture zone analysis, groundwater flow modeling, water budgeting, and aquifer vulnerability assessment.

ERTH 5501 [0.5 credit] (GEO 5151)

Precambrian Geology

Geology and tectonic history of the Canadian Shield, emphasizing modern four-dimensional interpretations (2D mapping, depth, time); comparison and correlation with other Precambrian shields; global Precambrian tectonic evolution through review of continental reconstructions; Precambrian mineral deposits; field trips and research projects.

ERTH 5507 [0.5 credit] (GEO 5157)

Tectonic Processes Emphasizing Geochronology and Metamorphism

Applications of empirical, analytical and quantitative techniques to problems in regional geology and crustal tectonics; orogenic processes; heat and metamorphism; isotopic geochronology as applied to thermal history.

ERTH 5600 [0.5 credit] (GEO 5160)

Chemistry of the Earth

An examination of the composition of the mantle and crust in selected tectonic settings, such as subduction zones and hot spots. Topics may include how geochemical data constrain geodynamic settings of study areas.

ERTH 5603 [0.5 credit] (GEO 5163)

Stable Isotope Geochemistry

Mechanisms of isotope fractionation in nature; physical and chemical isotope fractionation, kinetic isotope effects. Variation of stable isotope ratios (hydrogen, carbon, oxygen and sulphur) in nature. Preparation techniques of natural samples for isotope analysis. Applications of stable isotopes to study magma genesis, ore genesis, nature of water and formation fluids and sedimentary environments.

ERTH 5609 [0.5 credit] (GEO 5169)

Radiogenic Isotope Geochemistry

Nucleosynthesis; chemical differentiation of the Earth. Evolution of large-scale isotopic reservoirs. Isotopic tracers (143Nd/144Nd, 87Sr/86Sr, common Pb). Geochronology; fundamentals and application of Sm/Nd, Rb/Sr, U/Pb, K/Ar and Lu/Hf methods. Evolution of the solid Earth from the isotopic perspective.
Precludes additional credit for Geology 67.565 (GEO 5165) (taken before 1997-98).

ERTH 5701 [0.5 credit] (GEO 5171)

Physics of the Earth

The physics and dynamics of the solid Earth: seismology; gravitational and magnetic fields, thermal state. Geophysical constraints on the structure and composition of the interior. Geodynamic processes.

ERTH 5703 [0.5 credit] (GEO 5173)

Structural Geology

Deformation processes and the analysis of geological structures at all scales.

ERTH 5704 [0.5 credit] (GEO 5174)

Tectonics

Dynamic and geological aspects of plate tectonics throughout Earth history.

ERTH 5707 [0.5 credit] (GEO 5177)

Engineering Seismology

Seismological topics with engineering applications. Characterization of seismicity and seismic sources (areas and faults). Seismic hazard analysis. Empirical and theoretical modeling of strong ground motion in time and frequency domain.

ERTH 5708 [0.5 credit] (GEO 5178)

Earthquake Signal Processing

Theoretical and practical aspects of earthquake signal processing, seismic instrumentation, instrument response and application of spectral analysis and response spectra.

ERTH 5900 [1.0 credit] (GEO 5190)

Directed Studies

Directed reading and/or laboratory studies for 1.0 credit course, under the guidance of selected extramural or intramural directors. A written description of the project must be submitted for departmental approval prior to registration. This course does not count for credit toward the graduate degree requirements.

ERTH 5901 [0.5 credit] (GEO 5191)

Directed Studies

Directed reading and/or laboratory studies for 0.5 credit course, under the guidance of selected extramural or intramural directors. A written description of the project must be submitted for departmental approval prior to registration. This course does not count for credit toward the graduate degree requirements.

ERTH 5903 [0.5 credit] (GEO 5193)

Field Studies

Systematic investigations of geological problems, based on a minimum of fifteen days field work plus related library research and laboratory projects. Written report required.

ERTH 5906 [0.0 credit]

M.Sc. Geoscience Seminar
Participation in the Geoscience Seminar Series.

ERTH 5907 [0.0 credit]

Ph.D. Geoscience Seminar
Participation in the Geoscience Seminar Series.

ERTH 5909 (GEO 7999)

M.Sc. Thesis
A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

ERTH 6909 (GEO 9999)

Ph.D. Thesis
A thesis proposal must be approved by the research advisory committee by the end of the first year of registration.

Economics

Loeb Building C877
Telephone: 613-520-3743
Fax: 613-520-3906
E-mail: economics@carleton.ca
carleton.ca/economics

The Department

Chair of the Department: K.G. Armstrong
M.A. Supervisor: P.J. Coe
Ph.D. Supervisor: C. Worswick
Director of Joint Doctoral Program with the University of Ottawa: C. Worswick

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

Qualifying-Year Program

Applicants who lack the required undergraduate preparation may be admitted to a qualifying-year program designed to raise their standing to honours status. If successful, they may be permitted to proceed to the master's program the following year.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is a B.A. (Honours) (or the equivalent) in Economics, with an average grade of B+ or higher.

Applicants are expected to have had adequate preparation in microeconomic and macroeconomic theory, econometrics, and mathematics. This could be satisfied, for example, by having completed undergraduate courses in the following areas: advanced microeconomic theory, advanced macroeconomic theory, econometrics, mathematical analysis in economics, and statistical analysis in economics. Students with deficiencies in their preparation may have their program requirements extended accordingly.

The Department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Program Requirements

All master's students in economics must fulfil the following requirements:

- ECON 5000, ECON 5002, ECON 5005

In addition, each candidate must select and complete one of the following:

- ECON 5006 and approved courses for 2.0 credits, 1.0 of which may be selected from among those offered in a related discipline, with approval of the Department, through the M.A. Supervisor; or
- A thesis equivalent to 1.5 credits and approved courses for 1.0 credit.

Concentration in Financial Economics

Master’s students in economics may pursue a concentration in financial economics, in which case they must fulfil the following requirements:

ECON 5000, ECON 5002, ECON 5005, ECON 5051, ECON 5052

In addition, each concentration candidate must select and complete one of the following:

- ECON 5006 and approved courses for 1.0 credit, including at least one of ECON 5055, ECON 5058, ECON 5602, ECON 5608; or
- A thesis equivalent to 1.5 credits.

All approved courses normally will be taken at the 5000 level.

Internship Placement

An Internship option is available to full-time students in the M.A. program who are eligible to work in Canada. Registration in the Internship option requires departmental permission and is limited by availability of placements. Application for an internship placement will be considered after the student completes ECON 5000, ECON 5002, ECON 5005 and ECON 5006, or after completion of 3.0 credits.

Internship placements will locate students for at least one term in the public service, the private sector, or non-governmental organizations. Students will integrate theoretical and applied economic analysis in their work experience. During their work term, students are required to register in ECON 5902 (Internship Placement), which is additional to the aforementioned program requirements. While taking ECON 5902, students are considered to be part-time, and may register for at most 1.0 credit in total.

Academic Standing

A grade of B- or higher must normally be received in each credit counted towards the master's degree. With respect to the required core credits in the program, ECON 5000, ECON 5002, ECON 5005 and ECON 5006, there will be no exceptions. A candidate may, with the recommendation of the Department and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in up to 1.0 credit.

Guidelines for Completion of Master's Degree

Full-time master's students are expected to complete their requirements within two terms. Part-time students will take a minimum of five terms but must complete within an elapsed period of six calendar years, as set out in Section 13 of the General Regulations of this Calendar.

Doctor of Philosophy

The doctoral program is offered jointly by the Departments of Economics at Carleton University and the University of Ottawa.

The Ph.D. program stresses the application of economic theory to the analysis of Canadian economic policy and economic development. Six areas of specialization are available for intensive study and thesis research: economic development, economics of the environment, industrial organization, international economics, monetary economics, and public economics. The program of courses and thesis guidance, drawing upon the faculty of the two departments, will encompass course requirements, policy-oriented workshops, comprehensive examinations, and a thesis. Students are expected to have, or to acquire, proficiency in mathematics and statistics before proceeding with the program.

In cases of exceptional merit, Ph.D. candidates may be accepted on a part-time basis.

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree (or the equivalent) from a recognized university, with high honours standing. The Department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and who demonstrates high promise for advanced research during the master's program may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without completing the M.A. program:

- The student will have completed ECON 5000, ECON 5002, and ECON 5005;
- The student must make formal application to the graduate studies committee;
- Students permitted to transfer into the Ph.D. program will be required to complete the equivalent of 13.5 credits of which 6.0 or 7.0 credits will be assigned to the Ph.D. Thesis, depending on the student's background and grades at the time of the transfer;
- Students who have taken ECON 6000 and/or ECON 6002 as part of the M.A. curriculum will be granted advanced standing in these courses.

Program Requirements

Notwithstanding additional course work that may be required by the admissions committee as a condition of entry, students admitted to the Ph.D. program are required to complete:

- 4.0 credits in ECON 6000, ECON 6002, ECON 6005, ECON 6900, ECON 6902, ECON 6905, ECON 6907, ECON 6908; and
- 2.0 credits in economics electives; and

- A thesis equivalent to 5.0 credits.

Students are also required to do course work in two of six fields of specialization leading to a field comprehensive examination and the writing of a thesis. To fulfil this requirement, students must pass, within twenty-four months of beginning full-time study, at least two of the three courses associated with each of two chosen fields as well as a comprehensive examination in one of them (ECON 6905).

The courses in the six fields of specialization are:

Economic Development
ECON 5500, ECON 5504, ECON 5505
Economics of the Environment
ECON 5507, ECON 5803, ECON 5804
Industrial Organization
ECON 5301, ECON 5302, ECON 5303
International Economics
ECON 5601, ECON 5602, ECON 5603
Monetary Economics
ECON 5606, ECON 5607, ECON 5609
Public Economics
ECON 5401, ECON 5402, ECON 5403

Comprehensive Examinations

Although not compulsory, a candidate may be required by an examining committee to sit an oral examination.

Theory
Each student will register in ECON 6900 and ECON 6902 in order to write the comprehensive examinations in microeconomic and macroeconomic theory. Both of these examinations must be successfully completed within twelve months of beginning full-time study. Students who fail to meet this requirement will normally be withdrawn from the Ph.D. program.
Primary Field
Each student will register in ECON 6905 in order to write a comprehensive examination in his or her chosen field. This examination must be successfully completed within twenty-four months of beginning full-time study. Students who fail to meet this requirement will normally be withdrawn from the Ph.D. program.

Seminar Attendance

Students who have completed the comprehensive examinations in microeconomic and macroeconomic theory will be required to attend a minimum of eight departmental seminars in economics during each academic year until they have submitted their thesis to the Faculty of Graduate Studies and Research.

Thesis Requirements

Doctoral students will write and defend a Ph.D. thesis. In preparing the thesis, the student is required to give two thesis workshops. In the first (ECON 6907), a research proposal for the thesis will be presented for evaluation by at least three faculty members. In the second (ECON 6908), a substantial portion of the research for the thesis will have been completed and will be presented and evaluated as above.

Academic Standing

Doctoral students normally must obtain a grade of B- or higher in each credit counted towards the degree.

Guidelines for Completion of Ph.D. Degree

Full-time Ph.D. students are expected to complete their requirements within four calendar years. Students who undertake the program by a combination of full-time and part-time study must complete their degree requirements within an elapsed period of eight calendar years, as set out in the General Regulations section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Enrolment in graduate courses requires the permission of the Department, through the M.A. or Ph.D. Supervisor.

Corresponding University of Ottawa course numbers, where applicable, appear in parentheses following the Carleton course number.

Update ECON 5806 and ECON 5807 are no longer offered and have been removed from the course list (Update posted April 8, 2009)

ECON 5000 [0.5 credit]
Microeconomic Theory
Theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price determination.
Precludes additional credit for ECON 5001.

ECON 5002 [0.5 credit]
Macroeconomic Theory
Macroeconomic theory and its implications for economic policy are surveyed in this course, comparing alternative approaches for a variety of topics.

ECON 5005 [0.5 credit]
Econometrics I
An introduction to econometrics at the graduate level. Topics include the analysis and treatment of univariate and multivariate regression models, GLS, IV, and maximum likelihood estimation, hypothesis testing, seemingly unrelated regression models, and simultaneous equations models, together with relevant economic applications.

ECON 5006 [0.5 credit]
Methods of Economic Research
Formulation, specification and analysis of economic and econometric models; derivation of policy implications; communication of results and economic methodology.
Prerequisites: ECON 5000 (ECON 5001 if taken before 2007-2008) and ECON 5005, or permission of the Department.

ECON 5010 [0.5 credit] (ECO 7125, ECO 7525)
Mathematical Economics
General equilibrium; dynamic optimization; game theory.
Precludes additional credit for ECON 5205.

ECON 5051 [0.5 credit]
Asset Pricing
Value, the dynamic optimization problems of firms and investors, risk-neutral pricing, and related topics.

ECON 5052 [0.5 credit]
Financial Markets and Instruments
Capital structure, debt financing, options, financial planning, corporate governance, and related topics.

ECON 5055 [0.5 credit]
Financial Econometrics
The econometrics of empirical finance including parametric and nonparametric models of volatility, evaluation of asset-pricing theories, and models for risk management and transactions data.
Prerequisite: ECON 5005 (or equivalent).

ECON 5058 [0.5 credit]
Advanced Topics in Financial Economics
Current research in financial economics. Topics may include theoretical analysis, quantitative methods, policy issues, and applications to the financial industry.
Prerequisite: ECON 5051 or ECON 5052, which may be taken concurrently with ECON 5058.

ECON 5209 [0.5 credit] (ECO 6106, ECO 6506)
Selected Topics in the History of Economic Thought
The development of economic thought through time in relation to selected economic problems. Also offered at the undergraduate level, with different requirements, as ECON 4209, for which additional credit is precluded.
Precludes additional credit for ECON 5201 and ECON 5202.

ECON 5230 [0.5 credit]
Economic History
The application of economic theory and quantitative techniques to selected topics in economic history, which may include historical patterns of growth and welfare, nineteenth-century globalization, technological change, the development of agriculture, industrialization, the Great Depression, and the origins of central banks.

ECON 5301 [0.5 credit] (ECO 6140, ECO 6540)
Firms and Markets
Theories pertaining to industrial organization and their application to industries in Canada and elsewhere by way of empirical studies.

ECON 5302 [0.5 credit] (ECO 6141, ECO 6541)
Competition Policy
An examination of the rationale and application of competition policy with particular attention to the Canadian economy.

ECON 5303 [0.5 credit] (ECO 6142, ECO 6542)
Regulation and Public Enterprise
An examination of regulation and public enterprise as alternative approaches for influencing industry conduct and performance.

ECON 5309 [0.5 credit]
Applied Industrial Economics
The application of industrial economics, with special emphasis on Canada and the rest of North America. Topics include the structure of consumer demand, firm production and investment, industrial structure and international trade, and the effect of government policies on industrial development.

ECON 5361 [0.5 credit] (ECO 6191, ECO 6591)

Labour Economics I

The application of microeconomic and macroeconomic theory to the labour market. Topics include labour supply and labour demand, wage determination, human capital, and the economics of education, and unemployment.
Precludes additional credit for ECON 5360 and ECON 5307.

ECON 5362 [0.5 credit] (ECO 6192, ECO 6592)

Labour Economics II

Personnel economics and contract theory. Topics include the economics of unions, discrimination, the economics of the household, gender and fertility, and labour mobility.

ECON 5363 [0.5 credit] (ECO 6193, ECO 6593)

Advanced Topics in Labour Economics

Topics may include program evaluation, inequality, labour markets and health, labour markets and crime, and the structural estimation of labour market models.
Precludes additional credit for ECON 5360 and ECON 5307.

ECON 5401 [0.5 credit] (ECO 6130, ECO 6530)

Public Economics: Expenditures

A discussion of the role of government expenditures, both in theory and with reference to the Canadian economy.

ECON 5402 [0.5 credit] (ECO 6131, ECO 6531)

Public Economics: Taxation

Analysis of the effects of various forms of taxation on economic performance.

ECON 5403 [0.5 credit] (ECO 6133, ECO 6533)

Public Choice

The integration of economics and politics to provide a broader understanding of the evolution of the public sector. The consequences of political institutions for the allocation and distribution of resources. Applications to a variety of Canadian and international policy issues.

ECON 5404 [0.5 credit] (ECO 6132, ECO 6532)

Fiscal Federalism

Economic aspects of federalism, including efficiency, redistribution, consideration of a federal system of government, intergovernmental grants, and problems of stabilization policy in a federal context.

ECON 5407 [0.5 credit]

Cost-Benefit Analysis and Project Evaluation

Techniques and problems in cost-benefit analysis and the evaluation of public and private projects. Topics may include surplus measurement, investment decision rules, shadow pricing, the valuation of non-marketed goods, distributive weights, and the evaluation of projects involving uncertainty, loss of life, and/or population change.

ECON 5500 [0.5 credit] (ECO 6170, 6570)

Theory of Economic Development

Theoretical approaches of the economic development literature in relation to the historical, economic, environmental, social, and political dimensions of the development process.

ECON 5504 [0.5 credit] (ECO 6171, ECO 6571)

Economic Development: Internal Aspects

Major domestic problems of economic development. Topics may include employment, income distribution, choice of technology, sectoral allocation of resources, human resource development, and domestic environmental issues.

ECON 5505 [0.5 credit] (ECO 6172, ECO 6572)

Economic Development: International Aspects

Key problems of international economic development such as trade in primary commodities and manufactures, financial flows and debt, the role of multinational corporations, the transfer

of technology, and the international dimensions of environmental issues as they relate to developing countries.

ECON 5507 [0.5 credit] (ECO 6173, ECO 6573)
Environmental Aspects of Economic Development
Policy aspects of sustainable economic development and environmental quality in developing countries. Topics may include energy use, deforestation, drought and desertification, depletion of natural resources, debt, environment and poverty, sustainable industrial and agricultural development, conservation policies, pollution control, and global environmental issues.

ECON 5601 [0.5 credit] (ECO 6160, ECO 6560)
International Trade: Theory and Policy
International trade theory and its implications for economic policy, with emphasis on topics such as determinants of trade and specialization, gains from trade and commercial policy, international factor mobility, growth, and development.

ECON 5602 [0.5 credit] (ECO 6161, ECO 6561)
International Monetary Theory and Policy
Key aspects of international monetary theory and policy, with emphasis on topics such as sources of equilibrium and disequilibrium in the balance of payments, balance-of-payments adjustment under fixed versus flexible exchange rates, international capital movements, and recent issues in the international monetary system.

ECON 5603 [0.5 credit] (ECO 6162, ECO 6562)
Topics in International Economics
Key topics in international economics, including theoretical analysis, quantitative methods and policy formulation, implementation, and evaluation.
Prerequisite: ECON 5601 or ECON 5602, which may be taken concurrently with ECON 5603.

ECON 5606 [0.5 credit] (ECO 6180, ECO 6580)
Microeconomic Aspects of Monetary Theory
Microeconomic foundations of monetary theory. Alternative theories for the existence of money. Commodity, private and fiat money systems. The integration of monetary theory with the theory of value.

ECON 5607 [0.5 credit] (ECO 6181, ECO 6581)
Macroeconomic Aspects of Monetary Theory
Monetary theory and the macroeconomic interactions of money. Topics may include: inflation, money and wealth; the optimum quantity of money; the welfare aspects of monetary economies; the supply of money and its composition; stabilization policy; money, capital, and growth.

ECON 5608 [0.5 credit] (ECO 6182, ECO 6582)
Aspects of Financial Intermediation
The evolution of the financial system with emphasis on the theory of financial institutions and its interrelationship with the money supply process and the central bank. Contemporary monetary and finance theory applied to institutional problems in both historical and contemporary settings.

ECON 5609 [0.5 credit] (ECO 6183, ECO 6583)
Explorations in Monetary Economics
Explorations in theory, policy recommendations, and empirical study. Course material challenges traditional approaches by examining such topics as the endogeneity of money, the role of credit, the finance motive, the circuit approach, flow-of-funds analysis, and austerity policies.

ECON 5700 [0.5 credit]

Social and Economic Measurement

Index number theory and national accounting. Topics may include: biases in indexes, inflation accounting, the theory of international comparisons, and the measurement of business and personal income, capital and depreciation, and productivity.

ECON 5712 [0.5 credit] (ECO 6175, ECO 6575)

Micro-Econometrics

Analysis of the concepts and tools used in micro-econometrics with particular focus on empirical applicability. Topics may include discrete choice models, limited dependent variables, panel data, duration models, and program evaluation, together with relevant economic applications.
Precludes additional credit for ECON 5702.
Prerequisite: ECON 5005 (or equivalent).

ECON 5713 [0.5 credit] (ECO 6176, ECO 6576)

Time-Series Econometrics

Analysis of the concepts and tools used in time-series econometrics with particular focus on empirical applicability. Topics may include cointegration analysis, error-correction models, VAR models, volatility analysis, and non-linear time-series models, together with relevant economic applications.
Precludes additional credit for ECON 5703.
Prerequisite: ECON 5005 (or equivalent).

ECON 5801 [0.5 credit]

Regional Economics

Regional economic disparities in Canada, theories and public policy relating thereto. Consideration will be given to the concept of regions, location of industry and industrial structure, and to growth determinants.

ECON 5802 [0.5 credit]

Urban Economics

The economic properties of urban areas. Attention will be focused on the macrodynamics of urban development, together with the microstatics of the equilibrium properties of the urban land market.

ECON 5803 [0.5 credit] (ECO 6143, ECO 6543)

Economics of Natural Resources

Dynamic optimization; theory of renewable and non-renewable natural resources, including the environment; policy options for correcting market failures.
Precludes additional credit for ECON 5305.

ECON 5804 [0.5 credit] (ECO 6151, ECO 6551)

Economics of the Environment

The environment as natural capital; environmental valuation techniques; elements of environmental income accounting; sustainable development theories and practice; institutional questions and policy issues.
Precludes additional credit for ECON 5306.
Prerequisite: ECON 5803.

ECON 5821 [0.5 credit]

Canadian Economy I

Aspects and problems of the Canadian economy. Topics may include the economic development of Canada, regional development, industrial organization, factor markets, income distribution, international trade and capital flows, and macroeconomic stability.
Precludes additional credit for ECON 5101.

ECON 5822 [0.5 credit]

Canadian Economy II

Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution, and aggregate economy.
Precludes additional credit for ECON 5102.

ECON 5840 [0.5 credit]

Law and Economics

The interrelationships between law and economics, emphasizing transaction costs and property rights. Economic analysis of such topics as the allocative effects of alternative property rights, contract, tort, and nuisance law, and the economics of crime, pollution, pay television, and eminent domain.
Precludes additional credit for ECON 5308.

ECON 5880 [0.5 credit]

Special Topics

Topics may vary from year to year and are announced in advance of the registration period.
Prerequisite: permission of the Department.

ECON 5902 [0.5 credit]

Internship Placement

Internship students are required to register in this course during their work term.
Prerequisite: permission of the Department.

ECON 5904 [0.5 credit]

Directed Readings

This course is designed to permit students to pursue research on topics chosen in consultation with faculty members and the M.A. Supervisor.
Prerequisite: permission of the Department.

ECON 5906 [0.5 credit]

Directed Research

At least one paper will be required of a student enrolled in this course.
Prerequisite: permission of the Department.

ECON 5909 [1.5 credit]

M.A. Thesis

ECON 6000 [0.5 credit] (ECO 7922)

Economic Theory: Microeconomics

Critical aspects of microeconomic theory drawn from recent analysis of consumer behaviour, costs and production, transaction costs, uncertainty, and the organization of economic activity.
Prerequisite: ECON 5000 (or equivalent).

ECON 6002 [0.5 credit] (ECO 7923)

Economic Theory: Macroeconomics

Critical aspects of macroeconomic theory drawn from recent analysis of the microeconomic foundations of macroeconomics, concepts of macroeconomic equilibrium, and the impact of monetary and fiscal disturbances. Attention is also directed to a variety of topics related to the conduct of macroeconomic policy.
Precludes additional credit for ECON 6001.
Prerequisite: ECON 5002 (or equivalent).

ECON 6005 [0.5 credit] (ECO 7126, ECO 7526)

Econometrics II

Statistical foundations of econometrics: estimation, inference, and decision theory. Topics may include likelihood and moment-based inference, asymptotic theory, semi-parametric and non-parametric models, Bayesian approaches, and structural models, together with relevant economic applications.

Precludes additional credit for ECON 5701.
Prerequisite: ECON 5005 (or equivalent).

ECON 6714 [0.5 credit] (ECO 7177, ECO 7577)
Advanced Topics in Econometrics
Coverage of one or more areas of current econometric research.
Prerequisite: ECON 6005.

ECON 6900 [0.5 credit] (ECO 7990)
Comprehensive Examination in Microeconomic Theory

ECON 6902 [0.5 credit] (ECO 7991)
Comprehensive Examination in Macroeconomic Theory

ECON 6903 [0.0 credit]
Seminar Attendance

ECON 6904 [0.5 credit] (ECO 7980)
Directed Readings
This course is designed to permit students to pursue research on topics chosen in consultation with faculty members and the Ph.D. Supervisor.
Prerequisite: permission of the Department.

ECON 6905 [0.5 credit] (ECO 9990)
Comprehensive Examination in Primary Field

ECON 6907 [0.5 credit] (ECO 7002)
Thesis Workshop I

ECON 6908 [0.5 credit] (ECO 7004)
Thesis Workshop II

ECON 6909 [5.0 credits] (ECO 9999)
Ph.D. Thesis

Ottawa-Carleton Institute for Electrical and Computer Engineering

Carleton University
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Ottawa, ON, Canada K1S 5B6
Telephone: 613-520-5659
Fax: 613-520-3899
Web site: www.ociece.ca

The Institute

Director of the Institute: Jianping Yao

The Institute was established in 1983. By combining the programs and resources of the Departments of Electronics, Systems and Computer Engineering at Carleton University and the School of Information Technology and Engineering (SITE) at the University of Ottawa, OCIECE has become one of the largest electrical and computer engineering graduate studies/research groups in Canada. Programs leading to master's and Ph.D. degrees are available through the Institute in a wide range of fields of electrical and computer engineering.

Members of the Institute

The home department of each member is indicated by (DOE) for the Department of Electronics, Carleton University; (SCE) for the Department of Systems and Computer Engineering, Carleton University; (SITE) for the School of Information Technology and Engineering, University of Ottawa.

The following codes identify the Research Fields:

CAD Computer-Aided Design for Electronic Circuits
CSE Computer and Software Engineering
CCN Computer Communication Networks and Distributed Systems
DWC Digital and Wireless Communications
ME Microwave and Electromagnetics
SSIP Signal, Speech and Image Processing
ICD Integrated Circuits and Devices
SMI Systems and Machine Intelligence
PS Photonic Systems
BE Biomedical Engineering

A. Aboulnasr, SSIP (SITE)
R. Achar, *CAD, ME, ICD* (DOE)
C. Adams, *CSE, CCN, DWC* (SITE)
A. Adler, *SSIP, BE* (SCE)
N.U. Ahmed, *DWC, SSIP* (SITE)
V. Aitken, *SMI, SSIP* (SCE)
S.A. Ajila, *CSE, SMI* (SCE)
J. Albert, PS, ME (DOE)
A. Al-Dhaher, CSE, SMI (SITE)
S. Ali, DWC, SSIP (SCE-Adjunct)
D. Amyot, CSE (SITE)
H. Anis, *PS*, *BE* (SITE)
A. Arya, CSE, CCN (SCE)

A. Banihashemi, *DWC*, *SSIP* (SCE)
C. Barrière, *SMI* (SITE-Adjunct)
P. Berini, *PS*, *ME* (SITE)
G. von Bochmann, *CSE*, *CCN* (SITE)
M. Bolic, *SSIP*, *CSE* (SITE)
M. Bouchard, *SSIP*, *SMI*, *DWC* (SITE)
A. Boukerche, *CSE* (SITE)
L. Briand, *CSE* (SCE)
A. Chan, *BE*, *SSIP* (SCE)
J.W. Chinneck, *SMI*, *CSE* (SCE)
J. Chouinard, *DWC*, *SSIP*, *CCN* (SITE-Adjunct)
D.C. Coll, *CCN*, *SSIP* (SCE)
A. Cuhadar, *SSIP*, *BE* (SCE)
C. D'Amours, *DWC*, *SSIP* (SITE)
F. Danilo-Lemoine, *DWC* (SCE)
R.M. Dansereau, *SSIP*, *BE*, *DWC* (SCE)
R. Dekemp, *BE* (SITE)
G.Y. Delisle, *DWC* (SITE - Adjunct)
H. Ding, *SSIP* (SITE - Adjunct)
E. Dubois, SSIP, SMI, DWC (SITE)
A. El Saddik, *CCN*, *CSE*, *BE* (SITE)
M.S. El-Tanany, *DWC*, *SSIP*, *CCN* (SCE)
M. Elhadef, *SMI, CSE* (SITE)
B. Esfandiari, *SMI, CSE, CCN* (SCE)
A. Fahim, CSE, ME (SITE)
D.D. Falconer, *DWC* (SCE)
F. Famili, *SMI* (SITE-Adjunct)
N. Fong, *ICD* (DOE-Adjunct)
R.G. Franks, *CSE, CCN* (SCE)
M. Frize, *BE, SMI, SSIP* (SITE and SCE)
E. Gad, *CAD, ME* (SITE)
P.A. Galko, *DWC, PS* (SITE)
R. Gauthier, *DWC, ISD* (DOE)
N.D. Georganas, *CCN, CSE* (SITE)
D.T. Gibbons, *BE, SSIP, CSE* (SITE)
C. Giguere, *BE, SSIP* (SITE)
R.A. Goubran, *SSIP, BE, DWC* (SCE)
J.R. Green, *SMI, SSIP* (SCE)
V. Groza, *CSE, SMI, BE* (SITE)
W. Gueajeb *SMI* (SITE)
P. Gunupudi, *CAD* (DOE)
R. Habash *BE* (SITE)
R.H.M. Hafez, *BWC, CCN* (SCE)
T. Hall *PS* (SITE)
R. Harrison, *ME, ICD* (DOE)
C. Huang, *CCN, PS* (SCE)
J. Huang, *CCN* (SCE - Adjunct)
D. Inkpen, *SMI* (SITE)
D. I.A. Ionescu, *CCN, CSE* (SITE)
N. Japkowicz, *SMI* (SITE)
P. Jay, *SSIP* (SITE - Adjunct)
C. Joslin, *CSE, SMI* (CSIT & SCE)
A. Karmouch, *CCN, CSE, SMI* (SITE)
J.P. Knight, *SMI, CAD, DWC* (DOE)
T. Kunz, *CCN, CSE* (SCE)
T.A. Kwasniewski, *ICD, DWC* (DOE)

Y. Labiche, *CSE* (SCE)
R. Laganière, *SSIP, SMI* (SITE)
D. Landheer, *ICD* (DOE - Adjunct)
J. Lang, *CSE, SSIP, SMI* (SITE)
W. Lee, *CSE*, *SSIP*, *SMI* (SITE)
T. Lethbridge, *CSE* (SITE)
R. Liscano, *CSE, CCN, SMI* (SITE)
P. Liu, *SMI, BE, CCN* (SCE)
S. Loyka, *DWC, ME* (SITE)
C.H. Lung, *CSE, CCN* (SCE)
L. MacEachern, *ICD, DWC, PS* (DOE)
S.A. Mahmoud, *DWC, CCN, SSIP* (SCE)
S. Majumdar, *CSE, CCN* (SCE)
D. Makrakis, *CCN, DWC* (SITE)
Y. Mao, *DWC* (SITE)
I. Marsland, *DWC* (SCE)
R. Mason, *ICD* (DOE)
A. Matrawy, *CCN, CSE* (SCE)
S. Matwin, *SMI* (SITE)
D. McNamara, *ME* (SITE)
A. Miri, *CCN, CSE, DWC* (SITE)
H.T. Mouftah, *DWC, CCN* (SITE)
L. Moura, *CSE, CCN* (SITE)
M.S. Nakhla, *CAD, ME, ICD* (DOE)
A. Nayak, *CSE, CCN* (SITE)
Y. Ono, SSIP (SCE)
B. Pagurek, *CSE, CCN* (SCE)
P. Payeur, *SMI, SSIP* (SITE)
T. Pearce, *CSE* (SCE)
D.C. Petriu, *CSE, CCN* (SCE)
E.M. Petriu, *SMI, CAD, BE* (SITE)
L. Peyton, *CSE, SMI* (SITE)
C. Plett, *ICD, DWC, ME* (DOE)
B. Raahemi, *CCN, SMI* (Management)
J. Rogers, *DWC, ME, ICD* (DOE)
S. Roux, *PS, ME* (SITE-Adjunct)
L. Roy, *ME, ICD, PS* (DOE)
H.M. Schwartz, *SMI, SSIP* (SCE)
M. Shams, *ICD, BE, CAD* (DOE)
S. Shirmohammadi, *CCN*, *CSE* (SITE)
T.J. Smy, *ME, ICD* (DOE)
A. Steele, *PS* (DOE)
M. St-Hilaire, CCN, DWC (SCE)
I. Stojmenovic, *CCN, DWC* (SITE)
B.A. Syrett, *ME, PS* (DOE)
S. Szpakowicz, *SMI* (SITE)
V. Szwarc, *ICD, SSIP* (DOE - Adjunct)
N. Tait, *ICD, PS, ME* (DOE)
J. Talim, *CCN* (SCE)
S. Taney, CSE, PS, BE (SCE)
N.G. Tarr, *ICD* (DOE)
T.T. Tran, *CSE* (SITE)
M. Turcotte, *BE, SMI* (SITE)
I. Uzunov, *ME* (SITE-Adjunct)
G. Wainer, *CSE, BE, SMI* (SCE)
S. Wang, *ICD, CAD* (DOE-Adjunct)

A.D. Whitehead, *CSE* (CSIT & SCE)
J.S. Wight, *ME, DWC* (DOE)
C.M. Woodside, *CSE* (SCE)
M. Yagoub, *ME*, *CAD* (SITE)
O.W. Yang, *CCN*, *DWC*, *PS* (SITE)
H. Yanikomeroglu, *DWC*, *CCN* (SCE)
J. Yao, *PS, ME, DWC* (SITE)
Q. Ye, *ME* (DOE - Adjunct)
T.Yeap, *DWC*, *ICD*, *PS* (SITE)
G. Yee, CSE (SITE)
A. Yongaçoglu, *DWC*, *SSIP* (SITE)
F.R. Yu, CCN, DWC (SCE)
Q.J. Zhang, *CAD*, *ME*, *ICD* (DOE)
J. Zhao, *SSIP*, *CCN*, *DWC* (SITE)

Master's Degree

Admission Requirements

The normal requirement for admission to a master's program is a bachelor's degree with at least high honours standing in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the departmental chair, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics). Master's programs with a thesis earn the Master of Applied Science degree, while other master's programs earn the Master of Engineering degree.

Master's Degree by Thesis
Eighteen course credits plus thesis
Master's Degree by Course Work
Twenty-seven course credits plus a project (nominally six credits)
Cooperative Master's Degree by Thesis
Eighteen course credits plus a thesis
Cooperative Master's Degree by Course Work
Twenty-four course credits plus two projects (each conducted in one work term)
Participation in the cooperative master's program is subject to acceptance by a suitable sponsoring organization.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the advisory committee, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).

- A minimum of nine course credits
- A comprehensive examination involving written and oral examinations and a written thesis proposal, to take place before the end of the fourth term of registration
- A thesis which must be defended at an oral examination

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or advisory committee. Course descriptions may be found in the departmental section of the calendar. All courses are of one term duration. Only a selection of courses listed is given in a particular academic year. The following codes identify the department offering the course.

Carleton University

- ELEC Department of Electronics
- SYSC Department of Systems and Computer Engineering

University of Ottawa

- EACJ Department of Electrical Engineering

The CSI designation refers to the Department of Computer Science at the University of Ottawa. The ELG designation refers to the Department of Electrical Engineering at the University of Ottawa.

Course List by Research Area

Biomedical Engineering

SCE	SYSC 5300 (ELG 6130)	Health Care Engineering
SCE	SYSC 5301 (ELG 6131)	Advanced Topics in Biomedical Engineering
SCE	SYSC 5302 (ELG 6321)	Biomedical Instrumentation
SCE	SYSC 5303 (ELG 6133)	Interactive Networked Systems and Telemedicine
SCE	SYSC 5304 (ELG 5127)	Medical Image Processing
SCE	SYSC 5307 (ELG 6307)	Biological Signals
SITE	EACJ 5127 (ELGH 6131)	Advanced Topics in Biomedical Engineering
SITE	EACJ 5303 (ELG 5123)	Health Care Engineering
SITE	EACJ 5304 (ELG 5127)	Medical Image Processing
SITE	EACJ 6132 (ELG 6132)	Ethics, Research Methods, and Standards

Computer Aided Design for Electronic Circuits

DOE	ELEC 5401 (ELG 6341)	Signal Integrity in High-Speed Designs: Modeling and Analysis
DOE	ELEC 5404 (ELG 6344)	Neural Networks for High-Speed/High-Frequency Circuit Design
DOE	ELEC 5504 (ELG 6354)	Analysis of High-Speed Electronic Packages and Interconnects
DOE	ELEC 5506 (ELG 6356)	Simulation and Optimization of Electronic Circuits
DOE	ELEC 5508 (ELG 6358)	Computer Methods for Analysis and Design of VLSI Circuits
DOE	ELEC 5704 (ELG 6374)	Advanced Topics in CAD
DOE	ELEC 5803 (ELG 6383)	Behavioural Synthesis of IC's
SITE	EACJ 5705 (ELG 5195)	Digital Logic Design: Principles and Practices

Computer and Software Engineering

SCE	SYSC 5003 (ELG 6103)	Discrete Stochastic Models
SCE	SYSC 5005 (ELG 6105)	Optimization Theory and Methods
SCE	SYSC 5006 (ELG 6106)	Design of Real-Time and Distributed Systems
SCE	SYSC 5101 (ELG 6111)	Design of High Performance Software
SCE	SYSC 5102 (ELG 6112)	Performance Measurement and Modeling of Distributed Applications
SCE	SYSC 5103 (ELG 6113)	Software Agents
SCE	SYSC 5104 (ELG 6114)	Methodologies for Discrete-Event Modeling and Simulation
SCE	SYSC 5105 (ELG 6115)	Software Quality Engineering and Management
SCE	SYSC 5108 (ELG 6118)	Topics in Information Systems
SCE	SYSC 5315 (ELG 6305)	Ethics, Research Methods, and Standards
SCE	SYSC 5508 (ELG 6158)	Digital Systems Architecture
SCE	SYSC 5701 (CSI 5117)	Operating System Methods for Real-Time Applications
SCE	SYSC 5703 (ELG 6173)	Integrated Database Systems
SCE	SYSC 5704 (ELG 6174)	Elements of Computer Systems
SCE	SYSC 5706 (ELG 6176)	Analytical Performance Models of Computer Systems
SCE	SYSC 5708 (ELG 6178)	Development of Real-Time and Distributed Software with Reusable Components
SCE	SYSC 5709 (ELG 6179)	Advanced Topics in Software Engineering
SCE	SYSC 5806 (ELG 6186)	Object Oriented Design of Real-Time and Distributed Systems
SCE	SYSC 5807 (ELG 6187)	Advanced Topics in Computers Systems
SITE	EACJ 5102 (ELG 5197)	Introduction to Embedded Systems
SITE	EACJ 5190 (ELG 5190)	Software Usability
SITE	EACJ 5200 (ELG 5200)	Software Engineering Project Management
SITE	EACJ 5203 (ELG 5191)	Design of Distributed System Software
SITE	EACJ 5204 (ELG 5124)	Virtual Environments
SITE	EACJ 5205 (ELG 5125)	Quality of Service Management for Multi-media Applications
SITE	EACJ 5703 (ELG 5194)	Design and Testing of Reliable Digital Systems
SITE	EACJ 5705 (ELG 5195)	Digital Logic Design: Principles and Practices
SITE	EACJ 5807 (ELG 7186)	Topics in Computers I
SITE	EACJ 5808 (ELG 7187)	Topics in Computers II
SITE	EACJ 5900 (ELG 7573)	Sujets choisis sur les ordinateurs

Computer Communications, Distributed Systems, and Multimedia

SCE	SYSC 5109 (ELG 6119)	Teletraffic Engineering
SCE	SYSC 5201 (ELG 6121)	Computer Communication
SCE	SYSC 5207 (ELG 6127)	Distributed Systems Engineering
SCE	SYSC 5306 (ELG 6136)	Mobile Computing Systems
SCE	SYSC 5403 (ELG 6143)	Network Access Techniques
SCE	SYSC 5502 (ELG 6152)	Advanced Linear Systems
SCE	SYSC 5800 (ELG 6180)	Network Computing
SCE	SYSC 5801 (ELG 6181)	Advanced Topics in Computer Communications
SCE	SYSC 5808 (ELG 6188)	Communications Network Management
SITE	EACJ 5009 (ELG 5383)	Survivable Optical Networks

SITE	EACJ 5104 (ELG 5199)	Design of Multimedia Distributed Database Systems
SITE	EACJ 5108 (ELG 5382)	Switching and Traffic Theory for Integrated Broadband Networks
SITE	EACJ 5134 (ELG 5134)	Computer Animation
SITE	EACJ 5200 (ELG 5120)	Queuing Systems
SITE	EACJ 5202 (ELG 5122)	Modeling, Analysis and Performance Evaluation in Computer Communications
SITE	EACJ 5206 (ELG 5126)	Source Coding and Data Compression
SITE	EACJ 5500 (ELG 5371)	Digital Communications by Satellite
SITE	EACJ 5605 (ELG 7177)	Topics in Communications I
SITE	EACJ 5606 (ELG 7178)	Topics in Communications II
SITE	EACJ 5607 (ELG 5374)	Computer-Communication Networks
SITE	EACJ 5369 (ELG 5369)	Internetworking Technologies
SITE	EACJ 5384 (ELG 5384, CSI 5105, COMP 5406, LEG 5384)	Network Security and Crytography

Digital and Optical Communications

DOE	ELEC 5605 (ELG 6365)	Optical Fibre Communications
DOE	ELEC 5606 (ELG 6366)	Phase-Locked Loops and Receiver Synchronizers
SCE	SYSC 5200 (ELG 6120)	Algebraic Coding Theory
SCE	SYSC 5503 (ELG 6153)	Stochastic Processes
SCE	SYSC 5504 (ELG 6154)	Principles of Digital Communication
SCE	SYSC 5506 (ELG 5170)	Information Theory
SCE	SYSC 5605 (ELG 6165)	Advanced Digital Communication
SCE	SYSC 5606 (ELG 6166)	Introduction to Mobile Communications
SCE	SYSC 5607 (ELG 6167)	Source Coding and Data Compression
SCE	SYSC 5608 (ELG 6168)	Wireless Communications Systems Engineering
SCE	SYSC 5609 (ELG 6169)	Digital Television
SCE	SYSC 5700 (ELG 6170)	Spread Spectrum Systems
SCE	SYSC 5802 (ELG 6182)	Introduction to Information and Systems Science
SCE	SYSC 5804 (ELG 6184)	Advanced Topics in Communications Systems
SITE	EACJ 5002 (ELG 5380)	Advanced Channel Coding
SITE	EACJ 5003 (ELG 5106)	Fourier Optics
SITE	EACJ 5105 (ELG 5373)	Data Encryption
SITE	EACJ 5106 (ELG 5113)	Stochastic Systems
SITE	EACJ 5109 (ELG 5119)	Stochastic Processes
SITE	EACJ 5131 (ELG 5131)	Graphical Models
SITE	EACJ 5132 (ELG 5132)	Smart Antennas
SITE	EACJ 5133 (ELG 5133)	Introduction to Mobile Communications
SITE	EACJ 5300 (ELG 7114)	Topics in Systems and Control II
SITE	EACJ 5301 (ELG 7574)	Sujets choisis en systèmes et réglage automatique
SITE	EACJ 5360 (ELG 5360)	Digital Watermarking
SITE	EACJ 5501 (ELG 5170)	Information Theory
SITE	EACJ 5503 (ELG 5179)	Detection and Estimation
SITE	EACJ 5504 (ELG 5372)	Error Control Coding

SITE	EACJ 5506 (ELG 5375)	Principles of Digital Communication
SITE	EACJ 5605 (ELG 7177)	Topics in Communications I
SITE	EACJ 5606 (ELG 7178)	Topics in Communications II
SITE	EACJ 5702 (ELG 7572)	Sujets choisis en télécommunications et en traitement de signaux
SITE	EACJ 5704 (ELG 5180)	Advanced Digital Communication

Integrated Circuits and Devices

DOE	ELEC 5402 (ELG 6342)	Computer Methodologies for Digital and RF Design
DOE	ELEC 5502 (ELG 6352)	Analog Integrated Filters
DOE	ELEC 5503 (ELG 6353)	Radio Frequency Integrated Circuit Design
DOE	ELEC 5509 (ELG 6359)	Integrated Circuit Technology
DOE	ELEC 5600 (ELG 6360)	Digital Integrated Circuit Testing
DOE	ELEC 5703 (ELG 6373)	Advanced Topics in Solid State Devices and IC Technology
DOE	ELEC 5705 (ELG 6375)	Advanced Topics in VLSI
DOE	ELEC 5706 (ELG 6376)	Submicron CMOS and BiCMOS Ciruits for Sampled Data Applications
DOE	ELEC 5707 (ELG 6377)	Microelectronic Microsensors and MEMS
DOE	ELEC 5800 (ELG 6380)	Theory of Semiconductor Devices
DOE	ELEC 5801 (ELG 6381)	High-Speed and Low-Power VLSI
DOE	ELEC 5802 (ELG 6382)	Surface-Controlled Semiconductor Devices
DOE	ELEC 5804 (ELG 6384)	VLSI Design
DOE	ELEC 5805 (ELG 6385)	VLSI Design Project
DOE	ELEC 5808 (ELG 6388)	Signal Processing Electronics
DOE	ELEC 5809 (ELG 6389)	Nonlinear Electronic Circuits
SCE	SYSC 5803 (ELG 6183)	Logic Programming
SITE	EACJ 5001 (ELG 5107)	Semiconductor Optical Logic
SITE	EACJ 5006 (ELG 7132)	Topics in Electronics I
SITE	EACJ 5007 (ELG 7133)	Topics in Electronics II
SITE	EACJ 5008 (ELG 7575)	Sujets choisis en électronique
SITE	EACJ 5103 (ELG 5198)	Parallel Processing with VLSI
SITE	EACJ 5208/ELEC 5200 (ELG 6320)	Advanced Topics in Integrated Circuits and Devices

Microwaves and Electromagnetics

DOE	ELEC 5409 (ELG 6349)	Microwave and Millimeterwave Integrated Circuits
DOE	ELEC 5501 (ELG 6351)	Passive Microwave Circuits
DOE	ELEC 5602 (ELG 6362)	Microwave Semiconductor Devices and Applications
DOE	ELEC 5604 (ELG 6364)	Radar Systems
DOE	ELEC 5607 (ELG 6367)	Antennas and Arrays
DOE	ELEC 5608 (ELG 6368)	Fourier Optics
DOE	ELEC 5609 (ELG 6369)	Nonlinear Microwave Devices and Effects
DOE	ELEC 5707 (ELG 6377)	Microelectronic Sensors
DOE	ELEC 5709 (ELG 6379)	Advanced Topics in Electromagnetics
SITE	EACJ 5305 (ELG 5108)	Electromagnetic Compatibility and Interference

SITE	EACJ 5308 (ELG 7500)	Sujets choisis en électromagnetisme
SITE	EACJ 5401 (ELG 5104)	Electromagnetic Waves: Theory and Applications
SITE	EACJ 5402 (ELG 5379)	Numerical Methods in Electromagnetic Engineering
SITE	EACJ 5403 (ELG 5504)	Ondes électromagnetiques : théorie et applications
SITE	EACJ 5404 (ELG 7100)	Topics in Electromagnetics I
SITE	EACJ 5405 (ELG 7101)	Topics in Electromagnetics II
SITE	EACJ 5406 (ELG 5779)	Méthodes numériques en génie électromagnetique

Photonic Systems

DOE	ELEC 5701 (ELG 6371)	Fibre and Waveguide Components for Communications and Sensors
DOE	ELEC 5702 (ELG 6372)	Optical Electronics
DOE	ELEC 5705 (ELG 6375)	Advanced Topics in VLSI
DOE	ELEC 5708 (ELG 6378)	ASICs in Telecommunications
DOE	ELEC 5709 (ELG 6379)	Advanced Topics in Electromagnetics
SITE	EACJ 5004 (ELG 5381)	Photonics Networks
SITE	EACJ 5201 (ELG 5103)	Optical Communications Systems
SITE	EACJ 5404 (ELG 7100)	Topics in Electromagnetics I

Signal, Speech and Image Processing

SCE	SYSC 5304 (ELG 5127)	Medical Image Processing
SCE	SYSC 5600 (ELG 6160)	Adaptive Signal Processing
SCE	SYSC 5601 (ELG 6161)	Neural Signal Processing
SCE	SYSC 5602 (ELG 6162)	Digital Signal Processing
SCE	SYSC 5603 (ELG 6163)	Digital Signal Processing: Microprocessors, Software and Applications
SCE	SYSC 5604 (ELG 6164)	Advanced Topics in Digital Signal Processing
SITE	EACJ 5360 (ELG 5360)	Digital Watermarking
SITE	EACJ 5370 (ELG 5370)	Multiresolution Signal Decomposition: Analysis and Applications
SITE	EACJ 5385 (ELG 5385)	Matrix Methods and Algorithms for Signal Processing
SITE	EACJ 5507 (ELG 5376)	Digital Signal Processing
SITE	EACJ 5508 (ELG 5776)	Traitement numérique des signaux
SITE	EACJ 5509 (ELG 5378)	Image Processing and Image Communications
SITE	EACJ 5600 (ELG 7172)	Topics in Signal Processing I
SITE	EACJ 5601 (ELG 7173)	Topics in Signal Processing II
SITE	EACJ 5603 (ELG 7179)	Topics in Signal Processing III
SITE	EACJ 5800 (ELG 5377)	Adaptive Signal Processing

Systems and Machine Intelligence

SCE	SYSC 5001 (ELG 6101)	Simulation and Modeling
SCE	SYSC 5004 (ELG 6104)	Optimization for Engineering Applications
SCE	SYSC/COMP 5007 (ELG 6107)	Expert Systems
SCE	SYSC 5401 (ELG 6141)	Adaptive and Learning Systems
SCE	SYSC 5402 (ELG 6142)	Advanced Dynamics with Applications to Robotics

SCE	SYSC 5005 (ELG 5162)	Knowledge-Based Systems: Principles and Design
SITE	EACJ 5100 (ELG 5163)	Machine Vision
SITE	EACJ 5204 (ELG 5124)	Virtual Environments
SITE	EACJ 5207 (ELG 5161)	Robotics: Control, Sensing, and Intelligence
SITE	EACJ 5209 (ELG 7113)	Topics in Systems and Control I
SITE	EACJ 5709 (ELG 5196)	Automata and Neural Networks
SITE	EACJ 7116 (ELG 7116)	Topics in System and Machine Intelligence: Introduction to Convex Optimization
SITE	EACJ 5386 (ELG 5386)	Neural Networks and Fuzzy Systems

Electronics

Mackenzie Building 5170
Telephone: 613-520-5754
Fax: 613-520-5708
www.doe.carleton.ca

The Department

Chair of the Department: L. Roy
Associate Chair, Graduate Studies: B. Syrett

In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations section of this Calendar.

The Department of Electronics offers programs of study and research leading to M.A.Sc., M.Eng. and Ph.D. degrees in Electrical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE), which is jointly administered by the Departments of Electronics and of Systems and Computer Engineering at Carleton University, and the School of Information Technology and Engineering (SITE) at the University of Ottawa. For further information, including admission and program requirements, see the Institute's section of this Calendar.

The Department of Electronics is concerned with the fields of applied and physical electronics. Effort is strongest in four broad areas: computer-aided design for electronic circuits; physics and fabrication technology for solid-state electronic and photonic devices; VLSI and high-speed analog integrated circuits; and microwave and photonic subsystems and circuits. Specific areas of specialization include:

Computer-Aided Circuit Design
: Development of hierarchical simulators for mixed analog/digital circuits; analysis and design of switched-capacitor networks; analysis and design of high speed circuits; optimization techniques; synthesis of VLSI circuits using both algorithmic and knowledge-based approaches; analysis and simulations of communications systems links; layout synthesis and module generation.

Photonic Devices
: Waveguides and holographic optical elements for optical interconnects; electro-optic modulators and switches; waveguides for sensing applications.

Solid State Devices
: Fundamental semiconductor device physics; device design and novel device structures; device modeling for CAD; new fabrication processes; submicron and quantum effect devices; photovoltaics; semiconductor sensors and transducers.

Integrated Circuit Engineering
: Design and development of linear and digital integrated circuits; fabrication processes and test techniques; MOS, bipolar and BiCMOS ICs; VLSI; computer-aided circuit design; MEMS.

Analog Signal Processing
: Switched-capacitor filters, transversal filters, operational amplifiers and radio frequency functions in analog signal processing applications, particularly for integrated circuit realization.

Circuits
: Active filters; linear and nonlinear circuit design; computer-aided circuit design; phase-locked circuits, carriers and clock synchronizers; mixers, modulators and demodulators.

Microwave Electronics
: Microwave amplifiers, oscillators, modulators, frequency converters, phase-shifters; use of FET and bipolar transistors, Schottky barrier, varactor, step recovery and PIN diodes; design using finline, microstrip, stripline, coax, and waveguide; monolithic microwave ICs in GaAs;

miniature hybrid microwave ICs. High-performance microwave packaging including low temperature co-fired ceramics.

Communications and Radar Electronics

Circuits for terrestrial and satellite communications; circuit implementation of digital modulation techniques; antenna and array design; communication channel characterization; optical communications circuits; radar transmitter and receiver design.

CITO

The Department is part of the CITO (Communications and Information Technology of Ontario) Centre of Excellence. Current research areas of the Centre with major participation from the Department are: integrated services digital networks, mobile and portable wireless networks, VLSI in communications, and millimetre wave/optical antennas and circuits for personal communications.

Micronet

The Department is a member, along with seven other Canadian universities and several major industrial organizations, of Micronet, the federally sponsored network on Microelectronic Devices, Circuits and Systems for ULSI (ultra-large scale integration). Within the Department, Micronet supports research on: device structures, modeling and fabrication processes for submicron CMOS and BiCMOS ICs; high-speed filters, phase detectors, A-to-D converters, frequency synthesizers and other circuit elements for silicon ICs operating at radio frequencies; analysis and optimization of interconnects for high-speed ICs; and automated generation of custom cells for VLSI design.

Course Offerings

The structure of the courses offered allows a well-integrated master's or Ph.D. program of study to be chosen that is appropriately related to the field of thesis research. Device- and integrated-circuit-oriented courses cover: fabrication, semiconductor device theory, semiconductor device design, integrated circuit design, and integrated circuit reliability. Circuit-oriented courses include: signal-processing electronics, microprocessor electronics, computer-aided circuit design, phase-locked circuits, filter circuits, RF and microwave circuits, antenna and array design. Systems-oriented courses cover: optical fibre communications and radar systems.

Microfabrication Facility

Housed in a Class 100 cleanroom, this laboratory offers a complete set of equipment for the fabrication of solid state devices and small-scale integrated circuits for research purposes. There is a strong emphasis on silicon devices and process technology, including MEMS and silicon photonics. Photomasks can be generated in-house. An e-beam direct-write system supports deep submicron lithography. Modern diffusion furnaces can grow industrial quality gate oxide. LPCVD of silicon nitride, glasses, and polysilicon is available. RIE and ECR plasma etchers can pattern deep submicron features. Magnetron and RF sputtering and e-beam and thermal evaporation are available for metal deposition. A rapid thermal annealer and a variety of diagnostic tools including a SEM, ellipsometer and thin film profilometer complete the equipment set. A well-equipped semiconductor device characterization laboratory complements the facility.

Computing and Circuit Design Facilities

The Department has excellent computing facilities for software development, circuit design and layout for integrated circuits and microwave circuits. IC designs using synthesis, standard cells and layout are supported for fabrication through the Canadian Microelectronics Corporation or in-house.

The graduate computer network consists of 70 SUN workstations and has access to the Internet. Industry standard software includes CADENCE, Mentor Graphics, SYNOPSYS, HSpice, SUPREM,

Xilinx, MEDICI, Agilent ADS, Agilent Momentum, Agilent HFSS, MATLAB, MATHEMATICA, FRAMEMAKER, and others.

Measurement Facilities

Advanced instrumentation supports automated testing of both analog and digital integrated circuits at frequencies up to 20 GHz. Low noise test facilities include a phase noise measurement system, dynamic signal analyzers, spectrum analyzers, network analyzers, arbitrary waveform generators, digital sampling oscilloscopes, digital data analyzers and generators, and RF frequency synthesizers, all of which may be controlled using the IEEE 488 interface.

The Department has up-to-date facilities for optical frequences, and circuit development and measurement including wafer probing at microwave frequencies ranging up to 40 GHz. Thin-film microwave integrated circuits can be fabricated in-house; there is provision for the fabrication of GaAs MMICs through foundry services. Special purpose microwave equipment includes automated network analyzers, spectrum analyzers and frequency synthesizers, and a complete microwave link analyzer. Data generators and error-detection equipment is available for work on digital communications. The Department also has an anechoic chamber with an automated measurement system for the characterization of antennas up to 20GHz. The research laboratories maintain extensive collaboration with government and industrial research and development agencies in the Ottawa area.

Graduate Courses

Only a selection of listed courses are offered in a particular academic year. All courses extend over one term and are worth 0.5 credit (3.0 credits at the University of Ottawa). Consult the Ottawa-Carleton Joint Institute for Electrical and Computer Engineering (OCIECE) website for course and timetable information at www.ociece.ca

ELEC 5200 [0.5 credit] (ELG 6320)
Advanced Topics in Integrated Circuits and Devices
Topics vary from year to year.

ELEC 5401 [0.5 credit] (ELG 6341)
Signal Integrity in High-Speed Designs: Modeling and Analysis
Crosstalk, distortion, ground bounce, skin effect. Interconnect modeling/simulation, packages, ground/power planes, Elmore delay, lossy-coupled, frequency-dependent transmission lines, telegraphers equations, extraction, measured parameters, macromodeling: passivity/causality, MoC/MRA, vector fit, model reduction, electromagnetic compatibility/interference, mixed-domain systems, concurrent analysis.
Precludes additional credit for this course previously offered as a Special Topics course ELEC 5704 (ELG 6374).
Prerequisite: permission of the Department.

ELEC 5402 [0.5 credit] (ELG 6342)
Computer Methodologies for Digital and RF Design
Digital design process: behavioral models, HDL languages, synthesis, design hierarchy. Simulation of digital circuits. Analog/RF Circuits: large-signal models, timing analysis and relaxation techniques. Iterative methods for solution of nonlinear differential equations. Power supply analysis, ground analysis. Simulation of mixer circuits, multi-tone circuits. Thermal analysis, self-heating.
Precludes additional credit for this course previously offered as a special topics course ELEC 5704Y (ELG 6374Y).
Prerequisite: permission of the instructor.

ELEC 5404 [0.5 credit] (ELG 6344)

Neural Networks for High-Speed/High-Frequency Circuit Design

Introduction to neural network methodologies for computer-aided design of high-speed/high-frequency circuits, including modeling of passive and active devices/circuits, and their applications in high-level design and optimization in wired and wireless electronic systems.

ELEC 5409 [0.5 credit] (ELG 6349)

Microwave and Millimeterwave Integrated Circuits

Design of communications electronics components with emphasis on GaAs MMIC implementation. Overview of MESFET, HEMT, HBT device modeling. Integrated lumped/ distributed passive element modeling. Broadband impedance matching. Design of direct-coupled amplifiers, distributed amplifiers, power devices and amplifiers, phase shifters, switches, attenuators, mixers, oscillators.

ELEC 5501 [0.5 credit] (ELG 6351)

Passive Microwave Circuits

Characteristics of homogeneous and inhomogeneous transmission lines and waveguides. Planar transmission lines: stripline, microstrip, coplanar line, slotline. Coupled transmission lines. Modeling of discontinuities. Ferrite components. Microwave network analysis: s-parameters, CAD models. Design of impedance-matching networks, directional couplers, power splitters, filters. Applications in MICs and MMICs.

ELEC 5502 [0.5 credit] (ELG 6352)

Analog Integrated Filters

The fundamentals and details of analog continuous-time and SAW filters. Comparison to switched-capacitor filters. Review of filter concepts, types of filters, approximations, transformations. Building blocks such as op amps, transconductance amplifiers, and gyrators. Design using cascaded second-order sections, multiple loop feedback and LC ladder simulations.

ELEC 5503 [0.5 credit] (ELG 6353)

Radio Frequency Integrated Circuit Design

Integrated radio front-end component design. Overview of radio systems, frequency response, gain, noise, linearity, intermodulation, image rejection, impedance matching, stability, and power dissipation. Detailed design of low-noise amplifiers, mixers, oscillators and power amplifiers. Use of on-chip inductors and baluns. Process variations, parasitics, and packaging.

ELEC 5504 [0.5 credit] (ELG 6354)

Analysis of High-Speed Electronic Packages and Interconnects

Introduction to modeling, simulation and optimization of high-speed VLSI packages; models for packages, interconnects and ground/power planes; lumped, distributed and EM models for interconnects; delay, crosstalk and switching noise; moment matching techniques; concurrent thermal/electrical analysis of IC packages and boards.

ELEC 5506 [0.5 credit] (ELG 6356)

Simulation and Optimization of Electronic Circuits

Introduction to computer simulation and optimization of electrical circuits. Time- and frequency-domain formulations for sensitivity analysis and optimization. Optimization techniques for performance-, cost- and yield-driven design of electronic circuits. Optimization approaches to modeling and parameter extraction of active and passive elements.

ELEC 5508 [0.5 credit] (ELG 6358)

Computer Methods for Analysis and Design of VLSI Circuits

Formulation of circuit equations. Sparse matrix techniques. Frequency and time-domain solutions. Relaxation techniques and timing analysis. Noise and distortion analysis. Transmission line effects. Interconnect analysis and crosstalk simulation. Numerical inversion techniques. Asymptotic waveform estimation. Mixed frequency/time domain techniques. Sensitivity analysis.

ELEC 5509 [0.5 credit] (ELG 6359)

Integrated Circuit Technology

Survey of technology used in silicon VLSI integrated circuit fabrication. Crystal growth and crystal defects, oxidation, diffusion, ion implantation and annealing, gettering, CVD, etching, materials for metallization and contacting, and photolithography. Structures and fabrication techniques required for submicron MOSFETs. Applications in advanced CMOS processes.

ELEC 5600 [0.5 credit] (ELG 6360)

Digital Integrated Circuit Testing

Production testing of digital integrated circuits. Outline of methods of testing used in production. Testing schemes and design for testability. Faults and fault models, yield estimates, testability measures, fault simulation, test generation methods, sequential testing, scan design, boundary scan, built-in self test, CMOS testing.

ELEC 5602 [0.5 credit] (ELG 6362)

Microwave Semiconductor Devices and Applications

Theory of operation for microwave diodes (varactor, p-i-n, Gunn, IMPATT) and transistors (BJT, MESFET, HBT, HEMT). Small-signal, large-signal, and noise models for CAD. Diode oscillators and reflection amplifiers. Design of transistor oscillators and amplifiers. Discussion of technology/fabrication issues and MMIC applications.

ELEC 5604 [0.5 credit] (ELG 6364)

Radar Systems

Fundamentals; range equation, minimum detectable signal, radar cross-section, pulse repetition frequency, range ambiguities. Radar classes: CW, FM-CW, MTI, tracking, air surveillance, SSR, PAR, MLS, SAR, SLAR, OTH, 3D and bistatic radars. Radar subsystems; transmitters, antennas, receivers, processors, displays, detection criteria; CFAR receivers, noise, clutter precipitation.

ELEC 5605 [0.5 credit] (ELG 6365)

Optical Fibre Communications

Transmission characteristics of and design considerations for multi-mode and single-mode optical fibre waveguides; materials, structures, and device properties of laser light sources; properties and performance of p-i-n and avalanche photodiodes; types of optical fibre signal formats, preamplifier topologies, noise, receiver sensitivity, transmitter design, link design.

ELEC 5606 [0.5 credit] (ELG 6366)

Phase-Locked Loops and Receiver Synchronizers

Phase-locked loops; components, fundamentals, stability, transient response, sinusoidal operation, noise performance, tracking, acquisition and optimization. Receiver synchronizers: carrier synchronizers including squaring loop, Costas loop, and remodulator for BPSK, QPSK BER performance; clock synchronizers including early-late gate, in-phase/midphase, and delay line multiplier.

ELEC 5607 [0.5 credit] (ELG 6367)

Antennas and Arrays

Design projects are interspersed with live and video lectures. Lectures cover definitions, wire structures, mutual coupling, method-of-moments, array theory, photonic devices, frequency independent structures, reflectors, horns, feeds, slotted waveguide and microstrip arrays. Design projects include a printed dipole, yagi and series-fed microstrip patch array.

ELEC 5608 [0.5 credit] (ELG 6368)

Fourier Optics

The theory and applications of diffractive and non-diffractive coherent optics, with emphasis on holograms, tomography and high-speed optical computing. Mathematical basis: generalized 2-D Fourier transforms, transfer function of an optical system, 2-D sampling theory, Helmholtz equation, Green's theorem, and the classical diffraction theories.

ELEC 5609 [0.5 credit] (ELG 6369)

Nonlinear Microwave Devices and Effects

The physical basis and mathematical modeling of a variety of microwave/millimeter-wave devices, (some of which exhibit the most extreme nonlinear behaviour known), how they can be exploited in practical circuits and systems, and how the resulting device/circuit interactions can be analyzed.

ELEC 5701 [0.5 credit] (ELG 6371)

Fibre and Waveguide Components for Communications and Sensors

Optical wave propagation in dielectric waveguides. Theory and practice for passive photonic devices used for routing, filtering, and signal processing, including structural and biochemical sensors. Directional couplers and splitters, filters (gratings and etalons), Mach-Zehnder interferometers, Arrayed waveguide gratings, and dispersion compensators.
Precludes additional credit for this course taken previously as a special topics course ELEC 5709W (ELG 6379W).
Prerequisites: ELEC 3909 or equivalent.

ELEC 5702 [0.5 credit] (ELG 6372)

Optical Electronics

Electromagnetic wave propagation in crystals; review of geometric optics; Gaussian beam propagation; optical fibres; dielectric waveguides for optical integrated circuits; optical resonators; optical properties of materials; theory of laser oscillation; specific laser systems; electro-optic modulators; photorefractive materials and applications; holography; optical interconnects.

ELEC 5703 [0.5 credit] (ELG 6373)

Advanced Topics in Solid State Devices and IC Technology

Recent and advanced topics in semiconductor device physics, modeling, and integrated circuit fabrication technology. Topic varies from year to year according to departmental research interests. Students may be expected to contribute lectures or seminars on selected topics.

ELEC 5704 [0.5 credit] (ELG 6374)

Advanced Topics in CAD

Recent and advanced topics in computer-aided techniques for the design of VLSI and telecommunications circuits. Topics will vary from year to year according to the departmental research interests. Students may be expected to contribute lectures or seminars on selected topics.

ELEC 5705 [0.5 credit] (ELG 6375)

Advanced Topics in VLSI

Recent and advanced topics in the design of very large scale integrated circuits, with emphasis on mixed analog/digital circuits for telecommunications applications. Topic varies from year to year according to departmental research interests. Students may be expected to contribute lectures or seminars on selected topics.

ELEC 5706 [0.5 credit] (ELG 6376)

Submicron CMOS and BiCMOS Circuits for Sampled Data Applications

The analog aspects of digital CMOS and BiCMOS circuit design in submicron technologies including reliability; sampled analog circuits, including amplifier non-ideal characteristics and switch charge injection; CMOS/BiCMOS amplifier design considerations, leading up to standard folded-cascode and two-stage circuits.

ELEC 5707 [0.5 credit] (ELG 6377)

Microsensors and MEMS

Physical design of microelectromechanical systems (MEMS) and microfabricated sensors and actuators. An overview of thin and thick film processes and micromachining techniques will provide fabrication background. Device design including piezoresistive, piezoelectric, electromagnetic, thermal, optical, and chemical sensors and actuators.

ELEC 5708 [0.5 credit] (ELG 6378)

ASICs in Telecommunications

Introduction to modern ASIC technologies for Telecom. Review of circuit-level building blocks for typical wireline and wireless applications, including power/performance tradeoffs. Corresponding FPGA analog and digital IO circuits are discussed. A topical literature study and circuit level design exercises.

ELEC 5709 [0.5 credit] (ELG 6379)

Advanced Topics in Electromagnetics

Recent and advanced topics in electro-magnetics, antennas, radar systems, microwave devices and circuits, or optoelectronics. The subject material will vary from year to year according to research interests in the department and/or expertise provided by visiting scholars or sessional lecturers.

ELEC 5800 [0.5 credit] (ELG 6380)

Theory of Semiconductor Devices

Equilibrium and non-equilibrium conditions in a semiconductor. Carrier transport theory. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors, field effect devices. Current transport relationships for transistors. Charge control theory. Modeling of device mechanisms. Performance limitations of transistors.

ELEC 5801 [0.5 credit] (ELG 6381)

High-Speed and Low-Power VLSI

High-Speed and Low-Power CMOS VLSI circuit techniques. Low and high levels of abstraction; transistor, switch, logic-gate, module, system levels. State-of-the-art techniques to optimize the performance and energy consumption of a circuit. One or more of these techniques are used in a design project.
Prerequisite: ELEC 4708 or ELEC 5804 or the equivalent or permission of the instructor.

ELEC 5802 [0.5 credit] (ELG 6382)

Surface-Controlled Semiconductor Devices

Fundamentals of the MOS system; MOS capacitors. Long channel behaviour: theory, limitations and performance of the SPICE level 1 and 2 models. Small geometry effects. Subthreshold operation and modeling. Hot electron effects and reliability.

ELEC 5803 [0.5 credit] (ELG 6383)

Behavioural Synthesis of ICs

Various topics related to computer analysis and synthesis of VLSI circuits including: logic synthesis, finite state machine synthesis, design methodologies, design for reuse, testing, common VLSI functions, a review of Verilog.
Prerequisite: Some IC design knowledge such as given in ELEC 4708.

ELEC 5804 [0.5 credit] (ELG 6384)

VLSI Design

An IC design course with a strong emphasis on design methodology, to be followed by ELEC 5805 (ELG 6385). in the second term. The design philosophies considered will include Full Custom design, standard cells, gate-arrays and sea-of-gates using CMOS and BiCMOS technology. State-of-the-art computer-aided design tools are used.

ELEC 5805 [0.5 credit] (ELG 6385)

VLSI Design Project

Using state-of-the-art CMOS and BiCMOS technologies, students will initiate their own design of an integrated circuit using tools in the CAD lab and submit it for fabrication where the design warrants.

ELEC 5808 [0.5 credit] (ELG 6388)

Signal Processing Electronics

CCDs, transveral filters, recursive filters, switched capacitor filters, with particular emphasis on integration of analog signal processing techniques in monolithic MOS ICs. Detailed op amp

design in CMOS technology. Implications of nonideal op amp behaviour in filter performance. Basic sampled data concepts.

ELEC 5809 [0.5 credit] (ELG 6389)

Nonlinear Electronic Circuits

Introduction to non-linear circuits used in today's telecommunications ICs; CMOS non-linear circuits such as direct-RF-sampling mixers, phase-detectors; digital loop-filters, DCOs, frequency synthesizers and clock-and-data-recovery are introduced. Modeling of these non-linear circuits and existing options for simulations and closed form circuit analysis is presented.

Precludes additional credit for this course taken previously as a special topics course ELEC 5705 (ELG 6375).

Prerequisite: permission of the Department.

ELEC 5900 [0.5 credit]

Engineering Project I

A one-term course, carrying 0.5 credit, for students pursuing the course work M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Written and oral reports are required. This course may be repeated for credit.

ELEC 5901 [1.0 credit]

Engineering Project II

A one-term course, carrying full-course credit, for students pursuing the course work or co-op M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Written and oral reports are required. This course may be repeated for credit.

ELEC 5906 [0.5 credit]

Directed Studies

Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

ELEC 5909 [2.0 credits]

M.A.Sc. Thesis

ELEC 6909 [8.5 credits]

Ph.D. Thesis

English Language and Literature

Dunton Tower 1812
Telephone: 613-520-2310
Fax: 613-520-3544
carleton.ca/english

The Department

Acting Chair of the Department: P. Keen
Departmental Supervisor of Graduate Studies: G. Williams

The Department of English Language and Literature offers programs of study leading to the M.A. and Ph.D. in English language and literature. Additional information may be obtained by consulting the departmental supervisor of graduate studies.

Master of Arts

Admission Requirements

The minimum admission requirement for the master's program is a B.A. (Honours) (or the equivalent) in English language and literature, with at least a high honours standing (normally B+ or better).

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

Qualifying-Year Program

Applicants who hold a general (3-year) B.A. degree with at least a high honours standing (normally B+), with a major in English language and literature, may be admitted to the qualifying-year program. Normally, these students will be required to complete 4.0 or 5.0 credits in English, as determined by the department, and to maintain a high honours standing (normally B+) before being considered for admission into the master's program. For more information regarding the qualifying year, see the General Regulations section of this Calendar.

Program Requirements

Each candidate will select one of the following program patterns:

- 2.0 credits in English, selected from those at the 5000-level (excluding ENGL 5908), plus ENG 5005, and a master's thesis; an oral examination on the thesis will be required. A prospectus for the thesis must be submitted to the graduate committee by December 1 after registration in September, or at the end of three months for any other registration, or
- 3.0 credits in English selected from those at the 5000-level (excluding ENGL 5909), plus ENGL 5005, and a research essay; an oral examination on the research essay may be required, or
- 4.0 credits in English selected from those at the 5000-level (excluding ENGL 5908 and ENGL 5909), plus ENGL 5005.

Each program is designed to be completed within the three-term academic year. Each program is of equal status.

Guidelines for Completion of Master's Degree

Full-time master's candidates are expected to complete all requirements in twelve months or three terms of registered full-time study. Part-time master's candidates are expected to complete their degree requirements within an elapsed period of six calendar years after the date of initial registration.

All candidates are required to demonstrate a reading knowledge of one language other than English, approved by the Department.

Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

Doctor of Philosophy

The Department of English Language and Literature offers a program of studies leading to the degree of Doctor of Philosophy in English. There is one field of study in the program: The Production of Literature.

Admission Requirements

Applicants will normally hold a master's degree in English (or equivalent) with at least an A- average (10 G.P.A.) Applicants judged to be deficient in preparation may be asked to complete course work in addition to the Ph.D. program requirements.

Program Requirements

Students admitted to the Ph.D. program are required to complete a total of 10.0 credits.

- ENGL 6000 Doctoral Seminar (1.0 credit)
- ENGL 6001 Proseminar (0.5 credit)
- 2.0 credits of approved courses
- 1.0 comprehensive credit (ENGL 6900)
- 1.0 research project credit (ENGL 6901)
- 4.5 dissertation credits (ENGL 6909)

ENGL 6000 and ENGL 6001 are required courses. Optional English coures will be selected from a list approved annually by the department. Students may take up to 1.0 credit of approved courses offered in other departments. Students may also choose directed reading courses with the core faculty of the program.

Comprehensive Examination and Research Project

Students are required to complete one comprehensive examination and one doctoral research essay. Each has a 1.0 credit value. The comprehensive examination (ENGL 6900) will focus on relevant theoretical and methodological issues and will take the form of a written examination set and marked by members of core faculty. This will normally take place at the beginning of the second year of full-time doctoral study. The doctoral research project (ENGL 6901) will focus on the general historical period or conceptual issues of the candidate's research and will comprise a written research project of publishable length followed by an oral examination. This will normally be completed before the end of the second year of full-time studies.

Language Requirements

Candidates must demonstrate reading ability in a language other than English, normally by successfully completing a translation examination during the second year of full-time enrolment in the program.

Thesis

All students are required to submit a thesis proposal before proceeding to the writing of the thesis. The proposal must be approved by the graduate supervisor and the thesis committee. This will normally take place early in the third year of doctoral study. All students are required to complete a thesis (4.5 credits) in partial fulfilment of the requirements of the degree offered by the program. The thesis must be defended at an oral examination.

This program is designed to be completed in four years of full-time study. Students admitted to part-time study will normally complete all requirements within eight years of registration.

Academic Standing

Doctoral students must normally obtain a grade of B- or better in each course counted toward the fulfilment of the degree requirements.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult central.carleton.ca

ENGL 5000 [0.5 credit]
Literary Criticism
A study of specific topics or particular areas of literary criticism.

ENGL 5002 [0.5 credit]
Contemporary Literary Theory
Contemporary approaches to theory and literary studies. Topics vary from year to year and may include Marxism, feminism, hermeneutics, narrative theory, psychoanalysis, or postcolonialism.

ENGL 5003 [0.5 credit]
Feminism/s: The Literary Dimension
This course examines a range of topics in feminist and gender theory. Topics vary from year to year and may include women and mass media, gender panics, female spectacles and specularization.

ENGL 5004 [0.5 credit]
Literature, Contact, and Empire in
Colonial and Post-Colonial Societies
Topics in colonial, postcolonial, native and diasporic literature and theory. Topics vary from year to year.

ENGL 5005 [0.5 credit]
M.A. Seminar
Examines topics such as research resources and methodologies, current issues in literary theory and professional concerns. Graded Satisfactory/Unsatisfactory.

ENGL 5207 [0.5 credit]
Early Medieval Studies
Topics in early medieval period. Topics vary from year to year and may include Old English, Old Norse, Latin texts in translation, or pre-Chaucerian texts.

ENGL 5208 [0.5 credit]
Middle-English Studies
Topics in the literature and culture of the Middle English period. Topics vary from year to year and may include Chaucer, Piers Plowman, Arthurian literature, medieval drama, medieval romance, 15th Century Literature, religious and mystical texts. Also may be offered at the undergraduate level, with different requirements, as ENGL 4208, for which additional credit is precluded.

ENGL 5301 [0.5 credit]
Renaissance Poetry
Topic may vary from year to year.

ENGL 5302 [0.5 credit]
Seventeenth-Century Poetry
A study of selected seventeenth-century poets.

ENGL 5304 [0.5 credit]
Renaissance Drama
Topics vary from year to year and may include a focus on specific dramatists, themes, or genres.

ENGL 5307 [0.5 credit]
Renaissance Authors
A study of selected Renaissance authors.

ENGL 5308 [0.5 credit]
Renaissance Studies
Topic may vary from year to year.

ENGL 5402 [0.5 credit]
Eighteenth-Century Studies
Eighteenth-century cultural concerns such as: literature and the marketplace; gender, authorship and genre; the literary periodical; literature and the public sphere; literature and nationalism; literature and science.

ENGL 5408 [0.5 credit]
Studies in Romanticism
Selected texts of Romantic literature and culture. Topics vary from year to year and may be organised by theme, author or genre.

ENGL 5501 [0.5 credit]
Nineteenth-Century Studies
A study of works written between 1830 and 1870 in terms of gender representation in relation to generic modalities, exploring the thesis that poets of the period - Tennyson, the Brownings, the Rossettis, Arnold, Clough - confronted a crisis in gender ideology that problematized the lyric.

ENGL 5503 [0.5 credit]
Nineteenth-Century Fiction
Topic may vary from year to year.

ENGL 5508 [0.5 credit]
Nineteenth-Century Literature
Topic may vary from year to year.

ENGL 5601 [0.5 credit]
Twentieth-Century Poetry
Topic may vary from year to year.

ENGL 5603 [0.5 credit]
Twentieth-Century Fiction
A study of selected twentieth-century writers.

ENGL 5604 [0.5 credit]
Twentieth-Century Drama
Topic may vary from year to year.

ENGL 5606 [0.5 credit]
Twentieth-Century Literature
Topics vary from year to year and may include issues of genre, selected themes, particular literary movements or developments in critical theory.

ENGL 5607 [0.5 credit]
Twentieth-Century Authors
A study of twentieth-century authors of fiction.

ENGL 5608 [0.5 credit]
Twentieth-Century Studies
Topic may vary from year to year.

ENGL 5701 [0.5 credit]
American Poetry
A study of the formative poetry and poetics of several major modern American writers, including: Whitman, T.S. Eliot, Ezra Pound, William Carlos Williams, H.D., George Oppen, Charles Olson, and Robert Creeley.

ENGL 5703 [0.5 credit]
American Fiction
Topic may vary from year to year.

ENGL 5706 [0.5 credit]
American Literature
Topic may vary from year to year.

ENGL 5708 [0.5 credit]
Studies in American Fiction
Topic may vary from year to year.

ENGL 5801 [0.5 credit]
Canadian Poetry
Topic may vary from year to year.

ENGL 5802 [0.5 credit]
Ethnicity, Multiculturalism, and Canadian Literature
Canadian literature in relation to theoretical and critical issues posed by ethnicity and other aspects of Canadian cultural diversity.

ENGL 5803 [0.5 credit]
Canadian Fiction
Canadian writing of the last twenty to thirty years, with reference to the concept of ideology, within the contexts of Marxist, feminist, and postmodernist literary theories.

ENGL 5805 [0.5 credit]
Canadian English
Topic may vary from year to year.

ENGL 5807 [0.5 credit]
Selected Topics in Canadian Literature
Topic may vary from year to year.

ENGL 5809 [0.5 credit]
Colonial Discourse and Native Literatures in Canada
Topic may vary from year to year.

ENGL 5900 [0.5 credit]
Selected Topic
Topic may vary from year to year.

ENGL 5901 [0.5 credit]
Selected Topic
Topic may vary from year to year.

ENGL 5903 [0.5 credit]
English and Cultural Studies
The borders of literature and cultural studies. Topics vary from year to year.

ENGL 5904 [0.5 credit]
Special Studies in Dramatic Literature
Topic may vary from year to year.

ENGL 5908 [1.0 credit]
Research Essay

ENGL 5909 [2.0 credits]
M.A. Thesis

ENGL 6000 [1.0 credit]
Doctoral Seminar
Issues related to the production of literature as a material object, as an institutional site or practice, and as an enabling concept.

ENGL 6001 [0.5 credit]
Proseminar
Exploration of recent critical theory and discussion of issues related to the profession.

ENGL 6101 [0.5 credit]
Directed Reading
This tutorial is designed to permit students to pursue individual research. Topics will be chosen in consultation with at least one faculty member and the graduate supervisor.

ENGL 6102 [0.5 credit]
Studies in the Production of Literature
Explores selected studies/themes related to the production of literature.

ENGL 6103 [0.5 credit]
Selected Topics in the Production of Literature
Selected topics/themes related to the production of literature.

ENGL 6900 [1.0 credit]
Comprehensive Examination
This examination will include a range of topics related to the production of literature as a material object, as an institutional site or practice, and as an enabling concept.

ENGL 6901 [1.0 credit]
Doctoral Research Project
This project will comprise both an essay of publishable length and an oral defense in the general area of the project.

ENGL 6909 [4.5 credits]
Thesis

Undergraduate Courses

Master's students may take the equivalent of 1.0 credit at the senior undergraduate level.

Other Disciplines

With prior approval of the English department's supervisor of graduate studies or departmental Chair, graduate students may take the equivalent of 1.0 credit in a related discipline.

Other Universities

Graduate students may take the equivalent of 2.0 credits at another university or other universities. Students are especially reminded that the University of Ottawa offers a wide range of graduate courses which may be completed (under the general 2.0 credit ruling) for credit at Carleton University.

Ottawa-Carleton Institute for Environmental Engineering

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www.ociene.ca

The Institute

Director of the Institute: Paul Simms
Associate Directors of the Institute:
University of Ottawa, Civil Engineering: Kevin Kennedy
University of Ottawa, Chemical Engineering: Jason Zhang

Established in 2000, the Institute combines the research strengths and resources of the Department of Civil and Environmental Engineering at Carleton University and the Department of Civil Engineering and the Department of Chemical Engineering at the University of Ottawa. Programs leading to M.Eng., M.A.Sc. and Ph.D. degrees in Environmental Engineering are available through the Institute. Registration will be at the university with which the student's supervisor is affiliated. Related fields of study and research in environmental engineering are also available through the Ottawa-Carleton Institute for Civil Engineering (which offers graduate degrees in Civil Engineering) and the Department of Chemical Engineering at the University of Ottawa (which offers graduate degrees in Chemical Engineering).

Members of the Institute

Members of the Institute are listed below. The "home" department of each member is indicated by (C) for the Department of Civil and Environmental Engineering at Carleton University, (CVG) for the Department of Civil Engineering at the University of Ottawa, and (CHG) for the Department of Chemical Engineering at the University of Ottawa.

- O. Basu, *Water and wastewater process optimization, bioreactor and membrane systems (C)*
- P. Champagne, *Environmental engineering, passive treatment systems, acid mine drainage (AMD) mitigation, composting and solid waste management* (C)
- R. L. Droste, *Water and wastewater treatment process modeling, watershed modeling* (CVG)
- M.A. Dubé, *Biodiesel, polymer reaction engineering (CHG)*
- M. Fall, *Geotechnical engineering, hazards, mine base, GIS, finite element analysis* (O)
- L. Fernandes, *Agricultural and solid waste management, wastewater treatment, bioremediation (CVG)*
- L. Graham, *Mobile and stationary source emissions (C-Adjunct)*
- A. Hakami, *Air quality modeling, sensitivity and uncertainty analysis, inverse modeling and forecasting, modeling as policy support tool (C)*
- D. Karman, *Air pollution and control, motor vehicle emissions and urban air quality (C)*
- K. J. Kennedy, *Municipal and industrial wastewater treatment, advanced anaerobic digestion processes, fate of contaminants in wastewater treatment (CVG)*
- B. Kruczek, *Membrane gas separation processes (CHG)*
- C. Lan, *Biological treatment of industrial wastewater, magnetic field enhanced separation, ion exchange, membrane separation, membrane bioreactors (CHG)*
- T. Matsuura, *Membrane separation processes (CHG)*

- D. D. McLean, *Modeling, control, optimization and robust design of waste treatment processes (CHG)*
- R.M. Narbaitz, *Physicochemical water and wastewater treatment, solid waste management (CVG)*
- I. Nistor, *Hydraulics of landfill sites, dam safety, sediment transport on coastal areas, risk assessment, hydraulic structures (CVG)*
- B. Ormeci*, Water treatment, wastewater treatment, disinfection, treatment and management of biosolids (C)*
- W. J. Parker, *Wastewater treatment, fate of contaminants in engineered and natural systems, biological processes. (C-Adjunct)*
- G.G. Patry, *Wastewater treatment process simulation and control (CVG)*
- C. Rennie, *Surface water quality, climate change, fluvial habitat, sediment transport, river hydraulics (CVG)*
- N. Ross*, Biofilms in natural systems, groundwater bioremediation, microbial ecology, ecotoxicological assessment (CHG)*
- P. Simms, *Solid waste reduction, mine waste management, surface disposal of thickened tailings, flow in unsaturated soils, soil microstructure (C)*
- S. Sridhar, *Environmental impact assessment, waste water treatment, hazardous and radioactive wate, pollution control (C-Adjunct)*
- F. Handan Tezel, *Air pollution control, water pollution control, environmental engineering (CHG)*
- A.Y. Tremblay, *Synthetic membranes, process and wastewater treatment, air pollution and control (CHG)*
- S. Vanapalli, *Hog manure management, flow behaviour in contaminant soils, soil liners, acid mine drainage (CVG)*
- P. J. Van Geel, *Groundwater flow and contaminant transport, waste disposal* (C)
- M. A. Warith, *Solid waste management and landfill design and operation (CVG - Adjunct)*
- J. Zhang, *Modeling, scale-up of oxidations systems, combined photcatalytic/biological treatment (CHG)*

Master's Program

Admission Requirements

The requirement for admission to the master's program in Environmental Engineering is a four-year bachelor's degree in Environmental Engineering, other related engineering disciplines (Civil, Chemical, Mechanical, etc.), or Environmental Science disciplines.

All students entering the program are required to have courses in mathematics, probability and statistics equivalent to courses required in undergraduate engineering programs. Students admitted without full equivalency in these areas are expected to take appropriate undergraduate courses early in their studies. These courses will be additional to the normal degree requirements.

All students entering the program are also required to have taken undergraduate courses equivalent to the following:

Students registered at Carleton University

- MAAE 2300 Fluid Mechanics 1
- ENVE 3001 Water Treatment Principles and Design
- ENVE 3002 Environmental Engineering Systems Modeling

Students registered at the University of Ottawa in Chemical Engineering:

- CHG 3312 Fluid Flow
- CHG 3111 Unit Operations
- CHG 3127 Chemical Reactions Engineering

Students registered at the University of Ottawa in Civil Engineering

- CVG 2111 Introduction to Fluid Mechanics
- CVG 2131 Introduction to Environmental Engineering

These courses are considered to provide the minimum background in fluid mechanics, and in physical, chemical, and biochemical treatment principles, necessary to adequately follow environmental engineering courses at the graduate level. Depending on their background, students may have been exposed to these principles through a different combination of courses in their undergraduate curriculum. Students entering the program without an equivalent background in these topics are expected to take these courses early in their studies and they are considered additional to those normally required for the degree.

Program Requirements

Study at the master's level can be pursued through a thesis leading to a M.A.Sc., a project option leading to a M.Eng., or a coursework option leading to a M. Eng. The requirements for coursework are specified in terms of credits. At Carleton University, 1.0 credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. At the University of Ottawa, 1.0 course credit is one hour of instruction per week for one term. Thus 1.0 credit in Carleton University notation is equivalent to 6 course credits in the University of Ottawa notation.

Thesis Option (M.A.Sc.)

The requirements are:

- Completion of a minimum of 3.0 credits by course, with at least 0.5 credit from each of at least three of the areas of study listed below;
- Participation in the graduate seminar series (ENVE 5800) (0.0 credit);
- Completion and successful oral defence of a research thesis (ENVE 5909) (3.0 credits).

Project Option (M.Eng.)

The requirements are:

- Completion of a minimum of 4.0 credits by course;
- Completion of a project (ENVE 5900) (1.0 credit);
- Participation in the graduate student seminar series (ENVE 5800) (0.0 credit).

Coursework Option (M.Eng.)

The requirements are:

- Completion of a minimum of 5.0 credits by course;
- Participation in the graduate student seminar series (ENVE 5800) (0.0 credit).

Breadth Requirement

In keeping with the objective of ensuring a breadth of knowledge for graduates of the program, students in the master's program are expected to take at least one graduate level course from each of at least three of the following areas of study:

- Air Pollution
- Water Resources Management, Groundwater Management and Contaminant Transport
- Management of Solid, Hazardous, and Radioactive Waste, and Pollution Prevention
- Water and Wastewater Treatment
- Environmental Impact Assessment

This requirement serves the objectives of educating graduate professionals who are not only specialized in one area but who are sufficiently familiar with problems and different approaches in the other areas to enable them to interact readily at a >technical level with colleagues working in those areas. In addition to the courses associated with the individual areas, students will be encouraged to select courses from fundamental areas such as chemistry, numerical modeling, and applied statistics.

Master's or Ph.D. candidates transferring from another university must take at least half their courses at the Institute.

Doctoral Program

Admission Requirements

The normal requirement for admission into the Ph.D. Program in Environmental Engineering is completion of either:

A Master's degree in Environmental Engineering, or A Master's degree in an engineering discipline with an environmental specialization.

Students wishing to enter the program who do not have either of these backgrounds will be evaluated on a case-by-case basis. Additional course requirements may be specified in some cases.

Program Requirements

The requirements for the Ph.D. program (from a Master's degree) is the successful completion of 10.0 credits, of which 8.5 credits must be obtained from successful oral defence of a research thesis. The specific requirements are:

- Completion of a minimum of 1.5 credits by course
- Participation in the graduate student seminar series (ENVE 7800) [0.0 credit]
- Successful completion of the comprehensive examination, which consists of a presentation of a Ph.D. research proposal followed by an oral examination to assess any academic deficiencies in the student’s background related to the proposed research project and to assess the originality and feasibility of the proposed research project. The comprehensive examination should be completed within the first 16 months (or the equivalent of four full-time terms) of the student’s program
- Completion and successful oral defence of a research thesis (ENVE 6909) [8.5 credits]

Master's students with outstanding performance in the master’s courses may request transfer into the Ph.D. program without completing the master’s degree. Students who are permitted to do so require a minimum of 4.5 credits by course for a Ph.D., including any credits transferred from the Master's degree program.

Graduate Courses

Course selection is subject to the approval of the adviser or the Advisory committee. Students may choose courses offered at either university from among those listed below.

The courses listed below are grouped by area of study. Master's students must complete at least one course in three of the five areas. The Director will decide when a course offered under a Special Topics or Directed Studies heading can be considered to meet the requirements of a given area. Course descriptions may be found in the departmental sections of the calendars concerned. Course codes in parentheses are for University of Ottawa (CHG and CVG), and those that begin with the prefix "ENVE" or "CIVE" are offered at Carleton. Only a selection of courses is given in a particular academic year.

Air Pollution
- ENVE 5101(EVG 7101) Air Pollution Control
- ENVE 5102 (CVG 7161) Traffic-Related Air Pollution
- ENVE 5103 (CVG 7162) Air Quality Modeling
- ENVE 5104 (EVG 7104) Indoor Air Quality
- (CHG 8132) ENVJ 5105 Adsorption Separation Processes

Water Resources Management, Groundwater Management, and Contaminant Transport
- ENVE 5301 (EVG 7301) Contaminant Hydrogeology
- ENVE 5302 (CVG 7163) Case Studies in Hydrogeology
- ENVE 5303 (EVG 7303) Multiphase Flow in Soils
- CIVE 5504 (CVG 7108) Seepage through Soils
- (CVG 5124) CIVJ 5605 Coastal Engineering
- (CVG 5125) CIVJ 5601 Statistical Methods in Hydrology
- (CVG 5126) CIVJ 5602 Stochastic Hydrology
- (CVG 5131) CIVJ 5606 River Engineering
- (CVG 5160) CVJ 5503 Sediment Transport
- (CVG 5162) CIVJ 5504 River Hydraulics
- (CHG 8158) ENVJ 5304 Porous Media
- ERTH 5403 (GEO 5143) Environmental Isotopes and Groundwater Geochemistry
- ERTH 5404 (GEO 5144) Groundwater Resources
- ERTH 5406 (GEO 5146) Numerical Methods in Hydrogeology
- ERTH 5407 (GEO 5147) Geochemistry of Natural Waters
- ERTH 5408 (GEO 5148) Theory of Flow and Transport in Porous Media

Management of Solid, Hazardous, and Radioactive Waste and Pollution Prevention
- ENVE 5201 (EVG 7201) Geo-Environmental Engineering
- ENVE 5202 (EVG 7202) Contaminant Fate Mechanisms
- ENVE 5203 (EVG 7164) Hazardous and Radioactive Wastes
- (CVG 5331) ENVJ 5902 Sludge Utilization and Disposal
- (CVG 5133) ENVJ 5906 Solid Waste Disposal
- (CVG 5179) ENVJ 5908 Anaerobic Digestion

Water and Wastewater Treatment
- ENVE 5001 (CVG 7160) Biofilm Processes
- (CVG 5130) ENVJ 5900 Wastewater Treatment Process Design
- (CVG 5132) ENVJ 5901 Unit Operations of Water Treatment
- (CVG 5134) ENVJ 5907 Chemistry for Environmental Engineering
- (CVG 5135) ENVJ 5608 Water Supply and Sanitation in Developing Countries
- (CVG 5137) ENVJ 5905 Water and Wastewater Treatment Process Analysis
- (CVG 5138) ENVJ 5902 Advanced Water Treatment
- (CVG 5180) ENVJ 5909 Biological Nutrient Removal
- (CVG 5232) ENVJ 5911 Unit Operation of Water Treatment Lab [0.25 credit]
- (CVG 5238) ENVJ 5912 Advanced Water Treatment Processes Lab [0.25 credit]
- (CHG 8181) ENVJ 5501 Biochemical Engineering

(CHG 8192) ENVJ 5502 Membrane Applications in Environmental Engineering
(CHG 8198) ENVJ 5503 Reverse Osmosis

Environmental Impact Assessment

ENVE 5401(EVG 7401) Environmental Impacts of Major Projects
(CVG 5139) ENVJ 5700 Environmental Assessment of Civil Engineering Projects

Other Courses

To fulfil the requirements beyond the 1.5 credits of area courses, students may choose from the following:

ENVE 5402 (EVG 7402) Finite Elements in Field Problems
(CHG 8153) ENVJ 5500 Statistical Modeling and Control of Dynamic Processes
(CHG 8186) ENVJ 5506 Modeling of Steady-State Processes
(CHG 8194) ENVJ 5504 Membrane Separation Processes
(CHG 8195) ENVJ 5505 Advanced Numerical Methods in Transport Phenomena
(CHG 8196) ENVJ 5507 Interfacial Phenomena in Engineering
(CVG 5128) ENVJ 5604 Water Resources Planning and Policy
CIVE 5601 (CVG 7140) Engineering Statistics and Probabilities
CIVE 5304 (CVG 7150) Intercity Transportation
CIVE 5305 (CVG 7151) Traffic Engineering
CIVE 5307 (CVG 7153) Urban Transportation

Students may also, subject to approval, select courses from the graduate programs in Mechanical Engineering, Biology, Chemistry, Earth Sciences, Computer Sciences, Geography and Public Policy and Administration at both universities.

Seminars, Directed Studies and Special Topics

ENVE 5800 Master's Seminar
ENVE 5906 (EVG 6108) Directed Studies 1
ENVE 5907 (EVG 6109) Directed Studies 2
ENVE 7800 Ph.D. Seminar
ENVE 5701 (ENV 7301) - ENVE 5705 (ENV 7305) Topics in Environmental Engineering

Projects and Theses

ENVE 5900 Environmental Engineering Project
ENVE 5909 Master's Thesis
ENVE 6909 Ph.D. Thesis
(EVG 6000) Environmental Engineering Project
(EVG 7999) Master's Thesis
(EVG 9998) Comprehensive Examination
(EVG 9999) Ph.D. Thesis

European, Russian, and Eurasian Studies

1311 Dunton Tower
Telephone: 613-520-2888
Fax: 613-520-7501
carleton.ca/eurus

The Institute

Director: Andrea Chandler

The Institute of European, Russian, and Eurasian Studies continues a tradition of over forty years of teaching and research on the region at Carleton University. The Institute offers an interdisciplinary Master of Arts program in European, Russian, and Eurasian Studies, with the participation of faculty members from ten disciplines (art history, business, economics, geography, history, international affairs, law, political science, language studies, and sociology). They are joined regularly by visiting scholars from outside the University, including invited specialists from Europe and Russia.

In recent years, Europe, Russia, and Eurasia have witnessed dramatic developments, including the collapse of the communist system, the progression of European integration, the enlargement of the European Union, and increased mobility across state borders. These changes present a wide range of political, social, and economic challenges. While established democracies in Europe struggle to respond to issues such as immigration, economic integration, social policy reform, institutional change, and the development of a common foreign policy, the countries of Central and Eastern Europe face challenges deriving from the communist and pre-communist periods. States in Eurasia must balance Soviet legacies alongside a desire for national independence on the one hand and the rise of Islamic sentiment on the other. Other dynamics, such as nationalism, globalization, and environmental decline affect the entire region.

Institute courses and research programs focus on several broad themes. These themes combine attention to historical contexts with a thorough analysis of contemporary developments. Major themes include:

- the legacy of the Soviet system and its impact on contemporary developments
- the role of the European Union in transforming the continent
- transition periods in the history of the region, with emphasis on political, economic, and social dimensions of the post-communist transition
- nationalism, ethnicity, and migration as forces for change in the area
- international integration, and the reintegration of Eastern Europe and Eurasia into European institutions and the larger international community
- environmental problems and policies in a comparative perspective
- the changing relationship between state and society, with attention to ethnicity, class, gender, and religion

The interdisciplinary approach emphasizes the social sciences and history. Students may take advantage of the university's regular academic exchanges with post-secondary institutions in Austria, Belgium, Finland, France, Germany, the Netherlands, Poland, Russia, Spain, and the United Kingdom. In addition, EURUS faculty can facilitate research work and other study programs in other countries in the region.

The diploma program in European Integration Studies is a supplemental qualification available to graduate students enrolled in a M.A. or Ph.D. degree program at Carleton. Students in the Institute's M.A. program may work concurrently towards their diploma in European Integration Studies.

Qualifying-Year Program

Applicants who have a general (three-year) bachelor's degree in one of the disciplines represented in the program, or who lack sufficient area studies or language training, may be admitted to a qualifying-year program designed to raise their status to that of honours graduates in European, Russian, and Eurasian Studies. Students are expected to achieve a B+ average or better in the qualifying-year program in order to qualify for admission to the Master's year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an honours degree (or equivalent), with at least a B+ average.

For admission to the program, applicants should normally meet the following requirements:

- A B.A. Honours degree (or equivalent) in a humanities or social science discipline, with at least 3.0 credits in the European/Russian/Eurasian area covering three different disciplines (excluding language courses); and
- A reading knowledge of an appropriate major European language (normally equivalent to two academic years of instruction, or one year with an intensive summer program) or, at the discretion of the Institute, equivalent knowledge of another of the region's languages. Applicants admitted with no proficiency or inadequate proficiency in an appropriate language will require additional language training beyond normal M.A. requirements.

Practical experience in the area of study will also be taken into consideration.

Applicants who do not have the required interdisciplinary background in the European/Russian/Eurasian area are encouraged to apply to the program, but additional coursework beyond the 5.0 credits may be required.

It is expected that students will complete the degree within three to four academic terms of study (which may include summer term registration). However, students who need extra language training or who do not have sufficient interdisciplinary background at the undergraduate level may require extra time for degree completion, as will students who participate in an academic exchange abroad.

Program Requirements

1) Students in the program must complete 5.0 credits, consisting of the following:

- EURR 5001, which is a 0.5-credit core seminar offered specially by the Institute. The course incorporates the approaches of several relevant disciplines and introduces students to a variety of methodological approaches and tools needed to design and implement research projects;
- Selection of a concentration (either Russian, Eurasian and Transitions Studies or European and European Union Studies), with 1.0 credit of course work from the concentration course list provided below under the description of each concentration;
- Either EURR 5200 (recommended for students selecting the Russian, Eurasian and Transition Studies concentration), or EURR 5300 (recommended for students selecting the 'European and European Union Studies' concentration);

- An additional 1.0 credit in coursework chosen with the approval of the graduate supervisor from the electives course list below;
- *Either* EURR 5908 (1.0 credit), a research essay related to the concentration, incorporating the approaches of at least two disciplines represented in the program; the research essay must be defended orally and combined with an additional 1.0 credit coursework chosen with the approval of the graduate supervisor from the electives course list below,
- or
- EURR 5909 (2.0 credits), an M.A. thesis on a topic related to the concentration, which must combine interdisciplinary approaches with a greater degree of originality and a greater use of primary sources than that required of the research essay. The thesis must be defended orally. The thesis option cannot be taken without the specific permission of the graduate supervisor.
- No more than 1.0 credit may be taken at the 4000-level. No more than 0.5 credit in a language discipline may be counted towards program requirements.

2) Completion of the language requirement:

Each student must demonstrate language proficiency. Students entering the M.A. program with no language proficiency or inadequate language proficiency will require extra coursework and/or summer language training to meet the language proficiency requirement.

For the Russian, Eurasian and Transition Studies concentration the student may select German, Polish, Russian, Ukrainian, or Serbian/Croatian. For the European and European Union Studies concentration the student may select French, German, Italian, Polish, or Spanish. A student may request permission to use another major language to fulfill this requirement. However, the requested language (a) must be utilized in undertaking research for the research essay or M.A. thesis; and (b) its selection must be approved by the graduate supervisor.

Proficiency in the approved language may be demonstrated by successful completion of a written translation examination to be administered by the Institute or by completion of the appropriate language from the following list with a minimum grade of B+: RUSS 4200 and RUSS 4201; GERM 3605; SPAN 3605; ITAL 3000; or 1.0 credit in FREN at the 4000-level.

Concentrations

While one of the program's goals is to provide students with an integrative approach to the entire region, the concentration assures that each student's individual program will retain a particular focus. Europe and Eurasia have become increasingly integrated in terms of theoretical and methodological approaches. However, the two sub-regions covered by the program have distinct histories and legacies along with differing intellectual traditions. Selection of a concentration assures that each student's program will have an adequate level of intellectual coherence. Students studying the post-communist countries of Central and Eastern Europe that are EU member states or candidates for membership may select either concentration, depending on the thematic focus of the student's work. The Institute offers two concentrations that draw systematically from the program's range of courses and expertise. Students are required to pursue one of these concentrations:

- Russian, Eurasian, and Transition Studies
- European and European Union (EU) Studies

Russian, Eurasian, and Transition Studies

This concentration involves an interdisciplinary focus on the communist legacy and challenges facing countries in transition, with a geographic scope covering eastern and southeastern Europe, Russia, Ukraine, Belarus, the Caucasus, and post-Soviet Central Asia.
It is recommended that students pursuing this concentration complete EURR 5200 rather than EURR 5300.

Concentration course elective list: EURR 4002 or EURR 5002, EURR 4101, EURR 4205, EURR 4207, EURR 5005, EURR 5007, EURR 5008 EURR 5102, EURR 5107, EURR 5202, EURR 5203, EURR 5204, HIST 5600, PSCI 4501, PSCI 4503, PSCI 4601, PSCI 5104, PSCI 5105, PSCI 5106, SOCI 5804

European and European Union Studies

This concentration focuses on countries involved in the European Union and on European integration processes, consequences, and dynamics from an interdisciplinary perspective, including EU enlargement and relations of the EU with other states.
It is recommended that students pursuing this concentration complete EURR 5300 rather than EURR 5200.

Concentration course elective list: EURR 4006, EURR 5003, EURR 5008, EURR 5104, EURR 5105, EURR 5106, EURR 5108, EURR 5201, EURR 5204, EURR 5302, INAF 5804, INAF 5805, PSCI 5503, HIST 5100, HIST 5200

Electives Course List

Art History

ARTH 4202 Topics in Eastern Medieval Art

Economics

ECON 5603, ECON 5806, ECON 5807

Geography

GEOG 4600 Post-Communist Eastern Europe

History

HIST 4600 Seminar in Russian History
HIST 5100, HIST 5200, HIST 5600 HIST 5800, HIST 5810, HIST 5811

International Affairs

INAF 5202, INAF 5206, INAF 5602 INAF 5804, INAF 5805

Law

LAWS 4806 The Civilist Tradition

Political Science

PSCI 4503 Politics of Central Eurasia
PSCI 4601 Foreign Policies of Soviet Successor States
PSCI 5104, PSCI 5105, PSCI 5106, PSCI 5201 PSCI 5404, PSCI 5503, PSCI 5506, PSCI 5509 PSCI 5803, PSCI 5806

Russian

RUSS 4200 Russian Syntax and Translation
RUSS 4201 Russian for the Social Sciences

Sociology

SOCI 5804

European, Russian and Eurasian Studies

EURR 4006 European Integration and the Business Environment in East/Central Europe
EURR 4101 The Balkans
EURR 4205 Gender and Politics in Post-Communist Societies
EURR 4207 Politics of Central Eurasia
EURR 5000, EURR 5001, EURR 5002
EURR 5003, EURR 5005, EURR 5007
EURR 5008, EURR 5100, EURR 5102
EURR 5103, EURR 5104, EURR 5105

EURR 5106, EURR 5107, EURR 5108
EURR 5201, EURR 5202, EURR 5203
EURR 5204, EURR 5900, EURR 5901
EURR 5902, EURR 5903, EURR 5904
EURR 5905, EURR 5906

Other 4000- and 5000-level courses may be approved by the graduate supervisor as EURUS credits if they are deemed appropriate to a particular student's objectives.

Academic Standing

Master's candidates must obtain a grade of B- or higher on each credit counted towards the degree.

Guidelines for Completion of Master's Degree

Students in the 5.0-credit program with sufficient proficiency in Russian, German, or another approved language are expected to complete the degree within three to four terms of study.

Students participating in international exchanges will normally require longer to complete degree requirements.

Diploma in European Integration Studies

This diploma program is only open to students currently enrolled in a graduate degree program at Carleton University and is intended to provide an additional qualification to the student's main degree. Applications to the program should be made to the Institute of European and Russian Studies. Some previous coursework or practical experience in the field of European Studies is a prerequisite for admission to the program. The purpose of the diploma program is to supplement the student's program of study by providing in-depth study of processes of European integration from an interdisciplinary perspective and thus to prepare the student for professional work or further study in this field.

Students must complete 2.5 credits of coursework and take part in a non-credit seminar EURR 5809. Of the 2.5 credits required for the diploma, 1.0 credit must be unique to the diploma program and may not be counted toward meeting requirements for the student's main degree program. The unique diploma courses must include EURR 5003 and one additional course on the primary option list. In addition to English, the student must demonstrate proficiency in a second European language (approved languages are subject to the discretion of the Institute), as certified by a language examination.

Note: in order to be awarded the Dipoloma, students must apply to graduate with the Diploma at the same time as they apply to graduate with their M.A. or Ph.D.

Required courses:

- EURR 5003 Social and Political Perspective in Europe
- EURR 5809 Seminar in European Integration Studies

Primary Option List

At least two of the following:

- PSCI 5503 Topics in European Politics
- INAF 5804 International Relations in Europe
- INAF 5805 The E.U. in International Affairs
- EURR 5104 European Integration and European Security (also listed as PSCI 5608)
- EURR 5105 European Economic Integration
- EURR 5106 Selected Topics in European Integration Studies (also listed as PSCI 5609)
- EURR 5108 Canada-EU Relations: Summer Module (also listed as PSCI 5103)
- EURR 5302 EU Summer Study Abroad

Secondary Option List

One additional credit, which may include:

- ECON 5401 Public Economics: Expenditure
- ECON 5402 Public Economics: Taxation
- ECON 5601 International Trade: Theory and Policy
- ECON 5602 International Monetary Theory and Policy
- ECON 5806 Comparative Economic Systems I
- ECON 5807 Comparative Economic Systems II
- EURR 5102 The International Political Economy of Transition (also listed as INAF 5802)
- PSCI 5105 Post-Communist Politics in East Central Europe
- PSCI 5106 Selected Problems in the Politics of Soviet Successor States
- PSCI 5509 Governing in the Global Economy
- PSCI 5807 Analysis of International Organizations
- PSCI 5808 International Political Economy
- INAF 5308 International Trade: Theory and Policy
- INAF 5309 International Finance: Theory and Policy
- Other 5000-level courses may be approved by the graduate supervisor as Diploma credits if they are deemed appropriate to the program.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

EURR 5000 [0.5 credit]
Social Science Approaches to Communist and Post-Communist Studies
An overview of social science approaches to the field of study for students with limited background in the field. The course is open to graduate students from a variety of departments.
Prerequisite: permission of the Institute.

EURR 5001 [0.5 credit]
Interdisciplinary Seminar in European and Russian Studies
Current debates and methodological approaches within various academic disciplines relating to Europe, Russia, and Eurasia.
Prerequisite: permission of the Institute or enrolment in the EURUS program.

EURR 5002 [0.5 credit]
Post-Soviet States and Societies
The relationship between social forces and state structures at both the national and local levels in the USSR and the post-soviet states. (Also listed as PSCI 5110)
Precludes additional credit for EURR 4002.

EURR 5003 [0.5 credit]

Social and Political Perspectives in Europe

The emergence of a European polity, identity and culture. Examination of whether 'Europe' as a defined entity exists and the ways in which we may try to understand its evolution. Also offered at the undergraduate level with different requirements as EURR 4003, for which additional credit is precluded.

EURR 5005 [0.5 credit]

Environmental Problems and Politics in East/Central Europe and Eurasia

Nature, origins and policy responses viewed from economic, political and geographic perspectives. Also offered at the undergraduate level, with different requirements, as EURR 4005, for which additional credit is precluded.
Prerequisite: 1.0 credit in the area of East European or environmental studies, or permission of the Institute.

EURR 5007 [0.5 credit]

Social and Political Discourse in Russia

Contemporary, social and political issues as covered in Russian-language media. Most course reading and instruction is in the Russian language but student participation may be in English or Russian. Also offered at the undergraduate level, with different requirements, as EURR 4007, for which additional credit is precluded.
Prerequisite: appropriate facility in the Russian language and permission of the Institute.

EURR 5008 [0.5 credit]

Nationalism and Ethnic Conflict in Eastern and Central Europe

Ethnic basis of nationalism in the region. Ethnic politics and trends.
Precludes additional credit for EURR 4008.

EURR 5100 [0.5 credit]

Nation-Building in Central and Eastern Europe

Processes of nation building in the region examined in terms of a particular country, or set of countries. Country focus may vary. Also offered at the undergraduate level, with different requirements, as EURR 4100, for which additional credit is precluded.

EURR 5102 [0.5 credit]

The International Political Economy of Transition

Problems of reintegration into the world economy and dilemmas of transition from command to market economies. Topics may include new trade and investment patterns, role in regional and international economic organizations, search for appropriate exchange rate policies, impact of Western assistance. (Also listed as INAF 5802.)

EURR 5103 [0.5 credit]

Sustainability and Development in the Arctic: Transformations in the Circumpolar North

The Circumpolar Arctic Region is undergoing rapid political, economic, social and technological development, which impacts sustainability. Climate, contaminants and biological diversity focus international attention. Nunavut, the Russian North, major developments, and international circumpolar regime formation will be discussed, with emphasis on environment and development. (Also listed as GEOG 5700.)

EURR 5104 [0.5 credit]

European Integration and European Security

A seminar focusing on security issues related to the formation of supra-national decision-making structures in Europe. Also offered at the undergraduate level with different requirements, as EURR 4104, for which additional credit is precluded. (Also listed as PSCI 5608.)

EURR 5105 [0.5 credit]

European Economic Integration

Economic issues and policies related to the process of European integration and the development of the post-World War II European Union.
Prerequisite: ECON 1000.

EURR 5106 [0.5 credit]
Selected Topics in European Integration Studies
Selected topics related to post-World War II European integration.
(Also listed as PSCI 5609.)

EURR 5107 [0.5 credit]
Russia and the New World Order, 1992 to the Present
An examination of how the Russian Federation has sought a place for itself in the world order since the collapse of the USSR.
Precludes additional credit for EURR 4107.

EURR 5108 [0.5 credit]
Canada-EU Relations: Summer Module
Relations between Canada and Europe in the context of European integration, with attention to policy issues affecting the relationship and/or areas of common policy challenges.
Precludes additional credit for EURR 5106 and PSCI 5609 if taken in the summer of 2003-2004 or 2004-05. (Also listed as PSCI 5103).
Prerequisite: previous course in European integration or permission of the instructor.
Intensive two-week summer module.

EURR 5200 [0.5 credit]
Interdisciplinary Seminar on Russian, Eurasian and Transition Studies
Particular issues in post-communist transition. Discussion of student research proposals.
Precludes additional credit for EURR 5300.

EURR 5201 [0.5 credit]
Special Topics in European Studies
Selected topics related to Europe and/or the European Union.

EURR 5202 [0.5 credit]
Special Topics in Russian, Eurasian, and Transition Studies
Selected topics related to the communist and post-communist states and processes of transition they are undergoing.

EURR 5203 [0.5 credit]
Imperial and Soviet Russia
Legacies of the tsarist empire and the Soviet Union that influence the region today. Topics include political culture, empire, socialism, class, gender, and non-Russian peoples. Also offered at the undergraduate level with different requirements as EURR 4203, for which additional credit is precluded.
Also listed as HIST 5603.

EURR 5204 [0.5 credit]
Central Europe, Past and Present
Evolution and current status of Central Europe from periods of foreign control in the late nineteenth and twentieth centuries to independent statehood. Emphasis on national accommodations and conflicts.
Also offered at the undergraduate level with different requirements as EURR 4204, for which additional credit is precluded. Also listed as HIST 5604.

EURR 5300 [0.5 credit]
Interdisciplinary Seminar on European and European Union Studies
Particular issues in EU member countries as well as processes of European integration and EU enlargement. Discussion of student research proposals.
Precludes additional credit for EURR 5200.

EURR 5301 [0.5 credit]
Internship and Applied Policy Skills
A seminar accompanying an unpaid internship placement to develop workplace and applied policy skills. Relating applied experience to academic literature. Writing skills for an applied

policy setting. Also listed as EURR 4206, for which additional credit is precluded.
Prerequisite: Open only to EURUS MA students with a minimum B+ average and placement in an internship position in the same semester or in the previous semester (based on a competitive application process).
Internship placement: 12 days over 12 weeks.
Seminars: six three-hour seminar sessions.

EURR 5302 [0.5 credit]
EU Summer Study Abroad
This course is open only to students in approved summer study options in Europe, particularly the EU Study Tour.
Prerequisite: approval of the Institute.

EURR 5809 (0.0 credit)
Seminar in European Integration Studies
Each student must present a paper relating to European integration that was prepared for another diploma course. Diploma students are expected to attend presentations by other students and other seminar talks. Open only to students registered in the Diploma in European Integration Studies.

EURR 5900 [0.5 credit]
Tutorial in Russian-Area Studies
Directed readings on selected aspects of the Soviet successor states, involving preparation of papers as the basis for discussion with the tutor. Offered to meet specific program needs.

EURR 5901 [0.5 credit]
Tutorial in Russian, Eurasian and Transition Studies
Directed readings on selected aspects of Russian, Eurasian and Transition issues.
Prerequisite: permission of the Institute.

EURR 5902 [0.5 credit]
Tutorial in European and European Union Studies
Directed readings on selected aspects of European and European Union issues.
Prerequisite: permission of the Institute.

EURR 5903 [0.5 credit]
Tutorial in European and European Union Studies
Directed readings on selected aspects of European and European Union issues.
Prerequisite: permission of the Institute.

EURR 5908 [1.0 credit]
Research Essay
A research essay on a topic relating to European, Russian or Eurasian Studies.

EURR 5909 [2.0 credits]
M.A. Thesis
Prerequisite: permission of the Institute.

Film Studies

St. Patrick's Building 423
Telephone: 613-520-2342
Fax: 613-520-3575
carleton.ca/artandculture/filmstudies

The School

Director: Bryan Gillingham
Supervisor of Graduate Studies: Zuzana Pick

The School for Studies in Art and Culture offers a program of study and research leading to the degree of Master of Arts in Film Studies. This is a disciplinary M.A. with emphasis upon 1) the conceptual issues current in the field, and 2) the problematics of various national cinemas and other practices.

The program will develop in students a broadly based expertise in the discipline. The study of Canadian cinema is given a high priority, but provision is also made for the study of other national cinemas, and for the study of other traditions outside the mainstream, such as women's cinemas, post-colonial cinemas, and minority and regional practices.

Most work in the program is on the feature fiction film and its institutional foundations as an object of study. However, in line with the expertise of members of faculty, the study of other film forms like documentary, animation, experimental film and video is a necessary part of the course offerings.

Questions of critical and historical method and problems of theory inform all of the courses in the program. This conceptual emphasis is in line with the central developments in Film Studies as a discipline over the past twenty-five years.

Qualifying-Year Program

Applicants who lack an Honours degree, but who have a three-year degree in film studies or a related discipline with a minimum standing of B+, may be admitted to a qualifying-year program. Students who complete the qualifying-year requirements with high honours standing or better will be considered for admission to the master's program. The regulations governing the qualifying-year are outlined in the General Regulations section of this calendar.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program in either a full-time or part-time capacity is a B.A. (Honours) or the equivalent in film studies or a related discipline with high honours standing. Related disciplines might include mass communication, art history, literature, Canadian studies, women's studies, and history. Applicants without a background in film studies may be required to take a maximum of two full credits from designated courses in the undergraduate Film Studies program in addition to their normal M.A. program requirements.

Program Requirements

The specific program requirements for students in the M.A. program are as follows:

- 1.0 core credit required
- 2.0 additional credits
- Thesis (equivalent to 2.0 credits)
- Total of 5.0 credits required

In choosing the two additional credits beyond the core seminar and the thesis, students may take 0.5 credit outside the Film Studies program subject to the approval of the Graduate Supervisor.

Because of the strong conceptual demands of the program and the expectation that students be able to synthesize ideas in a substantial piece of written work, the research essay option will not be available in partial fulfillment of the requirements of the degree.

Deadlines

Normally, full-time students should complete their course work by the end of the second term, and part-time students by the end of the fifth term.

Thesis Proposal

Students normally will submit a detailed thesis proposal to the thesis proposal committee no later than March 1 of the first year of registration for students enrolled full-time and no later than the middle of the fifth term of registration for students enrolled part-time.

Language Requirements

A reading knowledge of french (or another language approved by the Film Studies Graduate Supervisor) is required.

Academic Standing

A standing of B- or better must be obtained in each course counted towards the master's degree.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule atcentral.carleton.ca

FILM 5000 [1.0 credit]
Directions in Film Theory and Film History
Recent developments in film theory and history. Topics may include spectatorship, identity, gender, cultural studies, fan cultures, performance, reception theory, formation of taste, discourse analysis, historical method, and concepts of national and transnational cinemas.

FILM 5001 [0.5 credit]
Directed Readings and Research
Tutorials designed to permit students to pursue research on topics in film studies which have been chosen in consultation with members of faculty.

FILM 5002 [0.5 credit]
Special Topics
Selected topics in film studies not available in the regular course program.

FILM 5105 [0.5 credit]

Changing Practices

Traditional and recent developments in non-feature film forms such as documentary, newsreel, experimental film, video and television. The aesthetic particulars that distinguish these forms from the fiction feature film and their social and cultural roles.

FILM 5201 [0.5 credit]

Topics in European Cinema

Some aspect of European cinema - a particular period, movement, style, genre, narrative development or co-production practice - is the focus of this course. The problematic concept of a national cinema in the light of current debates about nation-ness.

FILM 5202 [0.5 credit]

Cinemas of the America

Examination of one or more of the cinemas of the United States, the Caribbean, Latin America and Brazil. A particular period, movement, style, genre, narrative development, some relationship between these cinemas or the problematic concept of a national cinema may be dealt with.

FILM 5204 [0.5 credit]

Cultural Mediations

The processes of mediation that operate between mainstream and alternative, independent or marginal film industries and practices.

FILM 5208 [0.5 credit]

Historical Traditions in Canadian Cinema

Selected aspects of the history of cinema in Canada; with emphasis on the role of institutional bodies, government policies, economic decisions, aesthetic traditions, and related cultural practices.

FILM 5209 [0.5 credit]

Critical Perspectives on Canadian Cinema

Current critical approaches to Canadian film; the influence of Canadian and foreign cultural theory and criticism on film studies in Canada.

FILM 5401 [0.5 credit]

Studies in Authorship

Examination of the work of one or two filmmakers, with a concern for recent ideas about the concept of authorship and the formation of artistic and critical reputations.

FILM 5500 [0.5 credit]

Advanced Film Analysis

Issues and approaches to the detailed analysis of particular film texts. Work in narratology, hermeneutics, discourse analysis, psychoanalysis, deconstruction and semiotics will provide the methodological background to the study of individual films.

FILM 5501 [0.5 credit]

Gender and Cinema

The social production and reproduction of gender and gender relations through the cinema and its representations; the consequences of this work for feminist, gay and lesbian film practices and politics.

FILM 5601 [0.5 credit]

Studies in Genre

The theory and practice of film genres will be the object of study in this course.

FILM 5701 [0.5 credit]

Topics in Animation

Institutional histories, the work of individual animators, modes of production, and the social function of animation represent topics to be covered by this course.

FILM 5900 [0.5 credit]

Cinema and Modernism

Cinema's relationship to the history and theory of modernism. The concerns of classical film theory, the emergence of avant-garde, modernist film practices, and film's relationship to other twentieth-century art forms.

FILM 5901 [0.5 credit]

Cinema and the Postmodern

An examination of cinema's relationship to the history and theory of postmodern cultural practices in performance art, video, multimedia, architecture, literature, music, and other examples of artistic postmodernism.

FILM 5909

M.A. Thesis

French

Dunton Tower 1602
Telephone: 613-520-2168
carleton.ca/french

The Department

Chair of the Department: C. Khordoc
Departmental Supervisor of Graduate Studies: C. Duff

The program of studies leading to a Master of Arts degree in French offers to the student the opportunity to specialize in one of the following areas: linguistics, literature or translation. The availability of a variety of courses and the existence of FREN 5800, FREN 5907, FREN 5908, and FREN 5909, in which the student establishes course content in consultation with his/her adviser, allow for considerable flexibility and choice in wide ranging or highly specialized studies.

Qualifying-Year Program

Applicants who hold a general (3-year) bachelor's degree with at least B standing or higher, with a major in French, are required to register in the qualifying-year program (normally 5.0 credits in French chosen from those numbered at the 4000-level), and maintain at least B+ standing overall, before proceeding to the M.A. program.

Qualifying-year students should consult the Undergraduate Calendar for a listing of 4000-level courses.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is a B.A.(Honours) in French with at least high honours standing (normally B+ or better in Honours subject; B- or better overall).

Program Requirements

The requirement for the Master of Arts in French is 5.0 credits. Candidates select from one of three program options, chosen in consultation with an adviser from the Department, normally the Supervisor of Graduate Studies.

Comprehensive Examination Program

- FREN 5907 Comprehensive Examination (1.0 credit)
- FREN 5300 Méthodologie de la recherche (0.5 credit)
- 3.5 credits at the 5000-level

Research Essay Program

- FREN 5908 Research Essay (1.0 credit) (Mémoire de recherche)
- FREN 5300 Méthodologie de la recherche (0.5 credit)
- 3.5 credits at the 5000-level

Thesis Program

- FREN 5909 (2.0 credits)
- FREN 5300 Méthodologie de la recherche (0.5 credit)
- 2.5 credits at the 5000-level

With the approval of the Supervisor of Graduate Studies, M.A. students in French may select the equivalent of 1.0 credit at the graduate or senior undergraduate level in French or other departments.

Students are restricted to a maximum of 0.5 credit in directed readings FREN 5800 (Lectures dirigées).

Guidelines for Completion of Master's Degree

Normally, all full-time students are expected to fulfil the requirements of the M.A. program by the end of the fifth term of study. Generally, students should be able to complete their program within four terms.

Students are required to file with the Department of French a detailed proposal of their thesis, research essay or comprehensive exam. Full-time master's candidates are required to submit this proposal by the end of the ninth month of full-time registration.

Academic Standing

A grade of B- or better must be obtained in each credit counted towards the master's degree.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

The graduate courses offered by the Department are open to students in the M.A. program and, with permission of the Department, to students in the qualifying-year program. For prerequisites, please consult the Department.

FREN 5001 [0.5 credit]
Théories linguistiques françaises
Le contenu précis de ce cours varie selon les années.

FREN 5002 [0.5 credit]
Linguistique du français I
Le contenu précis de ce cours varie selon les années. Présentation des théories et initiation aux méthodes utilisées en linguistique historique par le biais de l'étude du changement en français. Analyse de documents anciens et modernes du point de vue de la morphologie et de la syntaxe. Survol de l'évolution dans l'étude de la langue. Also offered at the undergraduate level, with different requirements, as FREN 4413, for which additional credit is precluded..

FREN 5003 [0.5 credit]
Linguistique du français II
Le contenu précis de ce cours varie selon les années.

FREN 5004 [0.5 credit]

Linguistique du français canadien

Le contenu précis de ce cours varie selon les années. Sujet pour 2009-2010: Sociolinguistique de l'Ontario français. Analyse des conditions sociales et historiques de l'émergence du français en Ontario et de sa répartition géographique et démographique. Définition et évaluation de l'identité franco-ontarienne. Application de notions sociolinguistiques théoriques et méthodologiques au français parlé en Ontario. Bilinguisme, langues en contact et restriction..

FREN 5006 [0.5 credit]

Linguistique du français langue seconde

Le contenu précis de ce cours varie selon les années.

FREN 5007 [0.5 credit]

Traduction: théorie et pratique

Le contenu précis de ce cours varie selon les années.Sujet pour 2009-2010: Penser la littérature traduite: orientations contemporaines. Longtemps marginalisée, la part que prend l'activité de traduction à la production de la littérature motive aujourd'hui un intérêt soutenu dans le champ des études littéraires et culturelles. Nous en étudierons les principaux développements contemporains en considérant études de cas et réflexions critiques.

FREN 5200 [0.5 credit]

Aspect linguistique particulier

Le contenu précis de ce cours varie selon les années.

FREN 5300 [0.5 credit]

Méthodologie de la recherche

Introduction aux méthodes de recherche en études françaises. Ressources bibliographiques. Emploi de l'ordinateur. Différentes approches. Rédaction de dissertations et d'articles. Le cours se donne sous forme d'atelier avec projets individuels.

FREN 5400 [0.5 credit]

Théories littéraires

Sujet pour 2009-2010: Le postcolonial: théorie et pratique. Étude du postcolonial par rapport aux littératures caribéenne et africaine d'expression française. Rôle du postcolonial dans l'étude des littératures nées de sociétés dont le passé (et dans certains cas, le présent) est empreint de la marque d'un régime colonial, à savoir français. Also offered at the undergraduate level, with different requirements, as FREN 4212, for which additional credit is precluded.

FREN 5403 [0.5 credit]

Littérature et idéologie

Le contenu précis de ce cours varie selon les années.

FREN 5404 [0.5 credit]

Auteurs I

Le contenu précis de ce cours varie selon les années.

FREN 5405 [0.5 credit]

Thèmes, écoles, mouvements

Le contenu précis de ce cours varie selon les années.

FREN 5408 [0.5 credit]

Littérature française I

Sujet pour 2009-2010: Surréalisme et idéal : " Que reste-t-il de ces beaux jours? "
Dans les beaux jours du surréalisme, au moins jusqu'en 1930, le mouvement se nourrissait d'idéaux esthétiques, transformant l'art et la vie en vases communicants. Exploration de ces principes très exigeants dans les manifestes, la poésie et les récits d'auteurs comme Aragon, Breton et Leiris..

FREN 5409 [0.5 credit]
Littérature francaise II
Sujet pour 2009-2010: Le code des poèmes. Étude en diachronie de l'émergence du code poétique et de ses théories. Les premières manifestations : le code sans codification, les premières théorisations de la Renaissance, les théories classiques. La mise en cause romantique et le bouleversement symbolique et le vers dit "libre". Also offered at the undergraduate level, with different requirements, as FREN 4214, for which additional credit is precluded..

FREN 5500 [0.5 credit]
Littérature canadienne-française I
Sujet pour 2009-2010: Écriture migrante du Québec. Étude des manifestations thématiques et formelles de la migrance : l'exil, le passage entre langues, le deuil de l'origine, la quête identitaire, l'accueil et l'intégration dans la société d'adoption, le retour, le conflit des générations. Le rôle de cette écriture au sein d'un corpus national.

FREN 5501 [0.5 credit]
Littérature canadienne-française II
Le contenu précis de ce cours varie selon les années.

FREN 5601 [0.5 credit]
Études culturelles
Le contenu précis de ce cours varie selon les années.

FREN 5602 [0.5 credit]
Littérature, société, communication
Le contenu précis de ce cours varie selon les années.

FREN 5603 [0.5 credit]
Littérature et les autres arts
Le contenu précis de ce cours varie selon les années.

FREN 5604 [0.5 credit]
Paralittératures
Le contenu précis de ce cours varie selon les années.

FREN 5700 [0.5 credit]
Aspect littéraire culturel particulier
Le contenu précis de ce cours varie selon les années.

FREN 5800 [0.5 credit]
Cours de lectures dirigées
Sujet établi sur proposition de l'étudiant en consultation avec son conseiller.

FREN 5907 [1.0 credit]
Comprehensive Examination

FREN 5908 [1.0 credit]
Mémoire de recherche
L'étudiant prépare un mémoire d'une cinquantaine de pages sur un sujet de son choix. Ce travail est sanctionné par un examen oral.

FREN 5909 [2.0 credits]
M.A. Thesis

Geography

Loeb Building B349
Telephone: 613-520-2561
Fax: 613-520-4301
carleton.ca/geography

The Department

Chair of the Department: Michael Brklacich

Departmental Supervisor of Graduate Studies: Doug King

The Department of Geography and Environmental Studies offers programs of study and research in human and physical geography leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy.

The Department views the greatest strength of geography, as a discipline, as its ability to integrate and apply knowledge across the interface of the Earth's social and environmental systems. The structure of the Ph.D. program expresses this philosophy. Masters students may follow this approach or pursue studies in a thematic sub-field of the discipline.

Students are accepted into the graduate program based on the standard of previous academic work, research interests, letters of reference, and the availability of faculty to act as supervisors. Each student's program of study, as far as possible, is based on the interests of the individual, although certain courses may be required. An advisory committee, consisting of the student's research supervisor and at least one (Masters) or two (Ph.D.) other members of the faculty, is established to monitor progress and provide thesis research guidance.

Excellent research laboratory facilities exist for the study of near surface processes, the physics, chemistry, and thermodynamics of earth materials, and for geomatics (GIS, remote sensing, and computer cartography). These facilities are supported by highly qualified full-time staff in laboratory instrumentation, geomatics, and computing. The Maps, Data and Government Information Centre in the MacOdrum Library houses an extensive collection of geo-spatial resources, including imagery and digital products. The university's location in Canada's capital city offers students access to important federal resources, such as the National Library, the Public Archives of Canada, the Canada Centre for Remote Sensing, Statistics Canada, and the specialist libraries of many government departments.

Systematic interests of Departmental members are applied to a variety of world regions, although emphasis is given to Canada (including northern studies) and the developing world. Individual faculty research interests are posted on our Web site carleton.ca/geography. The interacting and overlapping clusters of research specialization within the Department are the following:

Physical Geography

Studies of natural and anthropogenic processes close to the earth's surface and their geotechnical significance; climate-ground interaction; geocryology; soils and sediments; vegetation structure and health; biogeography; Quaternary studies; karst.

Resource Development

Identification and analysis of development processes; the interplay of environmental, demographic, social, gender, political, and economic variables in the spatial development of land resources, settlement systems, and natural resource-based industries; environmental impact assessment and environmental management.

Cultural, Historical, and Political Geography

Rural and urban settlement history; ethnicity; territorial organization and the concepts of state, group politico-territorial identities, territoriality, and self-determination; role of territory in conflict situations; perceptions of environment and geographies of the mind; gender as a cultural variable; urban heritage conservation.

Social and Economic Geography

Geographical analyses of the social and economic organization of societies; area variations in social well-being; medical geography; provision of public and informal services in changing local and regional environments; implications of gender roles; industrial systems; philosophy of science and of geography.

Geomatics

Vegetation modeling, mapping, and monitoring using remote sensing and environmental data; environmental modeling of vegetated ecosystems in response to climate change; cybercartography and electronic atlas development; and applications of geomatics in the various thematic fields listed above.

Qualifying-Year Program

Applicants with exceptional promise who have a general (three-year) bachelor's degree, or who have substantially less than an Honours degree in Geography, may be admitted to a qualifying-year program. To be considered for admission into the master's program, qualifying-year students must attain at least B+ standing in their qualifying-year geography courses. See the General Regulations section of this Calendar for details about the qualifying year.

Master of Arts

Admission Requirements

The requirement for admission into the master's program is a B.A.(Honours) or B.Sc. (Honours) in Geography or a related discipline, with at least B+ standing. In exceptional cases, pertinent work experience may be considered in support of an application to the Department. Students entering the program from other disciplines or with academic deficiencies may be required to take additional courses.

Program Requirements

The specific program requirements of the Department of Geography and Environmental Studies are:

5.0 credits, which must include:

- One of GEOG 5000 or GEOG 5001
- M.A. thesis (2.5 credits) which must be defended at an oral examination
- GEOG 5905 - Masters Research Workshop
- 1.5 other credits

In addition to the formal requirements, M.A. students are required to attend the Departmental Seminar series, and the Graduate Field Camp.

Master of Science

Admission Requirements

The normal requirement for admission into the M.Sc. program in Geography is a B.Sc. (Honours) or B.A. (Honours) in Physical Geography or a related discipline, with at least B+ standing. Students entering the program from other disciplines or with academic deficiencies may be required to take additional courses. The intended research area must be eligible for NSERC support. Applicants for admission must provide an outline of their proposed project, which must be suitable for the M.Sc. program.

Program Requirements

The specific minimum program requirements are:

5.0 credits, which must include:

- GEOG 5001 Modeling Environmental Systems
- GEOG 5905 Masters Research Workshop
- GEOG 5906 M.Sc. Thesis (2.5 credits) which must be defended at an oral examination
- 1.0 credit in Physical Geography selected from:

GEOG 5103, GEOG 5104, GEOG 5107 GEOG 5303, GEOG 5307, GEOG 5800 GEOG 5803, GEOG 5804, GEOG 5900 GEOG 4004, GEOG 4013, GEOG 4017, GEOG 4101, GEOG 4103 GEOG 4104, GEOG 4108, GEOM 4003, GEOM 4008

or from courses offered by departments in the Faculty of Science.

- 0.5 credit free elective

Only 0.5 credit towards the program may be obtained in GEOG 5900 - Graduate Tutorial. Only 0.5 credit may be obtained at 4000 level.

In addition to the formal requirements, M.Sc. students are required to attend the Departmental Seminar Series, and the Graduate Field Camp.

Doctor of Philosophy

The doctoral program in geography is structured around two fields:

- the geography of societal change with emphasis on the global political economy; restructuring and the environment; geographies of socio-cultural evaluation; feminist geographies

- the geography of environmental change with emphasis on environmental processes and anthropogenic impacts; appraisal and societal management of environmental resources

Students in each field are required to complete GEOG 6000/GEOG 6001, which addresses substantive and methodological issues arising out of the interactions of social and environmental systems. Each student's thesis committee will include at least one other faculty member from the Department of Geography and Environmental Studies.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or the equivalent) in geography, with at least an A- average. A student already registered in the M.A. or M.Sc. program who shows outstanding academic performance and research promise may be permitted to transfer to the Ph.D. program with a recommendation by the Departmental graduate committee.

Applicants whose academic preparation has deficiencies in certain areas may be admitted to the Ph.D. program with the requirement that they complete additional course work.

Admission to the Ph.D. program is granted on a full-time basis in September for the fall term.

Program Requirements

Program requirements for the Ph.D. degree are outlined in the General Regulations section of this Calendar. The specific program requirements of the Department of Geography and Environmental Studies are:

- 10.0 credits
- GEOG 6000/GEOG 6001
- Either GEOG 6003/GEOG 6004 or GEOG 6006/GEOG 6007
- One written comprehensive examination in either GEOG 6906 or GEOG 6907
- Presentation and oral defence of the thesis proposal as outlined below
- A thesis equivalent to 8.0 of the required 10.0 credits which must be defended at an oral examination

Comprehensive Examinations

Each doctoral candidate is required to write one comprehensive examination:

. GEOG 6906 or GEOG 6907, according to the chosen field of specialization

The comprehensive examination must be completed after course requirements for the Ph.D. have been completed. The examination will occur no later than the winter term of second year of registration in the Ph.D. program. Failure to complete the examinations successfully will result in denial of permission to continue in the program.

Thesis Proposal

Candidates normally register in the thesis on entry to the program and work actively to define their research topic during the first term of registration. The thesis proposal is normally presented after comprehensive requirements have been fulfilled. Candidates submit and defend the thesis proposal at an oral examination no later than the end of the winter term of the second year of registration in the Ph.D. program. Continuous registration is required after initial registration in the thesis.

Residence Requirements

All Ph.D. candidates must be registered full time in a minimum of six terms to satisfy the residence requirement.

Collaborative Ph.D. with a Specialization in Political Economy

The Department of Geography and the Institute of Political Economy offer a Collaborative Ph.D. Program in Political Economy. See the Political Economy section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

In addition to the selection of courses offered by the Department, graduate students in geography are encouraged to consider, in partial fulfillment of their degree requirements, appropriate courses offered in such disciplines as biology, chemistry, economics, engineering, geology, history, international affairs, physics, political science, and sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. or M.Sc. program; permission of the Departments in both universities is required.

GEOG 5000 [0.5 credit]
Approaches to Geographical Inquiry
A review of the major philosophical perspectives shaping research and explanation by geographers. Particular attention is paid to interpretations of social structure and human action, the nature of the biophysical universe, and the interaction between human beings and their environments.

GEOG 5001 [0.5 credit]
Modeling Environmental Systems
Methods and problems of research on the physical environment, with illustrative material taken from the atmospheric and surface earth sciences. Issues such as the identification and behaviour of environmental systems, temporal and spatial scale, experimental method under field conditions, and simulation and model development are considered.

GEOG 5003 [0.5 credit]
Practicing Human Geography
Development of critical research skills in qualitative geographical research by considering the relationship between theory and method. Emphasis on practical experience in selected methods including: interviewing, personal narratives, focus groups, participant observation, archival research, visual methodologies and participatory research..

GEOG 5005 [0.5 credit]
Global Environmental Change: Human Implications
Global environmental change: its significance for societies, economies and international relations. Value systems underlying environmental discourse; political economy of the environment; sustainability and security. Environmental diplomacy and grassroots environmentalism. Regionalized impacts of pressures on natural environments; challenges of adaptation. (Also listed as INAF 5701.)

GEOG 5006 [0.5 credit]
Special Topics in Geography of the Environment
Research seminar on a selected theme within geographical approaches to environmental analysis. Topics will vary from year to year. Consult departmental web site for current details.

GEOG 5103 [0.5 credit]
Hydrologic Principles and Methods
Advanced physical hydrology with emphasis on atmospheric moisture, precipitation, evaporation, infiltration, soil water physics, snow hydrology and runoff generation. Analytical approaches and methods to solve practical hydrological problems.

GEOG 5104 [0.5 credit]
Advanced Biogeography
Current methods and theories in paleoecology are examined: dendrochronology, paleolimnology and other techniques for examining past climates and environmental condition. Numerical approaches to climate change studies.

GEOG 5107 [0.5 credit]
Field Study and Methodological Research
Field acquisition and analysis of geographic material; supervised field observations and methodology. (Individual or group basis, by special arrangement.)

GEOG 5201 [0.5 credit]
Special Topics in the Geography of Development
Research seminar within geographical approaches to development focusing on a selected theme or region. Topics vary from year to year. Consult departmental web site for current details.

GEOG 5303 [0.5 credit]
Geocryology
Development of ground ice in permafrost regions of Canada; ice segregation and pore-water expulsion during ground freezing; analytical and numerical approaches to modeling permafrost conditions.
Prerequisite: GEOG 4108 or permission of the Department.

GEOG 5307 [0.5 credit]
Soil Resources
Physical, mineralogical, chemical, and other properties of soils will be studied in agricultural, environmental, geomorphological and/or geotechnical contexts, as relevant to the students enrolled.

GEOG 5400 [0.5 credit]
Territory and Territoriality
Contemporary geographical and international relations theorizing is challenging notions of boundaries and territories in the political organization of modernity. Using contemporary writings on geopolitics, security, sovereignty, self-determination and identity politics this course investigates territoriality as a political and intellectual strategy. (Also listed as INAF 5402.)

GEOG 5406 [0.5 credit]
Special Topics in Cultural Geography
Research seminar on a selected theme within cultural (including historical) geography. Topic varies from year to year. Consult departmental web site for current details.

GEOG 5500 [0.5 credit]
Globalization and Localities
A review of recent theoretical and methodological debate in this field and analysis of the changing geography of production, employment, and social consumption in advanced economies. Policy issues will be considered.

GEOG 5502 [0.5 credit]

Special Topics in Geography of Globalization

Research seminar on a selected theme within geographical aspects of globalization. Topic varies from year to year. Consult departmental web site for current details.

GEOG 5700 [0.5 credit]

Sustainability and Development in the Circumpolar North

The Circumpolar Arctic Region is undergoing rapid political, economic, social and technological development, which impacts sustainability. Climate, contaminants and biological diversity focus international attention, Nunavut, the Russian North, major developments, and international circumpolar regime formation; emphasis on environment and development.

GEOG 5800 [0.5 credit]

Spatial Information Systems

Advanced concepts and problems involving spatial information systems. Topics may include: data access and implementation issues; integration of GIS and environmental models, and managing uncertainty; spatial decision support systems; visualization; quantitative spatial analysis.

Prerequisite: experience with GIS and permission of the department.

GEOG 5803 [0.5 credit]

Remote Sensing and Image Analysis

Topics may include: advanced sensors and calibration; radiometric data correction; spatial and temporal image analysis; non-parametric and object-based classification; spectral unmixing; scaling; physical-optical modeling; data fusion; selected applications in vegetation, urban, water, and geologic mapping.

GEOG 5804 [0.5 credit]

Geographic Information Systems

GIS for students with no previous experience. Includes data formats and structures, input/output and analysis capabilities, and GIS applications.

GEOG 5900 [0.5 credit]

Graduate Tutorial

Tutorial, directed reading or research, offered on an individual basis, to meet specific program needs; may be taken in one of the areas of specialization of the Department.

GEOG 5905 [0.5 credit]

Masters Research Workshop

A workshop which focuses on the challenges of research design in the various sub-fields of geography. The workshop will culminate with the development and defence of a thesis research proposal.

GEOG 5906 [2.5 credits]

M.Sc. Thesis

Thesis supervision will be given in Physical Geography, as listed in the introductory section of this department's program description.

GEOG 5909 [2.5 credits]

M.A. Thesis

Thesis supervision will be given in all areas of specialization of the Department, as listed in the introductory section of this department's program description.

6000-level courses are open only to students registered in the doctoral program.

GEOG 6000 [0.5 credit]
Doctoral Core Seminar: Geography, Society and the Environment
Geographical perspectives on the development of society/environment interrelations in Western thought and critiques thereof. The course is designed to represent and address integrative issues in the two fields of the program, the geography of social change and the geography of environmental change.

GEOG 6001 [0.5 credit]
Doctoral Core Seminar: Geography, Society and the Environment
Geographical perspectives on the development of society/environment interrelations in Western thought and critiques thereof. The course is designed to represent and address integrative issues in the two fields of the program, the geography of social change and the geography of environmental change.

GEOG 6003 [0.5 credit]
Field Seminar: Geography of Societal Change
Analysis of current geographical and related research into the three themes of global political economy: restructuring and the environment; geographies of socio-cultural evaluation; and feminist geographies.

GEOG 6004 [0.5 credit]
Field Seminar: Geography of Societal Change
Analysis of current geographical and related research into the three themes of global political economy: restructuring and the environment; geographies of socio-cultural evaluation; and feminist geographies.

GEOG 6006 [0.5 credit]
Field Seminar: Geography of Environmental Change
Analysis of geographical and related research into the appraisal and societal management of environmental resources, and environmental processes and anthropogenic impacts.

GEOG 6007 [0.5 credit]
Field Seminar: Geography of Environmental Change
Analysis of geographical and related research into the appraisal and societal management of environmental resources, and environmental processes and anthropogenic impacts.

GEOG 6906 [0.0 credit]
Comprehensive Examination: The Geography of Societal Change
This examination focuses on research challenges in theory and methodology in the themes of global political economy: restructuring and the environment; geographies of socio-cultural evaluation; feminist geographies. A specific theme will be identified for each candidate.

GEOG 6907 [0.0 credit]
Comprehensive Examination: The Geography of Environmental Change
This examination focuses on research challenges in theory and methodology associated with the appraisal and societal management of environmental resources, and environmental processes and anthropogenic impacts. A specific theme will be identified for each candidate.

GEOG 6909 [8.0 credits]
Ph.D. Thesis

History

Paterson Hall 430
Telephone: 613-520-2834
Fax: 613-520-2819
carleton.ca/history

The Department

Chair of the Department: A.B. McKillop
Departmental Supervisor of Graduate Studies: Dominique Marshall

At the M.A. level the Department of History offers two 5.0-credit programs: an M.A. in History, and an M.A. in Public History. Supervision is available in a wide variety of areas, including Canadian, American, Medieval, Early Modern and Modern European, British, Caribbean, Latin American, Atlantic World, Modern Asian, Sub-Saharan African, International, Public History, and the History of Women, Gender and Family. For a more detailed description of professors' areas of research and supervision, see the departmental website. We also offer a program of study and research leading to the Doctor of Philosophy degree with a concentration in Canadian history or history of Women, Gender, and Family. Ph.D. candidates may be accepted in other areas depending upon the availability of appropriate supervision. We strongly recommend that students consult the departmental Web site for further information about courses.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an Honours bachelor's degree (or the equivalent) with at least high honours standing.

The Department offers no qualifying-year program; applicants with a general (3-year) degree may be considered for admission into the fourth year of Carleton's B.A. (Honours) program.

Program Requirements

Candidates may follow either a regular or Public History M.A. program, as follows:

Regular M.A.

Thesis option

- 1.0 credit in HIST 5002 + HIST 5003;
- 1.0 credit in HIST 5803 + HIST 5804; or HIST 5805 + HIST 5806; or HIST 5809[1.0]; or HIST 5810 + HIST 5811;
- 1.0 credit in a graduate history seminar or seminars in the student's major area of concentration or, with permission of the Department, a graduate course (0.5 credit) in the Department, plus a second graduate course (0.5 credit) in the Department or in another unit at Carleton University, or in the Department of History at the University of Ottawa;
- 2.0 credits in HIST 5909: M.A. Thesis.

Research Essay option

- 1.0 credit in HIST 5002 + HIST 5003;
- 1.0 credit in HIST 5803 + HIST 5804; or HIST 5805 + HIST 5806; or HIST 5809 [1.0]; or HIST 5810 + HIST 5811;
- 1.0 credit in a graduate seminar or seminars in the student's major area of concentration; a seminar at the fourth-year level may be taken with permission of the Department.
- A graduate course (0.5 credit) in the Department, plus a second graduate course (0.5 credit) in the Department or in another unit at Carleton University, or in the Department of History at the University of Ottawa.
- 1.0 credit in HIST 5908: M.A. Research Essay

Public History M.A.

- 1.0 credit in HIST 5002 + HIST 5003;
- 1.0 credit in HIST 5803 + HIST 5804; or HIST 5805 + HIST 5806; or HIST 5809 [1.0]; or HIST 5810 + HIST 5811: a seminar or tutorial in the historiography of the appropriate country or area (1.0 credit);
- 0.5 credit in HIST 5700;
- 1.5 credits in public history courses, offered under the numbers HIST 5701 and HIST 5702. Appropriate courses in other units may be substituted with the approval of the Department;
- HIST 5704: Internship in Public History (0.0 credit);
- 1.0 credit in HIST 5908: M.A. Research Essay.

M.A. students are required to submit thesis or research essay proposals to the graduate advisor during their second term of full-time enrolment. Part-time students should discuss the timing of this requirement with the Department.

Guidelines for Completion of Master's Degree

Full-time students in the thesis option are expected to finish all requirements for the degree except HIST 5909 during their first two terms of study. The thesis requirement is designed to take an additional two or three terms.

Full-time students in the research essay option are expected to finish all requirements for the degree except HIST 5908 during their first two terms of study. The research essay requirement is designed to take an additional term.

Full-time students in the M.A. in Public History are expected to complete HIST 5002 + HIST 5003, 1.0 credit in historiography, Introduction to Public History and one other Public History 0.5-credit course during the fall and winter terms, their internship during the summer term, and the two remaining Public History 0.5-credit courses and their research essay HIST 5908 during the fall and winter terms of the second year. Some flexibility will be allowed in the distribution of the Public History courses to facilitate choice. Part-time students should complete all degree requirements except the thesis within twelve terms of study.

Language Requirements

All candidates are required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research. For seminars dealing with sources not in English, a reading knowledge of the appropriate language will be required before acceptance into the program. Details may be obtained from the supervisor of graduate studies.

Doctor of Philosophy

Admission Requirements

Applicants with an M.A. degree will be expected to have at least high honours standing. Applicants for the history of Women, Gender and Family program will be expected to have at least one of their earlier degrees in history.

Residence Requirement

The normal residence requirement for the Ph.D. degree is a minimum of three years of full-time study after the B.A. (Honours) degree, or two years after the M.A. degree.

Program Requirements

Candidates will be responsible for three fields: a major field (normally Canadian history or history of Women, Gender and Family) and two minor fields. One of the minor fields for students in the Canadian history (major) field must concern American, British, French, Russian, modern or early modern European or international history. At least one of the minor fields for students in the Women, Gender and Family (major) field must concern American, British, Canadian, French, Russian, modern or early modern European or international history. History of Women, Gender and Family majors must declare their area of concentration from among these fields.The second minor field for each major may be a transnational topic or in a related discipline. In each instance, the minor field should cover approximately one century. Written examinations will be taken in the minor field before the end of the student's second term in the minor; an oral examination in the major field will be arranged during the student's fourth term. Ph.D. candidates are required to submit a thesis proposal to the graduate supervisor within three months of completing their oral examination.

Students will complete:

- HIST 6808
- HIST 6906 Ph.D. Tutorials
- HIST 6907 Ph.D. Comprehensive, an oral comprehensive examination in the declared major field
- HIST 6100, HIST 6200, HIST 6400, or HIST 6500 (or HIST 6901 if the student is not in the Canadian major), plus a second of these courses or HIST 6600 (or HIST 6903 if the student is not in the Women, Gender and Family major), or an approved course of studies in a related discipline, but excluding the declared area of the major field.
- HIST 6909 Ph.D. Thesis in the declared major field (5.0 credits)

Guidelines for Completion of Doctoral Degree

It is expected that full-time students will complete the thesis requirement within two years, and part-time students within four years.

Language Requirements

A reading knowledge of French will be required. Proven competence in an additional language or languages will be required if it is pertinent to the candidate's program. The language examinations will be written early in the first post-M.A. year, and before the field examinations.

University of Ottawa

A Carleton University student may take one seminar in the Department of History at the University of Ottawa, with permission of the two departments.

Collaborative Ph.D. with a Specialization in Political Economy

The Department of History and the Institute of Political Economy offer a Collaborative Program in Political Economy at the Ph.D. level. For further details, see the Institute of Political Economy's Collaborative Ph.D. with a Specialization in Political Economy section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca For further details concerning courses, see the departmental Web site at carleton.ca/history

Admission to graduate seminars in the Department of History is normally restricted to graduate students in the Department and to others who have successfully completed two full upper-level undergraduate history courses, or the equivalent, in the general area of the seminar, or who have received permission of the Department.

HIST 5002 [0.5 credit]
Historical Practice
Topic selection, thesis and research essay proposals, and practical skills development.
Precludes additional credit for HIST 5000, HIST 5001[1.0] (no longer offered).

HIST 5003 [0.5 credit]
Historical Theory and Method
An examination of the meaning and use of historical theory.
Precludes additional credit for HIST 5000, HIST 5001[1.0] (no longer offered).

HIST 5006 [1.0 credit]
Seminar in Medieval History
Selected problems relating to medieval history. The themes and historical period will be specified each year.

HIST 5008 [0.5 credit]
The Early Modern World
An overview of the history of the early modern world.

HIST 5009 [0.5 credit]
Seminar in Early Modern History
A selected topic in the history of the early modern world.

HIST 5100 [1.0 credit]
Seminar in Early Modern European History
A selected problem in the history of Europe during the early modern period. Also offered at the undergraduate level with different requirements, as HIST 4100, for which additional credit is precluded.

HIST 5200 [1.0 credit]
Seminar in European History
A selected problem or period in the history of Europe. Also offered at the undergraduate level with different requirements, as HIST 4200, for which additional credit is precluded.

HIST 5310 [1.0 credit]
Canada: Culture and Ideas
A seminar in the history of Canadian culture and ideas. The themes and historical period will be specified each year.

HIST 5311 [1.0 credit]
Canada: Politics and Diplomacy
A seminar in the history of Canadian politics and diplomacy. The themes and historical period will be specified each year.

HIST 5312 [1.0 credit]
Canadian Social History
A seminar in Canadian social history. The themes and historical period will be specified each year.

HIST 5313 [1.0 credit]
Canadian Regional History
A seminar in Canadian regional history. The themes and historical period will be specified each year.

HIST 5400 [1.0 credit]
Seminar in American History
Research seminar in American history. The themes and historical period will be specified each year.

HIST 5506 [1.0 credit]
Perspectives on Power
An inquiry into historical analyses of politics in light of the current social philosophical conceptions of power and consciousness, with reference to early modern England, and/or Canada in the nineteenth and twentieth centuries, and/or Latin America in the late colonial period, with emphasis on Mexico, depending on the instructor(s).

HIST 5508 [1.0 credit]
Seminar in British History
Selected problems relating to the history of Britain in the early modern or modern period. The themes and historical period will be specified each year.

HIST 5509 [1.0 credit]
Seminar on Women and Gender
Selected problems relating to the history of women and gender. The themes and historical period will be specified each year.

HIST 5600 [1.0 credit]
Seminar in Russian History
An examination of primary sources available for research on revolutionary Russia, 1898-1921. A sound reading knowledge of Russian is required for admission.

HIST 5603 [0.5 credit]
Imperial and Soviet Russia
Legacies of the tsarist empire and the Soviet Union that influence the region today. Topics discussed include political culture, empire, socialism, class, gender, and non-Russian peoples. Also offered at the undergraduate level with different requirements, as HIST 4603, for which additional credit is precluded. Also listed as EURR 5203.

HIST 5604 [0.5 credit]
Central Europe, Past and Present
Evolution and current status of Central Europe, from periods of foreign control in the late nineteenth and twentieth centuries to independent statehood. Emphasis on national accommodations and conflicts. Also offered at the undergraduate level with different requirements as, HIST 4604, for which additional credit is precluded. Also listed as EURR 5204.

HIST 5700 [0.5 credit]

Introduction to Public History

Introduction to critical thinking about history's place in the public sphere, including history and popular culture, exhibiting history, the politics of the past, historical presentation and impact of digitization and other new information technologies, through lectures, readings, and field trips.

HIST 5701 [0.5 credit]

Archival Theory and Practice

Theories, methodologies and problems relating to archives and records management such as archival responses to the challenges of managing and preserving electronic records; principles and concepts guiding the work of archivists; records appraisal, collection, arrangement, description.

HIST 5702 [0.5 credit]

Public History Special Topics

Theoretical and practical instruction in topical areas such as 'history and new media,' 'oral history,' 'museums and national memory,' 'community history,' 'visual media,' 'material history,' etc.

HIST 5704 [0.0 credit]

Internship in Public History

Placement for a term, normally over the summer following the first year of study, to put into practice the precepts learned in course work. Students will be jointly supervised by their employers and a faculty member. A written report on work will be required from the student and an assessment from the employer.

HIST 5708 [1.0 credit]

Seminar in World History

A selected problem or period in the history of Asia-Oceania, Africa, or Latin America. Also offered at the undergraduate level, with different requirements, as HIST 4700, for which additional credit is precluded.

HIST 5800 [1.0 credit]

International History

A seminar in international history; the themes and historical period will be specified each year.

HIST 5802 [0.5 credit]

Selected Topics: Transnational or Thematic

A seminar on a transnational or thematic topic. The particular topic will be specified each year

HIST 5803 [0.5 credit]

Women, Gender and Family History: Foundations

Selected problems in the historiography of women, gender and family.

Precludes additional credit for HIST 5807 (no longer offered).

HIST 5804 [0.5 credit]

Problems in the History of Women, Gender and Family

Selected problems in the historiography of women, gender and family, focusing on a topic to be announced annually.

Precludes additional credit for HIST 5807 (no longer offered).

HIST 5805 [0.5 credit]

Historiography of Canada I

A seminar primarily for graduate students in Canadian history, which examines the trends and methods of Canadian historical writing and the influences upon it.

Precludes additional credit for HIST 5808 (no longer offered).

HIST 5806 [0.5 credit]

Historiography of Canada II

A seminar primarily for graduate students in Canadian history, which examines the trends and methods of Canadian historical writing and the influences upon it.

Precludes additional credit for HIST 5808 (no longer offered).

HIST 5809 [1.0 credit]
Historiography: Directed Studies
Selected problems in the historiography of a geographical or thematic area not covered by a scheduled course.

HIST 5810 [0.5 credit]
Early Modern European Historiography
An introduction to trends and methods in the writing of early modern European history, exploring the major schools of historical scholarship and thought through the study of selected problems.

HIST 5811 [0.5 credit]
Modern European Historiography
Trends and methods in the writing of modern European history, exploring the major schools of historical scholarship and thought through the study of selected problems.

HIST 5901 [1.0 credit]
Directed Studies - Canadian
A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

HIST 5902 [1.0 credit]
Directed Studies - Non-Canadian
A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

HIST 5903 [0.5 credit]
Directed Studies - Canadian
A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

HIST 5904 [0.5 credit]
Directed Studies - Non-Canadian
A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

HIST 5905 [0.5 credit]
Selected Topics - Canadian Field
A seminar in an area not covered by an existing graduate course.

HIST 5906 [0.5 credit]
Selected Topics - Non-Canadian Field
A seminar in an area not covered by an existing graduate course.

HIST 5908 [1.0 credit]
M.A. Research Essay
An examination of an approved topic in an area of departmental specialization or in an appropriate area of Public History.

HIST 5909 [2.0 credits]
M.A. Thesis
A substantial historical investigation. The subject will be determined in consultation with the Department, and a supervisor will be assigned. The candidate will be examined orally after presenting his/her thesis.

HIST 6100 [1.0 credit]
Modern Europe Minor
A program of supervised reading in modern European history leading to a minor field examination.
Offered in the winter and summer terms.

HIST 6200 [1.0 credit]
Early Modern Europe Minor
A program of supervised reading in early modern European history leading to a minor field examination.
Offered in the fall and winter terms.

HIST 6400 [1.0 credit]
Directed Studies - United States
Supervised reading in American history leading to a minor field examination.

HIST 6500 [1.0 credit]
Directed Studies - British
Supervised reading in British history leading to a minor field examination.

HIST 6600 [1.0 credit]
Directed Studies - Transnational or Thematic
Supervised reading in a transnational or thematic topic leading to a minor field examination.

HIST 6808 [1.0 credit]
Historical Theory and Method
A course primarily for doctoral candidates in history, offered in alternate years, in which trends in historical theory and methodology will be examined.

HIST 6901 [1.0 credit]
Canadian History Minor
A program of supervised reading in Canadian history leading to a minor field examination.

HIST 6903 [1.0 credit]
Women, Gender, Family Minor
A program of supervised reading in History of Women, Gender and Family leading to a minor field examination.

HIST 6906 [0.5 credit]
Ph.D. Tutorials
A program of supervised reading in preparation for the Ph.D. oral examination in the student's major field. Students must enrol in the appropriate course section and complete three terms (fall, winter, summer) of this course before sitting the oral comprehensive examination.
Precludes additional credit for HIST 6904 and HIST 6905 (no longer offered).

HIST 6907 [0.5 credit]
Ph.D. Comprehensive
Ph.D. oral comprehensive examination in the major field. The exam is undertaken in the student's fourth term.
Precludes additional credit for HIST 6900 and HIST 6902 (no longer offered).

HIST 6909 [5.0 credits]
Ph.D. Thesis

Industrial Design

Mackenzie Building 3470
Telephone: 613-520-5672
Fax: 613-520-4465
id.carleton.ca

The School

Director of the School: Thomas Garvey
Graduate Program Coordinator: Gitte Lindgaard

Master of Design (M.Des.)

The School of Industrial Design offers a program of study and research leading to the Master of Design degree. The M.Des. requires the successful completion of 5.0 credits, including a 1.5 credit thesis. The program is project-based, with a strong theoretical focus, and is normally completed after two years of study.

The focus of the M.Des. program is to advance the knowledge of design by building on the School's experience and strengths in the field of design education. The primary objectives of the program are to promote design research, strategic design planning, knowledge creation and dissemination, and interdisciplinary design development.

Students examine and incorporate multifaceted design principles and practices that contribute to the strategic value of design with particular focus on the following key areas: advanced materials and manufacturing processes, advanced visualization, design and culture, design management, extreme environments, human-oriented design, product interaction design, sustainable design, and strategic design research.

The School provides a collaborative graduate studio space, a sensor lab and prototyping labs. In addition, students have an opportunity to engage in interdisciplinary interactions with faculty from the School as well as faculty and students from a diverse range of disciplines, all linked to the design development process.

Qualifying-Year Program

Candidates with admission deficiencies would be required to successfully complete additional prescribed courses to qualify for admission. Applicants without a degree in design may be required to register for up to 2.0 credits of courses selected from the undergraduate Bachelor of Industrial Design program, in consultation with the Graduate Program Coordinator.

All courses must be approved by the Graduate Program Coordinator of the School in consultation with the Faculty of Graduate Studies and Research. (See General Regulations Section 2.3, "Completion of the Qualifying Year", for more details.) Completion of the Qualifying Year is not a guarantee of admission to the Master of Design. Re-application to the M.Des. program is required.

Admission Requirements

The University's general requirements for admission are outlined in Section 2.1 of the General Regulations in the Graduate Calendar. For admission to the Master of Design program, applicants

must have successfully completed a bachelor's degree in a design discipline, or the equivalent, with B- or better overall.

Applicants with a design-related background, but not a degree in design, will be required to demonstrate significant links between their academic background and professional experience in the design development process.

In addition to these academic credentials, applicants must submit the following materials to the School of Industrial Design.

Application Form

Statement of Intent (One page)

The quality of the statement of intent is critical to the likelihood of an applicant's admission. The writing should be succinct and as carefully considered as the content of the statement, which should address at least the four following areas:

- What is the area of intended research with specific reference to the program courses and the expertise of the faculty members
- How the applicant's academic background and professional experience relates to the program with reference to any previous research, scholarship, or project experience with interdisciplinary or collaborative teams
- How the intended research program will align with the objectives of the program relating to: design research, strategic design planning, knowledge creation and dissemination, and interdisciplinary design development
- An explanation of the specific reasons for choosing the School of Industrial Design at Carleton University.

Portfolio

The portfolio should provide the best examples of creative intellectual activity and recent professional work that indicates the applicant is sufficiently prepared to pursue studies in the program. These activities may be represented by proposals, reports, and/or analysis documents. Emphasis should be placed on evidence of understanding the communication of design ideas in visual form.

The presentation of the portfolio should be professional and facilitate the review process of the content, and should be submitted in prescribed format.

Three Letters of Recommendation

Applicants must provide three (3) confidential letters of reference appended to prescribed recommendation forms.

Language Proficiency
Proficiency in English is necessary to pursue graduate studies at Carleton University. All applicants are required to meet the requirements set out in Section 3.6 of the General Regulations of this Calendar.

Program Requirements

Master of Design

The Master of Design program requires the successful completion of 5.0 credits with at least 4.0 credits taken at the 5000 level or higher. The Graduate Program Coordinator must approve course selections. The program may be completed in four terms of study.

Specific requirements:

Year 1

Fall Term

IDES 5101 Interdisciplinary Design Development Seminar
IDES 5102 Research Methods

Winter Term

IDES 5103 Interdisciplinary Design Development Studio
1.0 credit of elective courses

Year 2

Fall Term

IDES 5201 Thesis Proposal
0.5 credit elective course

Winter Term

IDES 5202 Thesis

Academic Regulations

See the General Regulations section of this Calendar.

Industrial Design does not permit the C+ option as stipulated in Section 11.2 of the General Regulations.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of current course offerings and to determine the term of offering, consult central.carleton.ca.

Qualified students in other departments may, with permission of the School, enrol in IDES 5103.

IDES 5000 [0.5 credit]
Directed Studies in Industrial Design
Reading and research tutorials.

IDES 5101 [0.5 credit]

Interdisciplinary Design Development Seminar
Investigation of disciplines involved in design development, with experts in business, engineering, sociology/anthropology, architecture, psychology, human factors, industrial design, and others. Critical examination of methods used to integrate different approaches, and roles that personality, leadership, negotiation, conflict management, and teambuilding play in collaboration.

IDES 5102 [0.5 credit]

Research Methods
Critical analysis of research methods in design and disciplines contributing to design including anthropology, psychology, sociology, and business. Application areas include advanced materials and manufacturing processes, advanced visualization, product interaction design, extreme environments, sustainable design, design and culture, design management, and human-oriented design.

IDES 5103 [0.5 credit]

Interdisciplinary Design Development Studio
Team-based studio projects draw on interdisciplinary design development methods in achieving a common design objective. Projects will be supervised by academic and industry advisors from a wide range of disciplines, and conducted in collaboration with professionals from external organizations. Open to students from other programs.
Prerequisite: IDES 5101 and IDES 5102 or permission of the School of Industrial Design.

IDES 5201 [0.5 credit]

Thesis Proposal
Investigation into a theoretically and practically relevant research problem. Students will analyze and synthesize findings involving interdisciplinary design development processes and develop these into a thesis proposal. This is a directed study with specific content, objectives, and scheduling arranged between student and academic advisors.
Prerequisites: IDES 5101, IDES 5102, and IDES 5103.

IDES 5202 [1.5 credits]

Thesis
A comprehensive project that demonstrates the student's ability to conduct critical research in a specific area in which design can contribute to competitive advantage through design planning and interdisciplinary design development processes.
Prerequisites: IDES 5101, IDES 5102, IDES 5103, and IDES 5201.

Faculty interest and expertise lie in the following areas:

- Advanced materials and manufacturing processes
- Advanced visualization
- Design and culture
- Design management
- Extreme environments
- Human-oriented design
- Product interaction design
- Sustainable design
- Strategic design research

Information and Systems Science

See the School of Mathematics and Statistics; Department of Systems and Computer Engineering; and the School of Computer Science.

The Committee

Chair of the Committee: Jean-Pierre Corriveau

The program of graduate study and research leading to the degree of Master of Science in Information and Systems Science is offered by the Committee with the cooperation of the Department of Systems and Computer Engineering, the School of Mathematics and Statistics, and the School of Computer Science.

The purpose of the program is to provide training in the use and application of computers, to those who have not studied extensively in this field at the undergraduate level. The process of using the computer in problem solving is stressed. The program is flexible, though individual concentrations are usually in one of three broad areas:

- computer applications in a particular field (e.g., communications, energy systems)
- algorithms and methodologies for solution of complex problems by computer (e.g., graph theory, operations research, optimization, simulation and modeling)
- computer methods and technologies (e.g., databases, software engineering, computer languages)

Close links are maintained with the scientific, industrial, and technological communities, and an effort is made to direct students to project work of current practical significance.

Master of Science

Admission Requirements

Applicants should have an Honours bachelor's degree, or equivalent, with at least high honours standing, in mathematics, engineering, physics, chemistry, computer science, operations research, experimental psychology, econometrics, management science, or a related discipline. Undergraduate preparation should include a minimum of four half-credit courses in computing (at least one of which is at the third year level or higher), and a minimum of six half-credit courses in mathematics (at least two of which are at the third year level or higher). In addition, the student is required to have some knowledge of quantitative applications, such as numerical analysis, simulation, operations research, etc.

Admission to the program will be made through one of the three participating units. Since space, laboratory facilities and supervision will be provided by one of the units, students should apply through the unit with which they wish to be most closely associated.

Program Requirements

The normal program comprises 4.0 credits and a 1.5 credit thesis; additional requirements may be stipulated, depending upon the individual student's background. With the approval of the Committee,

students who have substantial work experience may be permitted to substitute, in place of the thesis, 1.5 credit courses, one of which must be a graduate project course.

Students must take at least 1.0 credit from the department in which they are registered, and at least 0.5 credit from each of the other two participating units. Students must also take course ISYS 5802.

Each student should consult with his/her faculty adviser in the selection of a course pattern related to his/her principal area of interest.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his/her thesis.

Course work may be completed on either a full-time or part-time basis. Thesis research normally requires full-time residence at the University; however, a candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the Committee.

Guidelines for Completion of Master's Degree

Full-time students in the M.Sc. in Information and Systems Science will normally complete the degree requirements in two years and part-time students within four years. In order to meet this goal, full-time students should arrange a thesis supervisor within the first term of study, and should try to complete the course requirements as quickly as possible.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

Graduate Course Descriptions

Refer to the corresponding unit in this Calendar for course descriptions in Computer Science, Mathematics and Statistics, and Systems and Computer Engineering.

ISYS 5802 [0.5 credit]

Introduction to Information and Systems Science

An introduction to the process of applying computers in problem solving. Emphasis is placed on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as MATH 5802, SYSC 5802, COMP 5802.)

ISYS 5908 [1.5 credits]

M.Sc. Thesis in Information and Systems Science

(Also listed as MATH 5908, SYSC 5908, COMP 5908.)

Due to the interdisciplinary nature of ISS, a student will, in some cases, benefit by taking an undergraduate course at the 3000- or 4000-level as part of his/her program. Where a 3000-level course is to be taken, it will be extra to the degree requirements; or else arrangements will be made to enrich the subject matter, normally through a directed study course with the professor. Students may include 1.0 credit at the 4000-level in their program without penalty, with the approval of the unit. Students in the program are prohibited from taking COMP 4804 Design and Analysis of Algorithms due to overlap of course material with ISYS 5802.

Interdisciplinary Studies

Dunton Tower 2201
Telephone: 613-520-2368
Fax: 613-520-3985
carleton.ca/iis

The Institute

Director of the Institute: Fran Cherry
Associate Director and Coordinator of Directed Interdisciplinary Studies: Barbara Leckie

The Institute of Interdisciplinary Studies offers graduate level courses which can be used towards a degree program in another discipline.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

ISSC 5100 [0.5 credit]
Researching Across Disciplines
Focuses on cross-disciplinary research issues and methodological solutions to problems that arise in the dialogue among the sciences, humanities and social sciences.

International Affairs

1401 Dunton Tower
Telephone: 613-520-6655
Fax: 613-520-2889
Email: international_affairs@carleton.ca
carleton.ca/npsia

The School

Director of the School: Fen O. Hampson
Associate Director: Dane Rowlands

The Norman Paterson School of International Affairs (NPSIA) was established in the mid-1960s with the generous support of the late Senator Norman M. Paterson to encourage and promote graduate study and professional research and publications in the field of international affairs. The NPSIA program is interdisciplinary, reflecting the philosophy that exposure to a range of disciplines is necessary to develop an understanding of our complex global environment.

NPSIA is a long-standing member of the Association of Professional Schools of International Affairs (APSIA), an association of the leading graduate programs in international affairs in countries that include the United States, France, Japan, and Russia. Like other APSIA schools NPSIA's raison d'être is the training of students for leadership in a world in which the destinies of all countries are increasingly linked by considerations of conflict resolution and peacebuilding, international trade and finance, development, and the sharing of human and natural resources. Many professionals currently working in the sphere of international affairs are alumni of APSIA graduate programs. Like its peers in APSIA, NPSIA is proud of its reputation for producing diverse, well-educated and sophisticated international affairs professionals.

NPSIA offers programs leading to a Qualifying Year, M.A., M.A./LL.B. (jointly with the University of Ottawa), and Ph.D. Degrees.

NPSIA has a specialized Resource Centre staffed by a full-time information specialist. Students and faculty have access to a broad range of current research materials, using the resources of the national capital area as well as internet-based bibliographic services across the range of issues and regions on which courses are offered.

Qualifying-Year Program

Admission Requirements

The qualifying-year program is designed to enable students with at least high honours standing, but with an inadequate background in the disciplines relevant to the M.A. program, to make up deficiencies. The qualifying year program is not intended as a grade raising opportunity. Candidates with a high standing in a general (3-year) bachelor's degree, in a discipline closely related to international affairs, will be required to take five full qualifying-year credits before being eligible to enter the master's program. Those with a B.A.(Honours) degree in an unrelated discipline may be required to take at least three full qualifying-year credits before being eligible to enter the master's program.

Students in the qualifying year are encouraged to select a cluster or clusters in which they are interested and to take courses that will prepare them for graduate work in that cluster. Courses in anthropology, economics, geography, history, law, political science, and sociology, among other

disciplines, are recommended. Students may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study of a region having particular relevance to the cluster(s) they have identified. Students should also be cognizant of the language requirement at the M.A. level and, if necessary, take the appropriate courses to enable them to fulfil that requirement.

Students who have not previously completed a 1.0-credit (or equivalent) course in introductory economics (introductory microeconomics and introductory macroeconomics for economics majors) must do so as part of their Qualifying Year program.

Other courses will be selected in consultation with the Associate Director.

Admission to the qualifying year does not guarantee admission to the M.A. program. To be considered for admission to the M.A. program, students in the qualifying year are expected to achieve the equivalent of high honours standing. Students in the qualifying year are considered for admission to the M.A. program at the same time as other applicants; if qualifying-year students are not admitted to the M.A. program in the first round of admissions, subsequent decisions on their admission will depend on performance and the availability of space in the M.A. program.

Guidelines for Completion of Qualifying Year

Candidates admitted to the qualifying-year program on a full-time basis must complete all requirements during the fall and winter terms after initial registration.

Master of Arts

NPSIA's M.A. program emphasizes imparting professional skills as well as knowledge. Our courses are policy as opposed to theoretically oriented and frequently involve the use of case studies and simulations. The majority of our students see the M.A. as their path to the workforce. NPSIA graduates find employment in Canada and abroad in government departments, non-governmental and international organizations, and the private sector. More detailed information on the range of jobs held by NPSIA graduates can be found on our Web site.

The M.A. program is organized around seven clusters:

- International Trade Policy
- Global Political Economy
- Conflict Analysis and Conflict Resolution
- Intelligence and National Security
- International Institutions and Global Governance
- International Dimensions of Development
- Human Security and Development

Students are encouraged to include at least one regional course in their degree program to provide an area focus to their studies. NPSIA offers a range of regional courses that can be linked to relevant course clusters to give students some regional expertise. NPSIA cooperates closely with the Institute of European and Russian Studies and with committees organized to encourage and coordinate faculty and student interests in Africa, Asia and Latin America.

Admission Requirements

The minimum requirement for admission into the master's program is a B.A. (Honours) degree in a discipline related to international affairs.

Under current practice, at least a high honours standing (B+ minimum) is normally required to be considered for admission to the program.

Applicants may submit Graduate Record Examination aptitude test scores; in some circumstances, students may be required to submit GRE scores.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English. NPSIA applicants must submit a CAEL Assessment™score of a minimum of 70 or a TOEFL score of 250 computer-based or 600 regular 100 iBT (minimum score of 25 in each of reading, writing, speaking and listening).

Students admitted to the NPSIA M.A. program must have successfully completed a 1.0 credit (or the equivalent) course in introductory economics (introductory microeconomics and introductory macroeconomics for economics majors) before starting the program.

Students who have not completed one credit of introductory economics at the time of their application will have their admission into the program made conditional upon its successful completion prior to registration. In some cases where the student is deemed by the admissions committee to have an insufficient background in international affairs they may be required to complete up to two additional courses as part of their M.A. program. Students who are uncertain about whether they meet the background requirements are encouraged to contact the School of International Affairs.

Program Requirements

Full-time M.A. Program Requirements

The Master of Arts in International Affairs is a 5.0 credit program and students must select one of three program patterns:

- Thesis [2.0 credits] plus 3.0 credits course work
- Research Essay [1.0 credit] plus 4.0 credits course work
- Course Work [5.0 credits]

Most students are admitted to the full-time program and must complete all of the degree requirements within two calendar years or six terms of full-time study. In exceptional cases, students may complete the program within one calendar year.

All courses used for credit in the degree must be approved in advance by the Associate Director of the School.

The specific requirements are:

- INAF 5001: Policy and Methods [0.5 credit] which must be completed by the end of the second term.
- Successful completion, by the end of the second term, of one of the following 0.5 credit economics courses associated with the cluster selected: INAF 5009, INAF 5214, INAF 5205, INAF 5308, INAF 5309, INAF 5600, or INAF 5703. If the required course is not offered in a

given year, or the student is deemed to have fulfilled the requirement by successfully completing an equivalent course, another economics course may be approved as a substitute.
- A compulsory 0.5-credit course associated with the cluster selected which must be completed by the end of the second term.
- An additional 3.5 credits (or the equivalent) which may be completed in one of the following ways: 3.5 credits of courses; 2.5 credits of courses plus a 1.0 credit research essay (INAF 5908); 1.5 credits of courses plus a 2.0 credit master's thesis (INAF 5909).
- 1.5 credits of the total required 5.0 credits may be selected from courses offered in other departments, with a maximum of 1.0 credit from a single department and a maximum of 1.0 credit selected from fourth year undergraduate courses. A minimum of 1.5 credits must be completed in each of the first two terms.
- A demonstrated ability to read a second major international language, or one appropriate to the primary research interests. Typically, for most English-speaking domestic students, the ability to read French will satisfy this requirement.

Part-time M.A. Program Requirements

In some cases, an applicant with relevant full-time employment experience may be admitted to a part-time M.A. program. While the program requirements are the same as those for full-time students, part-time students may take up to six calendar years from the date of initial registration to complete the program.

Part-time students must register for a minimum of one term in three, and must successfully complete INAF 5001: Policy and Methods for International Affairs [0.5 credit] by the end of the Winter term following the first Fall registration. In addition, the economics and compulsory cluster course requirements must be included in the first 2.5 credits completed.

Students enrolled in the full-time master's program may only request a transfer to the part-time program:

- once they have completed two terms of full-time study
- if they are employed 35 hours or more per week
- if they are medically unable to attend the program on a full-time basis

Students who elect to complete the program by a combination of full- and part-time study are governed by the following time limits: five calendar years if the candidate is registered full-time for two or three terms and part-time for the balance; four calendar years if the candidate is registered full-time for four or five terms and part-time for the balance.

Academic Standing

A grade of B- or better must be obtained in each credit counted towards the master's degree. The School does not permit exceptions to this rule.

Students will be required to withdraw from the program if their grade point average falls below 7.0 (B-), or if they receive a grade of less than B- in any two courses that are eligible to be counted toward the Master's degree.

Co-op Option

Full-time M.A.students who have completed 3.0 credits in the program may select a co-op option. The co-op program provides opportunities to integrate the theoretical and practical aspects of international affairs.

The 0.0 credit co-op is in addition to the 5.0 credits required for the M.A., and a minimum of two co-op terms must be successfully completed before the student is eligible to receive a co-op designation on their academic transcript. Students register in one of the co-op courses (INAF 5911, INAF 5912 or INAF 5913) and are restricted from taking more than 0.5 credit at the same time.

Work terms are four months in duration, and typically students are employed at the junior officer level in government departments or other organizations. Information and procedures can be obtained from the Carleton University Co-op Office.

Career Planning

Information on job opportunities is available to all students and recent graduates through NPSIA's Resource Centre Coordinator. Services to assist students in obtaining jobs in International Affairs after graduation also includes assistance with resumes, and information on alumni career paths. The on-line guide NPSIA WORKS outlines the major areas of alumni employment. Recent experience suggests that a strong background in research methods and economics as well as strong communication skills enhance job placement.

Students interested in continuing to doctoral programs should plan their programs to include courses in their discipline, if other than international affairs, which may be deemed necessary for their admission to doctoral programs. Interdisciplinary doctoral programs in international affairs are given in a number of institutions, and the faculty can provide guidance in planning for these programs.

Guidelines for the Completion of the Master's Degree

Transfer from Master's to the Ph.D. Program

Students in the full-time M.A. program who demonstrate outstanding academic performance and research potential may, with permission of the Associate Director, be admitted to the Ph.D. program after two terms of registration.

Students considering this option will be advised, when selecting courses for their M.A. program, to choose those courses at the master's level which are open to doctoral students and which may assist them in the doctoral comprehensive examinations.

Master of Arts/Bachelor of Laws

The Norman Paterson School of International Affairs and the Common Law Section of the Faculty of Law at the University of Ottawa offer a joint Master of Arts in International Affairs and Bachelor of Laws degree M.A./LL.B.).The benefit of the joint program is the integration of students, legal training and graduate studies in international affairs.

Admission Requirements

A student must make separate applications to the School of International Affairs at Carleton University and to the Faculty of Law at the University of Ottawa and be accepted by both institutions in accordance with the normal admission requirements of each program. Interest in pursuing the joint program must be specified in each application.

Program Requirements

A student will complete both the M.A. and the LL.B. programs over four calendar years. Students will be expected to fulfil the normal requirements of both the M.A. and LL.B. programs. In addition, students in the joint program will be required to complete courses in international law to be specified by the Faculty of Law.

Of the 5.0 credits completed for the M.A. degree, up to 1.5 credits may be applied to the Bachelor of Laws degree.

In undertaking the M.A./LL.B. research essay, students will be expected to integrate both components of the joint program into their work.

The normal sequence of courses for the two degrees is as follows:

First Year

- Normal LL.B. first year (required course work to include a 0.5-credit course in international law)
  Second Year
- Normal M.A. first year (as described in full-time M.A. program requirements)

Third and Fourth Year

Students will make up any additional M.A. credit requirements. These could include an M.A./LL.B. research essay (INAF 5906) or M.A./LL.B. research thesis (INAF 5919). M.A./LLB research essays and theses will have at least one supervisor from NPSIA and one supervisor from the Law School.

Doctor of Philosophy in International Affairs

NPSIA's Ph.D. program is interdisciplinary and focuses on international policymaking processes and institutions. Its objective is to provide students with advanced training and research skills suitable for both an academic career, or for more senior policy analysis and research positions in government and non-governmental institutions. Program requirements include course work, comprehensive examinations in two areas of specialization, and defence of a thesis. Students may specialize in two of the following doctoral fields: international conflict management and resolution, international development policy and international economic policy.

Fields

International Conflict Management and Resolution

Interdisciplinary and policy-oriented research on international and intrastate conflict management and resolution. Sources of and responses to conflict, drawing from traditional and non-traditional frameworks with an emphasis on diagnostic and analytic skills. Topics include conflict management, peacekeeping, crisis decision-making, the management of terrorism, arms control, concepts of security, peace-building, and conflict prevention.

International Development Policy

Interdisciplinary and policy-oriented research on international development. Global, regional, community and institutional dimensions of development as a social, economic and political process.

Topics include the linkages between development and trade, finance, regional integration, technology transfer and transnational enterprises, the environment and natural recourses, health, education, labour, and institutions.

International Economic Policy

Interdisciplinary and policy-oriented research on the relationship between the global markets, civil society, and states. Theories and policy approaches to international political economy, drawn from economics, political science and other disciplines. Topics include trade, finance, multinational corporations, international migration, and a critical analysis of the issues surrounding the phenomenon of global integration.

Admission Requirements

Admission into the Ph.D. program will be judged primarily on the applicant's ability to undertake research successfully and his/her prospects for completion of the program. Admission to the Ph.D. program is governed by the requirements stated in the General Regulations section of this Calendar.

The normal requirement for admission to the doctoral program in International Affairs is a Master's degree in a social science with at least an A- average. Relevant work experience is also considered. Students who lack sufficient background at the graduate level in international affairs will be required to take supplementary courses extra to degree prior to admission. Students with no formal training in economics must complete a 1.0 credit (or equivalent) course in introductory economics (introductory microeconomics and introductory macroeconomics for economics majors) plus at least 1.0 credit (or the equivalent) at the advanced undergraduate (typically third or fourth year) or intermediate theory level to be considered for admission. Students who are admitted to the doctoral program but lack sufficient specialization in their fields of study may be required to take additional courses at the graduate level in preparation for their field seminars.

All applicants whose first language is not English will be required to obtain an overall score of 70 or over on the Canadian Academic English Language Assessment with a minimum score of 70 for the writing section or a TOEFL score of 250 computer-based, 100 iBT (minimum score of 25) in each of reading, writing, speaking and listening.

Residence Requirement

All Ph.D. candidates must be registered full time for a minimum of six terms to satisfy the residence requirement.

Program Requirements

The Ph.D. in International Affairs is a 10.0 credit program. The specific requirements are:

- A thesis [5.0 credits]
- Two field seminars [0.5 credit each] in the area of declared fields
- Two field comprehensive examinations [0.5 credit each] in the area of declared fields
- A doctoral research seminar [0.5 credit] which requires public defence of a research prospectus
- 1.5 credits of compulsory courses in research methods and policy analysis
- 1.0 credit (or the equivalent) of compulsory economics courses
- A demonstrated ability in a second language

Detailed Program Requirements

Courses

The following 2.5 credits of compulsory courses must be completed within the first two years of initial registration.

- INAF 6001: Qualitative Research Methods [0.5 credit]
- INAF 6002: Quantitative Research Methods [0.5 credit]
- INAF 6003: Advanced International Policy Analysis [0.5 credit]
- An additional 1.0 credit (or the equivalent) selected from the economics courses offered by the School, related to the chosen comprehensive examination field and selected with permission of the Associate Director. Candidates with sufficient economics training may be permitted to substitute other courses.

Field Seminars

Two field seminars (0.5 credits each) must be completed within the first two years of initial registration. At least one of these will be in a field offered by NSPIA faculty (INAF 6100, INAF 6200, INAF 6300). The field seminars provide a venue for doctoral students to explore the literature that serves as the foundation for the comprehensive examinations and some students may be advised to take additional courses.

Field Comprehensives

Two field comprehensives (0.5 credit each) must be completed with grade of Satisfactory or Distinction within the first two years of initial registration. Failure to complete this requirement within the time limit may result in withdrawal from the program.

The comprehensive examination is based on a set of readings provided at the beginning of the academic year (Fall term) and may be completed through a combination of self-directed study, M.A. courses, the Field Seminar and consultation with faculty members. A candidate whose performance is not satisfactory may, at the discretion of the examining board, be required to submit to either an oral or written examination.

Students may, with the School's permission, apply to complete a field and an associated comprehensive examination in another discipline. The field must be in a discipline related to the student's program of study, and requires the approval of the host department. The student is required to fulfil all of the host department's requirements for the equivalence of a field designation, including any course work and the associated comprehensive examination.

Doctoral Research Seminar

A seminar where research issues are discussed. Satisfactory completion of the seminar requires the successful public defence of a research prospectus that will be the basis for the dissertation.

Thesis (5.0 credits)

- All Ph.D. candidates are required to successfully complete and defend a thesis equivalent to 5.0 credits on a topic approved by the School.

Language Requirement

- All students must demonstrate an ability to read academic material in a language other than English sufficient to conduct doctoral research in international affairs. This requirement will be fulfilled before the defence of the research prospectus. To fulfil the language requirement, a student must pass a written examination administered by the School, or meet the equivalent standard as determined by the School.

Academic Standing

To successfully complete the doctoral program, students must obtain a grade of B- or better in each course credit, and Satisfactory or Distinction in the field seminars, comprehensive examinations, doctoral research seminar, the research prospectus defence, and the Ph.D. thesis and its oral defence.

Required Courses

All students must complete:

INAF 5001 [0.5 credit] Policy and Methods for International Affairs

In addition, one of the following seven designated economics courses must be selected:

INAF 5009 [0.5 credit] International Aspects of Economic Development
INAF 5205 [0.5 credit] Economics of Conflict
INAF 5214 [0.5 credit] Economics for Defence and Security
INAF 5308 [0.5 credit] International Trade: Theory and Policy
INAF 5309 [0.5 credit] International Finance: Theory and Policy
INAF 5600 [0.5 credit] Human Resource Development
INAF 5703 [0.5 credit] Economics of Institutions and Global Governance

Note: students are required to take the economics course associated with their cluster as noted below. Candidates with sufficient economics training may be permitted to substitute other courses.

Clusters

NPSIA's M.A. program is organized around seven clusters. Each student must select a cluster and enrol in one of the designated cluster courses.

International Trade Policy

Designated economics course: INAF 5308
Designated Courses:
INAF 5101 The Politics and Institutions of International Trade
INAF 5306 Trade Policy in North America
INAF 5400 Trade Policy Analysis
INAF 5500 Comparative Trade Policy
INAF 5507 International Economic Law
INAF 5508 Law, Politics, and Economics in International Affairs

Global Political Economy

Designated economics course: INAF 5309
Designated Courses:
INAF 5300 The Political Economy of Multinational Enterprises
INAF 5401 International Financial Institutions and Policy

INAF 5407 International Relations Theory
INAF 5501 Global Political Economy
INAF 5502 State Sovereignty and Globalization

Conflict Analysis and Conflict Resolution

Designated economics course: INAF 5205
Designated Courses:
INAF 5108 Conflict Analysis
INAF 5109 Conflict Management: Theory and Evidence
INAF 5200 Peacebuilding and Reconstruction: Theory and Practice
INAF 5202 International Security after the Cold War
INAF 5203 International Mediation and Conflict Resolution
INAF 5506 International Law: Use of Force

Intelligence and National Security

Designated economics course: INAF 5214
Designated Courses:
INAF 5201 Disarmament, Arms Control and Nonproliferation
INAF 5202 International Security after the Cold War
INAF 5204 Intelligence, Statecraft, and International Affairs
INAF 5224 Intelligence and National Security: Policies and Operations
INAF 5234 National Security Policy and Law
INAF 5244 Terrorism and International Security

International Institutions and Global Governance

Designated economics course: INAF 5703
Designated Courses:
INAF 5405 International Organizations
INAF 5505 International Law: Theory and Practice
INAF 5701 Global Environmental Change: Human Implications
INAF 5702 International Environmental Affairs
INAF 5705 International Social Policy
INAF 5805 The EU in International Affairs

International Dimensions of Development

Designated economics course: INAF 5009
Designated Courses:
INAF 5002 Issues in International Development
INAF 5303 Science, Technology and International Affairs: The Third World
INAF 5601 Historical Dimensions of Development and Underdevelopment
INAF 5602 Development Assistance: Theory and Practice
INAF 5609 Development Project Evaluation and Analysis
INAF 5801 Regional Integration Among Developing Countries

Human Security and Development

Designated economics course: INAF 5600
Designated Courses:
INAF 5003 National and Domestic Dimensions of Development
INAF 5006 Agriculture and Rural Development
INAF 5209 Conflict and Development
INAF 5408 Gender in International Affairs
INAF 5704 Human Security: From Policy to Practice
INAF 5706 Global Health Policy

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Part-time students are permitted to enrol in a maximum of 1.0 credit per term.

INAF 5001 [0.5 credit]
Policy and Methods for International Affairs
Policy formulation and research methods in an international context. The policy component reviews key theories of policy formulation and their relationship to applied policy analysis and evaluation. The methods component examines the principles of social sciences research, basic research design, and techniques of analysis.
Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School of International Affairs.

INAF 5002 [0.5 credit]
Issues in International Development
International political, social and economic aspects of development. Approaches to trade policies, finance, regional integration, technology transfer and transnational enterprises, global governance, international civil society and development, the environment and natural resources, and social and labour issues in the international context.
Precludes additional credit for INAF 5004 (taken prior to 2001).

INAF 5003 [0.5 credit]
National and Domestic Dimensions of Development
Theoretical foundations and central policy issues of the domestic, economic, social, political, cultural and environmental aspects of development. Topics include theories of the developmental process, human resource development, national development strategies, sectoral issues, and governance and human rights and their interaction with the international system.
Precludes additional credit for INAF 5004 (taken prior to 2001).

INAF 5006 [0.5 credit]
Agriculture and Rural Development
A study of the agricultural sector, rural areas, and rural welfare in developing countries, including structural change in agriculture, agrarian reform, rural development strategies in various countries, and public policies affecting agriculture, activities ancillary to agriculture, rural industry, and public service.

INAF 5007 [0.5 credit]
Theories of Development and Underdevelopment
A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.
Prerequisite: enrolment in the Development Administration stream of the M.A. program in the School of Public Policy and Administration, or permission of the School of International Affairs.

INAF 5008 [0.5 credit]
Economic Development Policy and Planning
Developing country policies and planning and their impacts, including macro and sectoral techniques employed in development planning, budgeting, and problems in development administration.
Prerequisite: enrolment in the Development Administration stream of the M.A. program in the School of Public Policy and Administration, or permission of the School of International Affairs.

INAF 5009 [0.5 credit]

International Aspects of Economic Development

Economic theory and policy dimensions of key issues in international economic development. Topics include: trade theory and policy for developing countries; debt, adjustment and macroeconomic stabilization; the role of international financial institutions; financial flows and the role of multinational corporations. Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

INAF 5100 [0.5 credit]

Canada in International Affairs

Canada's role in international affairs; issues of conflict and conflict resolution, international political economy, and international development. Analysis of the content and formulation of Canada's international policies.

INAF 5101 [0.5 credit]

The Politics and Institutions of International Trade

Canadian trade practice; trade policy within the broader context of Canadian policy-making, comparison of Canadian policy and practice with that in the United States, Europe, Japan, and the major developing countries.
Precludes additional credit for INAF 5409 (taken prior to 1997-98).

INAF 5102 [0.5 credit]

Canada-U.S. Relations

The relationship between Canada and the United States from political, economic, diplomatic, military, and cultural perspectives. The history of Canada's relations with the United States, as our neighbor, trading partner, ally, and sometime antagonist.
Precludes additional credit for INAF 5409, if taken 2003/04, 2004/05.

INAF 5108 [0.5 credit]

Conflict Analysis

Sources of international and intrastate conflict. Students will gain practical insight and understanding of the causes of conflict by drawing on frameworks from a number of social sciences disciplines, with a focus on diagnostic and analytical skills in the decision making process.
Precludes additional credit for INAF 5105 (taken prior to 2001).

INAF 5109 [0.5 credit]

Conflict Management: Theory and Evidence

Evaluation of process and content-oriented measurements of effectiveness in the practice of conflict management; third-party intervention such as peacekeeping, crisis decision making, the management of terrorism and conflict prevention with applications to regional and intrastate conflict.
Precludes additional credit for INAF 5105 (taken prior to 2001).

INAF 5200 [0.5 credit]

Peacebuilding and Reconstruction: Theory and Practice

Social, economic and military dimensions of post-conflict reconstruction with special attention to the role of local and international government and non-government organizations in the peacebuilding process. Evidence is drawn from recent cases.

INAF 5201 [0.5 credit]

Disarmament, Arms Control and Nonproliferation

Origins, theory and practice, with a focus on so-called weapons of mass destruction and current controversies. Emphasis on treaty negotiation and implementation, including monitoring, verification, facilitation and enforcement of compliance.

INAF 5202 [0.5 credit]

International Security After the Cold War

The evolving strategic and security environment since the end of the Cold War, encompassing both traditional and non-traditional concepts. Topics include hegemonism; the rise of new

powers; terrorism; multilateralism; human security; and new security threats, including climate change.

INAF 5203 [0.5 credit]

International Mediation and Conflict Resolution

Exploration of various approaches to the prevention, management and resolution of international conflict including peacekeeping, preventive diplomacy, mediation and peacebuilding, as well as less formal mechanisms for third party collaborative problem solving.

INAF 5204 [0.5 credit]

Intelligence, Statecraft and International Affairs

The role of intelligence in foreign and security policy after the Cold War. Evolution of intelligence as regards strategic and policy requirements, the capabilities of selected services, interactions within government and civil society. Emphasis on the structure and functions of Canada's intelligence community.

INAF 5205 [0.5 credit]

Economics of Conflict

The economic dimensions of conflict and the application of economic methods to understanding conflict and conflict management.Precludes additional credit for INAF 5409 [formerly 46.549R] (taken in 2002-03).

INAF 5206 [0.5 credit]

Civil-Military Relations

Theoretical and practical issues of civil-military relations; analysis of the multidisciplinary and multidimensional nature of the relationship between society, political authority and the military, using comparative and global frames of reference.
Precludes additional credit for INAF 5409 sections R and S (taken 2002/03, 03/04).

INAF 5207 [0.5 credit]

Middle East Economic and Political Relations

Economic and political relations among countries of the Middle East; emphasis on the peace process and arrangements for regional security and regional economic cooperation; prospects for regional collaboration.

INAF 5208 [0.5 credit]

U.S. Foreign and Security Policy

Causes and consequences of U.S. foreign and security policy. Explanation and evaluation of past and present U.S. policies. Cases will be drawn from 20th century wars, interventions and crises; post-Cold War and post 9-11 U.S. policies.
Precludes additional credit for INAF 5409 section 'X' (taken 2001/02, 02/03).

INAF 5209 [0.5 credit]

Conflict and Development

Examination of competing interpretations of conflict in developing countries; material conditions, institutional factors, and ideological, or identity-based framing processes. The impact of war on development, and implications for policy.

INAF 5214 [0.5 credit]

Economics for Defence and Security

Examines the economic analysis of defence and security, applying economic analysis to topics such as defence production, procurement, offence and defence balance, alliance theory, deterrence, arms races, terrorism and terrorist financing.

INAF 5219 [0.5 credit]

Rights, Development, and Conflict

Uses economic institutionalism to examine the intersection of development and conflict, focusing on how the connection between property rights and development affects conflict. Topics include gender, land conflict, urban peripheries, migration and refugees, domestic and transnational crime, and state violence.

INAF 5224 [0.5 credit]

Intelligence and National Security: Policies and Operations

The roles and activities of intelligence services of selected countries. Their performance will be assessed in the light of historical experience, and in the context of the policy, legal and ethical constraints.

INAF 5234 [0.5 credit]

National Security Policy and Law

The international legal and policy implications of identifying and responding to national security threats. Topics include: intelligence gathering; verification regimes; military and counter-terrorism operations; criminal prosecution; and, balancing human rights and security concerns.

INAF 5244 [0.5 credit]

Terrorism and International Security

Contemporary international terrorism in comparative perspective, including religious and ideological motivations, sociology of recruitment and participation, evolving structures and dynamics of terror networks, financing and operations, and counter-terrorism measures. Examples are drawn from international and domestic terrorism.
Precludes additional credit for INAF 5409W in Winter 2008.

INAF 5300 [0.5 credit]

Political Economy of Multinational Enterprises

Recent economic and political developments in the fields of international economics and industrial organization as they affect multinational enterprises. The course develops concepts and analytical approaches to examine the impact of multinational enterprises on international affairs and the implications for public policy.

INAF 5303 [0.5 credit]

Science, Technology and International Affairs: The Third World

The problem of building indigenous technological capabilities in the Third World. The role of MNCs in the transfer of technology, the generation of appropriate technologies locally and the role of the state in the formulation of technology policy for development.

INAF 5305 [0.5 credit]

International Bargaining and Negotiation: Theory and Practice

An examination of bargaining and negotiation in international economic, political, and security issue areas, using case studies and theoretical analysis.

INAF 5306 [0.5 credit]

Trade Policy in North America

Canadian, American and Mexican trade and trade policy from colonial times to present, emphasizing the development of trade relations and the negotiation and operation of bilateral, regional (NAFTA), and multilateral trade agreements.
Precludes additional credit for INAF 5409, section 'F' (taken in 2005/06).

INAF 5307 [0.5 credit]

Macroeconomics in a Development Context

Macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibration, exchange rate and balance of payments management, fiscal and financial policy.
Prerequisite: enrolment in the Development Administration stream of the M.A. program of the School of Public Policy and Administration, or permission of the School of International Affairs.

INAF 5308 [0.5 credit]

International Trade: Theory and Policy

The pure theory of international trade and selected policy issues. Topics include theories of the pattern of trade, the gains from trade, the theory of distortions and welfare, and theories of endogenous trade policy formation.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

INAF 5309 [0.5 credit]

International Finance: Theory and Policy

Theory and policy in open economy macroeconomics and international finance. Topics include: exchange rate and output determination, balance of payments adjustment, monetary and fiscal policy under different exchange rate regimes, and the structure and performance of the international monetary system.
Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

INAF 5400 [0.5 credit]

Trade Policy Analysis

Selected trade and trade-related policy issues. Topics are drawn from current policy debates, and may include: multilateral vs. preferential trade liberalization; standards harmonization as a precondition for free trade; and globalization and the rising skill wage premium.
Prerequisites: M.A. standing in the Norman Paterson School of International Affairs, or permission of the School of International Affairs.

INAF 5401 [0.5 credit]

International Financial Institutions and Policy

Institutional arrangements, international financial flows, and critical events in international finance; development and operation of international financial institutions, and how they have shaped modern financial markets, events, and policy.
Precludes additional credit for INAF 5409 (taken prior to 1997-98).

INAF 5402 [0.5 credit]

Territory and Territoriality

Contemporary geographical and internatio nal relations theorizing is challenging conventional notions of boundaries and territories in the political organization of modernity. Using contemporary writings on geopolitics, security, sovereignty, self-determination and identity politics, this course investigates territoriality as a political and intellectual strategy. (Also listed as GEOG 5400.)

INAF 5405 [0.5 credit]

International Organizations in International Affairs

A critical analysis of the roles played by the United Nations and other international organizations in the field of international conflict, development, and political economy.

INAF 5406 [0.5 credit]

Advanced International Policy Analysis

Examination of international public policies of a number of countries, including Canada; approaches to the policy process and case studies of the formulation and evaluation of economic, political, and security policies.
Precludes additional credit for INAF 6003.
Prerequisite: permission of the School.

INAF 5407 [0.5 credit]

International Relations Theory

Overview of theories of international relations. Organized both historically and conceptually, the course will examine a variety of theoretical approaches to international relations, among them the realist, liberal, structural, neo-realist, and critical perspectives.

INAF 5408 [0.5 credit]

Gender in International Affairs

The role of gender differences in international affairs gender in the social sciences and feminist theories regarding war, nationalism, human rights, development, and the global economy.

INAF 5409 [0.5 credit]
Selected Topics in International Affairs

INAF 5418 [0.5 credit]
Gender and Human Security
Explores the intersection of gender and human security. Themes include: gender-based violence and vulnerabilities in war; masculinity and the military; trafficking in women and children; forced and child marriages; gender and international refugees; gender and crime; gender-based international policies.

INAF 5419 [0.5 credit]
Selected Topics in International Affairs

INAF 5429 [0.5 credit]
Selected Topics in International Affairs

INAF 5439 [0.5 credit]
Selected Topics in International Affairs

INAF 5449 [0.5 credit]
Selected Topics in International Affairs

INAF 5459 [0.5 credit]
Selected Topics in International Affairs

INAF 5500 [0.5 credit]
Comparative Trade Policy
Examination of trade policies of various states, and their associated institutional arrangement. Countries and country groupings to be examined include the United States, Japan, the European Union, and key developing countries.

INAF 5501 [0.5 credit]
Global Political Economy
The interaction between states, interest groups, firms and markets, how the global nature of the world economy affects states, especially Canada, and the governance of economic issues at the international level including trade, investment, finance and development.
Precludes additional credit for INAF 5000 (taken prior to 2001).

INAF 5502 [0.5 credit]
State Sovereignty and Globalization
How increased political, social and economic integration internationally affects a government's ability to formulate policy; examination of domestic and international policy issues and whether and how global forces and their domestic counterparts shape the policy-making environment.
Precludes additional credit for INAF 5000 (taken prior to 2001).

INAF 5505 [0.5 credit]
International Law: Theory and Practice
Theoretical perspectives on international law and the role international law plays in the international system. Topics include basis, creation and sources of international law, international dispute resolution, and international law and world order transformation. (Also listed as LAWS 5603.)

INAF 5506 [0.5 credit]
International Law: Use of Force
How legal constraints govern the use of force in international relations. Topics include legal options available to states and the international community, the use of weapons of mass destruction, terrorism, peacekeeping, and humanitarian intervention.
Precludes additional credit for INAF 5409 (taken in 2003).

INAF 5507 [0.5 credit]

International Economic Law: Regulation of Trade and Investment

Study of regulation of international economic relations. International institutions, legal aspects of integration, governmental regulation of trade and investment. (Also listed as LAWS 5200.)
Prerequisite: open only to graduate students in their master's year who have not previously studied international economic law.

INAF 5508 [0.5 credit]

Law, Politics and Economics in International Affairs

The linkages and differences among the disciplines of law, politics and economics as they relate to international affairs; the underlying assumptions of each discipline and how they affect the way different issues in international affairs are considered.
Precludes additional credit for INAF 5409 (section F, taken 2003/04, 04/05).

INAF 5600 [0.5 credit]

Human Resource Development

The economic analysis and theory of the major areas of human development in developing areas, including demography and population, education, health, nutrition, women and development, social security, labour markets, and human resources planning.
Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the School.

INAF 5601 [0.5 credit]

Historical Dimensions of Development and Underdevelopment

Comparative studies in the economic and social history of selected developed and developing countries. Identification of conditions that have fostered or inhibited development in the past, assessment of contemporary development strategies in the light of historical experience.

INAF 5602 [0.5 credit]

Development Assistance: Theory and Practice

Economic, moral, and political arguments for development assistance, aid effectiveness; the role of bilateral and multilateral donors; aid accounting, human development and human rights; NGOs and international assistance.

INAF 5603 [0.5 credit]

Issues in Development in Africa

Analysis of structures and processes of political, social, and economic change in intertropical Africa at scales ranging from the intrahousehold and local community to the state and international system. An objective will be to integrate gender and the environment into analyses which draw on theories of political economy.

INAF 5604 [0.5 credit] (formerly 46. 564)

Issues in Development in Latin America

Principal developmental trends, problems, and policies in the region since 1945; the design and implementation of future alternative developmental strategies.

INAF 5605 [0.5 credit]

The Ethical Dimension of International Affairs

Critical examination of the ethical dimensions of development, global conflict, and international political economy; beliefs and values, rights and obligations, individual and state morality.

INAF 5606 [0.5 credit]

Indigenous Peoples and Development

Major issues of the development, in its social, economic, political and environmental dimensions, of Indigenous peoples, including those of North America, Latin America, Australasia, India, Africa and the Polar regions.

INAF 5608 [0.5 credit]

Indigenous Perspectives on Third World Development

Some of the major perspectives and theories on Third World Development that have emerged from within the Third World. Included are authors representing structural, dependency, and radical theories of development, and those who see development as psychological or spiritual liberation.

INAF 5609 [0.5 credit]

Development Project Evaluation and Analysis

Examination of social cost-benefit analysis and other micro-economic methods of project evaluation in the context of the project cycle in developing countries with emphasis on policy analysis and implementation practice, case studies of development projects, including those of non-governmental organizations.

INAF 5701 [0.5 credit]

Global Environmental Change: Human Implications

Global environmental change; its significance for societies, economies and international relations. Value systems underlying environmental discourse; political economy of the environment; sustainability and security. Environmental diplomacy and grassroots environmentalism. Regionalized impacts of pressures on natural environments; challenges of adaptation. (Also listed as GEOG 5005.)

INAF 5702 [0.5 credit]

International Environmental Affairs

International environmental issues, with a focus on policy options and institutions relevant to addressing these issues. Topics include the relationship between the environment and trade, investment, globalization, development and conflict.
Precludes additional credit for INAF 5409 [formerly 46.549U] (taken in 2002/03).

INAF 5703 [0.5 credit]

Economics of Institutions and Global Governance

The economic analysis of institutions and of factors associated with global governance, including theories of cooperation, bureaucratic behaviour, externalities, common resource and environmental problems, public goods and other economic theories for state intervention applied to the international level.

INAF 5704 [0.5 credit]

Human Security: From Policy to Practice

Human security issues including perspectives of key governmental, international and non-governmental actors. Micro-disarmament, the protection of civilians, war economies, and post-conflict security issues.
Precludes additional credit for INAF 5409, section 'W' if taken in 2004/05 or 2005/06.

INAF 5705 [0.5 credit]

International Social Policy

Concepts of and approaches to international social policy. Concepts of social justice, comparative welfare regimes and citizenship. Topics include social reform, changes in the public/private provision of social services, participation in social policy, poverty reduction, health and education.

INAF 5706 [0.5 credit]

Global Health Policy

Global dimensions of health issues, including the linkages between health and development, international trade and economic policy, and human security. Approaches to understanding health challenges and examines the international policy framework for meeting them.

INAF 5800 [0.5 credit]

Asia Pacific Economic and Political Relations

The evolving pattern of economic and political relations in the Asia-Pacific region. Topics will include security issues; trade and investment; and development cooperation; institutional arrangements, including ASEAN, APEC, AFTA, and Canada's role in the regional affairs.

INAF 5801 [0.5 credit]

Regional Cooperation Among Developing Countries

The discourse between traditional and Southern theorists on regional integration among developing countries. The effects of regional trade, governance, investment, security and environmental agreements on development.

INAF 5802 [0.5 credit]

The International Political Economy of Transition

Problems of reintegration into the world economy and dilemmas of transition from command to market economies. Topics may include new trade and investment patterns, role in regional and international economic organizations, search for appropriate exchange rate policies, impact of Western assistance. (Also listed as EURR 5102.)

INAF 5804 [0.5 credit]

International Relations in Europe

International relations and organizations in Europe from theoretical and historical perspectives. Origins and development of European organizations such as the European Union and the Organization for Security and Co-operation in Europe.

INAF 5805 [0.5 credit]

The EU in International Affairs

The impact of the EU on international affairs; the internal development of the EU, the evolution of integration theory, and the growth of the EU's external relations capabilities.

INAF 5806 [0.5 credit]

Applied Techniques for Policy Research and Analysis

Basic survey of applied research techniques. Methodological overviews plus tools for evaluating research quality. Themes include unanticipated consequences, cause and effect, case studies, ethnography, surveys, experimental methods, statistical studies, mixed methods, practitioner techniques. Recommended for Thesis and Essay students.

INAF 5901 [0.5 credit]

Tutorials in International Affairs

To be chosen in consultation with the director.

INAF 5904 [0.5 credit]

Quantitative Research Methods

A basic introduction into the theory and application of quantitative analysis, primarily applied basic econometrics for the constructions and analysis of data sets with standard software packages.
Precludes additional credit for INAF 6002.
Prerequisite: permission of the School.

INAF 5905 [0.5 credit]

Qualitative Research Methods and Design

Problem statements, research questions and approaches to knowledge acquisition in international affairs, focusing on policy relevance. Topics include advantages and limitations of inductive and deductive research methods, variable selection and hypothesis development, case studies and field research, data gathering, and methodology choice.
Precludes additional credit for INAF 6001.
Prerequisite: permission of the School.

INAF 5906 [1.0 credit]

M.A./LL.B. Research Essay

A research essay that allows an M.A./LL.B. student to integrate legal and international affairs studies in an analysis of a topic of his or her choice.
Prerequisite: permission of the School after the submission of a satisfactory proposal and identification of a suitable supervisory team.

INAF 5908 [1.0 credit]

Research Essay

A research essay option that allows an M.A. student to apply their international affairs studies to a topic of his or her choice.
Prerequisite: permission of the School after the submission of a satisfactory proposal and identification of a suitable supervisory team.

INAF 5909 [2.0 credits]

M.A. Thesis

A research thesis option that allows a student in the M.A. program to combine original research with international affairs studies in an anlysis of a topic of his or her choice.
Prerequisite: A- average in all M.A. required courses and a minimum of 3.0 full course credits, permission of the School after the submission of a satisfactory proposal and identification of a suitable supervisory team.

INAF 5911 [0.0 credit]

Co-operative Work Term

Prerequisites: registration in the Co-operative Education Option of the Master of Arts program and permission of the School.

INAF 5912 [0.0 credit]

Co-operative Work Term

Prerequisites: registration in the Co-operative Education Option of the Master of Arts program, completion of INAF 5911, and permission of the School.

INAF 5913 [0.0 credit]

Co-operative Work Term

Prerequisites: registration in the Co-operative Education Option of the Master of Arts program, completion of INAF 5911 and INAF 5912 and permission of the School.

INAF 5919 [2.0 credits]

M.A./LL.B. Thesis

A research thesis option that allows a student in the M.A./LL.B. program to combine original research with legal and international affairs studies in an analysis of a topic of his or her choice.
Prerequisite: A- average in all M.A. required courses and a minimum of 3.0 full course credits, permission of the School after the submission of a satisfactory proposal and identification of a suitable supervisory team.

INAF 5921 [0.5 credit]

Tutorial in International Affairs

Prerequisite: permission of the School.

INAF 5922 [0.5 credit]

Tutorial in International Affairs

Prerequisite: permission of the School.

INAF 5923 [0.5 credit]

Tutorial in International Affairs

Prerequisite: permission of the School.

INAF 5924 [0.5 credit]

Tutorial in International Affairs

Prerequisite: permission of the School.

INAF 5925 [0.5 credit]
Tutorial in International Affairs
Prerequisite: permission of the School.

INAF 6001 [0.5 credit]
Qualitative Research Methods and Design
Problem statements, research questions and approaches to knowledge acquisition in international affairs, focusing on policy relevance. Topics include advantages and limitations of inductive and deductive research methods, variable selection and hypothesis development, case studies and field research, data gathering, and methodology choice.
Precludes additional credit for INAF 5905.
Prerequisite: standing in the NPSIA Ph.D. program or permission of the School.

INAF 6002 [0.5 credit]
Quantitative Methods
Basic theory and application of quantitative analysis, primarily applied basic econometrics for the construction and analysis of data sets with standard software packages.
Precludes additional credit for INAF 5915.
Prerequisite: standing in the NPSIA Ph.D. program or permission of the School.

INAF 6003 [0.5 credit]
Advanced International Policy Analysis
International public policies of a number of countries, including Canada; approaches to the policy process and case studies of the formulation and evaluation of economic, political, and security policies.
Precludes additional credit in INAF 5406.
Prerequisite: standing in the NPSIA Ph.D. program or permission of the School.

INAF 6100 [0.5 credit]
Doctoral Field Seminar in Conflict Management and Resolution
Core readings on conflict analysis, management and prevention; peacebuilding, security, terrorism and arms control.
Prerequisite: enrolment in the NPSIA Ph.D. program or permission of the School.

INAF 6101 [0.5 credit]
Comprehensive Examination in Conflict Management and Resolution
A comprehensive examination covering interdisciplinary and policy-oriented research on key policy issues in security, conflict analysis, management and prevention.
Prerequisite: enrolment in the NPSIA Ph.D. program or permission of the School.

INAF 6200 [0.5 credit]
Doctoral Field Seminar in International Development Policy
Core readings in international development policy, including concepts and measures of development, basic theoretical approaches to understanding development, and key policy issues such as foreign aid, economic policies, adjustment, health, environment institutions and governance.
Prerequisite: enrolment in the NPSIA Ph.D. program or permission of the School.

INAF 6201 [0.5 credit]
Comprehensive Examination in International Development Policy
A comprehensive examination covering interdisciplinary and policy-oriented research on key policy issues in the management of the global economy.
Prerequisite: Enrolment in the NPSIA Ph.D. program or permission of the School.

INAF 6300 [0.5 credit]
Doctoral Field Seminar in International Economic Policy
Core readings in international economic policy, including basic theories of international political economy, the role of civil society in economic policymaking, international economics institutions, and international policies in trade, finance, investment and migration.
Prerequisite: enrolment in the NPSIA Ph.D. program or permission of the School.

INAF 6301 [0.5 credit]

Comprehensive Examination in International Economic Policy

A comprehensive examination covering interdisciplinary and policy-oriented research on key policy issues in the management of the global economy.

Prerequisite: enrolment in the NPSIA Ph.D. program or permission of the School.

INAF 6900 [0.5 credit]

Doctoral Research Seminar

A seminar where research issues are discussed. Satisfactory completion of the seminar requires the successful public defence of a research prospectus that will be the basis for the dissertation.

Prerequisite: second-year standing in the NPSIA Ph.D. program.

INAF 6909 [5.0 credits]

Ph.D. Thesis

Selection of Courses

In addition to the graduate courses offered in the School, qualified students may choose from among courses in international affairs offered by related departments, schools, and institutes.

Journalism and Communication

St. Patrick's Building 346
Telephone: 613-520-7404
Fax: 613-520-6690
E-mail: journalism@carleton.ca
Web site: carleton.ca/sjc

The School

Director of the School: Karim H. Karim
Supervisor of Graduate Studies (Journalism): Allan Thompson

The School of Journalism and Communication offers courses leading to the degree of Master of Journalism. (For a description of the degrees of Master of Arts and Ph.D. in Communication, see the Mass Communication section of this Calendar). The emphasis in the M.J. program is on advanced professional education and related coursework for those who are or intend to become practising journalists in the news media. In practical terms, this entails both the polishing of professional journalistic skills to a high level of proficiency and advanced education in a related field of study.

Following a common first year of coursework examining the role of journalism in society, media law and reporting methods, complemented by professional workshops in print and broadcast media, students in the master's program will choose one of three areas of concentration in their second year of study:

Specialized Print Reporting
The focus of this specialty will be the study of advanced techniques in reporting, writing and producing material for print and online media.

Broadcast Journalism
The focus of this specialty will be the study of advanced techniques in reporting, writing and producing programs for the broadcast media.

Journalism Studies
This program is designed for applicants who wish to spend a year studying their craft and/or the news industry. This specialty encompasses a number of topics, which include the role of the media in society as it is conceived by selected social and political theorists, communications law, politics and the media, the economics of the media, and journalism history.

Carleton's School of Journalism and Communication is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, federal government departments and agencies, embassies, business and labour organizations, and major economic and cultural institutions.

Master of Journalism

Admission Requirements

The Master of Journalism program comprises 10.0 credits. Most applicants will be admitted to the First year of a two-year course of study, but some may qualify for admission directly to the Second year (see below). An admissions committee, including the supervisor of graduate studies, will determine the admissions qualifications of each applicant.

Admission will be selective. Admission will not be guaranteed to all who meet the published minimum requirements, as there are many more qualified applicants each year than there are available spaces.

A student who holds a bachelor's or master's degree from a recognized university in a field other than journalism may be admitted to the first year of study if he or she achieved at least high honours standing. International students whose first language is not English need TOEFL scores of at least 250 CBT or 600, IELTS scores of at least 7 in all components, or CAEL Assessment scores of at least 70. Such students who complete the core first year, outlined below, and meet the requirements of the Faculty of Graduate Studies and Research, Section 11 of the General Regulations section of this Calendar, may proceed to second year.

Applicants who have a three-year journalism degree with high honours standing may be admitted to a First year made up largely of approved courses from the Faculties of Arts and Social Sciences and Public Affairs and Management. Such students may proceed to the second year of study if they have achieved high honours standing.

A limited number of spaces will be made available for direct admission to the Second year of the M.J. program. Students must normally possess one of the following qualifications to be considered for this advanced admission: a B.J. (Honours) or the equivalent with high second-class standing, or a degree in another discipline from a recognized university plus at least five years of professional experience in journalism, or long and distinguished professional experience in journalism. Students with suitable professional qualifications but no degree may occasionally be admitted to a program in which they take a required number of undergraduate courses in addition to the M.J. program.

Application is made on forms available from the School of Journalism and Communication. Application deadlines can be found at https://gsapplications.carleton.ca .

As a condition for graduation, all students are required to have a minimum of four months of practical experience in the media, and a working knowledge of a second language, preferably French.

Program Requirements

First Year

Candidates admitted to the first year of the Master of Journalism program must complete the following courses before proceeding to the second year of study:

- JOUR 5000
- JOUR 5200
- JOUR 5202
- JOUR 5208
- JOUR 5401
- JOUR 5706
- 1.0 credit of approved electives

First year M.J. candidates may be considered for advanced standing in certain of the above-required courses, but in such cases will be required to replace waived courses with approved options.

Second Year

Credits will be determined according to the stream pursued:

Specialized Print Reporting

- JOUR 5208
- JOUR 5508
- JOUR 5700
- JOUR 5704
- JOUR 5705
- JOUR 5908
- 1.0 credit of approved electives in the student's area of specialization

Note: under special circumstances, and with the School's approval, a student could replace JOUR 5706, 5908 and 0.5 credit of approved electives above with a 2.0 credit M.J. Thesis, JOUR 5909.

Broadcast Journalism

- JOUR 5208
- JOUR 5508
- JOUR 5702
- JOUR 5707
- JOUR 5708
- JOUR 5908
- 1.0 credit of approved electives in the student's area of specialization.

Note: Under special circumstances, and with the School's approval, a student could replace JOUR 5706, 5908 and 0.5 credit approved electives above with a 2.0-credit thesis, JOUR 5909.

Journalism Studies

- JOUR 5000 (if admitted directly to second year). Students admitted to the two-year program will complete JOUR 5000 in the first year of studies and an approved replacement option in the second year.
- JOUR 5500
- JOUR 5909
- 2.0 credits related to the study of the media, chosen in consultation with the Supervisor of Graduate Studies.

Academic Standing

All candidates are required to obtain a grade of B- or better in each credit in the program. A candidate may, with the recommendation of the School and the approval of the Dean of the Faculty of Graduate Studies and Research be allowed a grade of C+ in 1.0 credit.

Full-time students in a 10.0 credit M.J. program are advised that their thesis or research essay proposal must be formally approved within eighteen months of initial registration. Students in a 5.0 credit program must have the proposal formally approved by the middle of their second term of full-time registration. Due dates for part-time students will be adjusted accordingly. Students failing to file a proposal may not be permitted to register in subsequent terms until this requirement has been met. Approval of proposals shall be the responsibility of a thesis committee appointed by the Director of the School.

Students are advised to consult the General Regulations section of this Calendar for other regulations relating to academic standing.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

First Year

JOUR 5000 [0.5 credit]
Journalism and Society I
An introduction to analysis of the news media in Western society, considering classical arguments and contemporary trends in the scholarly assessment of journalism practice.

JOUR 5200 [1.0 credit]
Print Journalism Laboratory
A laboratory course in basic reporting and editing techniques, followed by application in the print media.

JOUR 5202 [1.0 credit]
Broadcast Journalism Laboratory
A laboratory course in reporting and editing in the broadcast media.

JOUR 5206 [0.5 credit]
Reporting Methods
Topics covered will range from interviewing and observation skills to conducting a title search, lodging an access to information request and interpreting data.

JOUR 5208 [0.5 credit]
Public Affairs Reporting
A course devoted to understanding selected political, economic and social issues, and to analytical reporting on timely issues under professional conditions.

JOUR 5305 [0.5 credit]
Perspectives on Modern Society
A seminar course examining texts from the social sciences, philosophy, literature, and journalism for the contribution they make to an understanding of issues facing modern industrial society.

JOUR 5401 [0.5 credit]
Journalism Law
This course prepares journalists to function comfortably within the legal and ethical guidelines governing their occupation. Topics include: contempt of court; free press, fair trial; revealing of sources; civil defamation; obscenity; privacy; government secrecy.

JOUR 5706 [0.5 credit]
Professional Practices
Students examine current journalism practices in a critical and analytical way, and explore ways of producing thorough and investigative journalism. Guest speakers share their expertise and skills.

Second Year

JOUR 5208 [0.5 credit]
Public Affairs Reporting
A course devoted to understanding selected political, economic and social issues, and to analytical reporting on timely issues under professional conditions.

JOUR 5500 [0.5 credit]

Journalism and Society II

A critical examination of the conduct of the news media, exploring the social, political and economic contexts in which the media work and assessing the consequences of journalism practice for contemporary society.

Prerequisite: JOUR 5000 or permission of the School.

JOUR 5508 [0.5 credit]

Professional Practices: Specialized Media

A workshop course designed to give students instruction in specialized areas such as radio documentary, video documentary, film documentary, editing, magazine writing, photojournalism. Not all specialties will be offered each year. Also offered at the undergraduate level, with different requirements, as JOUR 4208 for which additional credit is precluded.

JOUR 5700 [1.0 credit]

Print Journalism

Students will explore and apply advanced journalistic principles and practices through a combination of readings, discussion and reporting in specific areas.

JOUR 5702 [1.0 credit]

Broadcast Journalism

A seminar combining critical analysis of television journalism and practical skill development in television reporting, writing and production.

JOUR 5704 [0.5 credit]

Advanced Reporting (Print)

Designed to enhance reporting and editing skills through the production of a community newspaper, Centretown News.

Preluces additional credit for JOUR 5701 [1.0] (no longer offered).

JOUR 5705 [0.5 credit]

Advanced Reporting (Online Publishing)

Designed to enhance reporting and editing skills through the production of online publications such as Capital News Online.

Precludes additional credit for JOUR 5701 [1.0] (no longer offered).

JOUR 5707 [0.5 credit]

Advanced Reporting (Radio)

Enhances radio reporting and production skills to include news features and mini-documentaries, preparation and presentation of public affairs programs, and multimedia delivery.

Precludes additional credit for JOUR 5703[1.0] (no longer offered).

JOUR 5708 [0.5 credit]

Advanced Reporting (Television)

Enhances television reporting and production skills to include news features and mini-documentaries, preparation and presentation of public affairs programs, and multimedia delivery.

Precludes additional credit for JOUR 5703[1.0] (no longer offered) .

JOUR 5800 [0.5 credit]

Survey Methods for Journalists

An examination of basic research design and data collection with emphasis on problems of interpretation.

JOUR 5808 [0.5 credit]

Directed Readings

Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

JOUR 5809 [0.5 credit]

Directed Research

Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

JOUR 5900 [1.0 credit]

Directed Studies

Reading and research tutorials.

JOUR 5901 [0.5 credit]

Directed Studies

Reading and research tutorials.

JOUR 5908 [1.0 credit]

M.J. Research Project

The student will complete a substantial piece of public affairs journalism; or a research project on the media; or a document that makes a major contribution to journalism education. The format of the MRP will be determined by the stream of study.

JOUR 5909 [2.0 credits]

M.J. Thesis

To fulfil the requirements of this 2.0-credit thesis course, students must produce a major piece of journalistic research or complete an academic thesis in the area of journalism studies.

Law

Loeb Building C473
Telephone: 613-520-3690
Fax: 613-520-4467
carleton.ca/law

The Department

Chair of the Department: R. Warskett
Supervisor of Graduate Studies: D. Buss

The Department of Law offers a program of advanced study and research leading to a Master of Arts degree in Legal Studies. The program is open to full-time and part-time students.

The Department also offers a Graduate Certificate in Conflict Resolution. Further information can be found at the end of this section. The M.A. program provides an interdisciplinary, theoretical, and research-oriented approach to studying law as a social and political institution, with emphasis on the relationship between law and social transformation. The plan of studies includes a range of fields linked by a common theoretical and methodological concern with the way law shapes and is shaped by its social environment. The program is designed to develop the conceptual and analytical skills required for conducting independent research on law and society.

Within this context, students will focus on one or more of the following areas of specialization:

- Legal Theory and Social Theory
- Law, Crime and Social Order
- Women, Law and Gender Relations
- Political Economy of Law
- International and Comparative Legal Regimes
- Social History of Law

The location of the M.A. program in Legal Studies at Carleton provides students with a wealth of resources for research purposes. As well as the resources of the MacOdrum Library, students will have access to extensive Canadian and international research material through the Social Science Data Archives located at Carleton. The Library of the Supreme Court of Canada, the National Library, the National Archives, the Library of Parliament, Statistics Canada, and the Centre for Justice Statistics are all located in Ottawa. Ottawa houses many federal government departments and agencies, and the national headquarters of non-governmental organizations such as the Elizabeth Fry Society, the John Howard Society, and the National Association of Women and the Law. Many government departments and non-governmental organizations maintain specialized libraries, and offer access to documents and other research materials.

Qualifying-Year Program

Applicants with exceptional promise who have less than B.A.(Honours) status may be admitted into a qualifying-year program designed to raise their standing to honours status. To be considered for admission into the master's program, students must obtain at least a high honours average in their qualifying-year courses.

Master of Arts

Admission Requirements

The requirement for admission into the M.A. program in Legal Studies is an Honours bachelor's degree or the equivalent, with at least high honours standing.

Applicants will be considered for admission on the basis of their academic background and standing. Where relevant, previous professional experience may be taken into account.

Applicants without a background in law may be required to complete one or more designated courses from the department's undergraduate program before taking courses towards the master's degree.

Application deadlines can be found at https://gsapplications.carleton.ca .

Program Requirements

In consultation with the supervisor of graduate studies, each candidate is required to complete one of the following programs of studies:

- 3.0 credits and a 2.0-credit thesis (LAWS 5909), which includes an oral examination.
- 4.0 credits and a 1.0-credit research essay (LAWS 5908)

All students are required to take LAWS 5000 and LAWS 5001. These courses provide students with a common theoretical and interdisciplinary framework for the program.

In addition, students are encouraged to take 0.5 credit in a related discipline, in consultation with the supervisor of graduate studies.

All students must obtain satisfactory grades in their course work; make satisfactory progress in their research; maintain a close working relationship with their thesis or research essay supervisors; and attend seminars on current research and related topics.

Thesis/Research Essay

The thesis or research essay must represent the result of the candidate's independent research undertaken after being admitted into graduate studies in the Department of Law. Previous work of the candidate may be used only as introductory or background material for the thesis or research essay.

A student may carry on research work related to the thesis or research essay off campus if the work is approved in advance and supervision arrangements have been made with the supervisor of graduate studies.

Guidelines for Completion of Master's Degree

Full-time students are expected to complete the required two courses, LAWS 5000 and LAWS 5001, and either an additional 2.0 credits (for those following the thesis program), or an additional 3.0 credits (for those following the research essay program) by the end of the second term of registration. The thesis or research essay should normally be submitted by the end of the fourth term of study.

Part-time students are expected to complete the required two courses, LAWS 5000 and LAWS 5001, and either an additional 2.0 credits (for those following the thesis program) or an additional 3.0 credits

(for those following the research essay program) by the end of their third year of study. The thesis or rsearch essay should normally be submitted by the end of the fifth year of study.

Certificate in Conflict Resolution

The Department of Law offers a program of advanced study leading to a Graduate Certificate in Conflict Resolution.

The Certificate provides an interdisciplinary program of study emphasizing theoretical models of conflict and its management and/or resolution, and integrating skills and techniques in the field. The program has an academic structure and a professional orientation, and is directed to individuals whose work involves negotiation or coping with conflict. The program develops in students an intellectual foundation and applied skills to enable them to function effectively in their field.

Interested students should contact the Department of Law for information concerning admission and program requirements, scheduled courses, and fee schedules.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Core Courses

The compulsory courses are designed to give substance to the major objectives of the program. They provide the theoretical and interdisciplinary framework which will set the terms of discussion and debate for the program. The courses are designated as compulsory because it is anticipated that students will be drawn from both law and social sciences backgrounds, and consequently there is a need to provide a central and shared basis for the whole program.

LAWS 5000 [0.5 credit]

Theories of Law and Social Transformation

Examines three groups of theories of law (liberal, sociological and Marxist) focusing on different ways law is conceived as an object of inquiry and on different accounts of trajectories of legal development. Potential of law for realizing or inhibiting social change provides analytic framework.

LAWS 5001 [0.5 credit]

Legal Method and Social Inquiry

Introduces problems of research strategy and methods. Explores contrasting methodologies in legal research; evaluates methodologies employed in understanding legal reasoning, discourses, and practices. Includes seminars in which participants present outlines of their own research projects, focusing on methodologies and research questions.

Other Law Courses

LAWS 5002 [0.5 credit]

Law and Gender Relations

Examines theoretical approaches informed by significance of gender to structure and operation of law. Concepts such as essentialism, difference, cultural determination, and social construction of gender relations examined in context of contemporary feminist debates. Focus on understanding and facility with feminist analysis and methodology.

LAWS 5003 [0.5 credit]

Law, Economy and Society

Addresses the relationship between law, economy, and society. Competing theoretical accounts of the relationship between legal regulation and social and economic change explored through selected historical and contemporary case studies.

LAWS 5004 [0.5 credit]

Law, Crime and Social Order

Examines theoretical dimensions of relationship between law, state, crime, and social order. Explores scope and limitations of criminal justice system as an agency of social control. Examines shifts in forms of social order and their relation to changes in criminal law and sanctions.

LAWS 5005 [0.5 credit]

Law, State and Politics

Examines theoretical explanations of relationships between law, state and politics, Selected areas such as rights theory, rule of law, separation of powers or judicial review may provide focus.

LAWS 5006 [0.5 credit]

Historical Perspectives on Law and Society

Examines historical relationship between social forces, law and legal institutions and utility of historical forms of knowledge and methods to legal studies. Surveys selected issues in private, public and criminal law.

LAWS 5007 [0.5 credit]

Race, Ethnicity and the Law

Examines ways race and racism interact with gender and class in shaping legal system. Explores ways legal system institutionalizes racism and potential for using the legal system to combat racism. Selected areas such as immigration law and native rights may be used to illustrate themes.

LAWS 5008 [0.5 credit]

Consuming Passions: The Regulation of Consumption, Appearance and Sexuality

Examines rise of consumption and private pleasures and their regulation and self-regulation. Social history of regulation of two fields of consumption: surfaces of the person: personal appearance, in particular of dress, the body, sexuality; and intakes of the body, focusing on food, alcohol, drugs. (Also listed as SOCI 5204.)

LAWS 5100 [0.5 credit]

Advanced Problems in Legal Philosophy

Studies in legal theory and analyses of law advanced by Hart, Dworkin, and others, and legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term. (Also listed as PHIL 5100.)

Prerequisites: either LAWS 3105 or LAWS 3101 (PHIL 3101) and LAWS 3102 (PHIL 3102), or permission of the Department.

LAWS 5200 [0.5 credit]

International Economic Law: Regulation of Trade and Investment

Study of regulation of international economic activity. Discussion of relevant international institutions, legal aspects of integration, governmental regulation of trade and investment. (Also listed as INAF 5507.)

Prerequisite: Open only to students in their master's year who have not studied international economic law.

LAWS 5302 [0.5 credit]

Feminism, Law and Social Transformation

Exploration of nature and possibilities of feminist engagement with law. Policies and strategies of law reform and/or social transformation formulated and evaluated through application of

theoretical frameworks to particular topics. Significance of Canadian Charter of Rights and Freedoms and human rights legislation is examined**.**

LAWS 5305 [0.5 credit]

Crime, Social Change and Criminal Law Reform

Examination of the ideological and practical consequences of criminal law reform and policy initiatives undertaken by the state. Specific reform proposals examined to illustrate possible alternate responses to social problems and the varying effects of these responses.

LAWS 5306 [0.5 credit]

Police and Capital

The idea of 'police' as a general historical project aimed at the fabrication of social order and the development of liberal philosophy, political economy and security. Contemporary public and private security provision considered in light of commodification, class conflict, and risk thinking. (Also listed as SOCI 5305.)

LAWS 5400 [0.5 credit]

Law, Economy and the Regulatory Process

Relationship between law, the economy, and the regulatory process. Examines models from political and economic perspectives, and impact of theories of regulation on regulatory practice and enforcement. Selected topics may be drawn from labour law, housing and consumer protection, environmental protection, and anti-combines legislation.

LAWS 5405 [0.5 credit]

Canadian Labour Law Policy from a Comparative Perspective

Examines major influences on formation of Canadian labour law policy using a comparative perspective to highlight divergencies in Western democratic nations. Question if and why Canadian labour law is distinctive. Includes collective bargaining and regulation of individual employment relationships.

LAWS 5500 [0.5 credit]

The Canadian Constitution

Familiarizes students with terminology, principles, and doctrines of judicial interpretation of Constitution Acts 1867-1982 and other constitutional statutes. Emphasis on division of legislative powers in the Canadian federation.

Prerequisite: open only to graduate students in their master's year who have not previously studied Canadian constitutional law.

LAWS 5503 [0.5 credit]

Advanced Legal Problems of Federalism

An advanced study of selected Canadian constitutional problems including constitutional revision. Some comparisons with other federal systems may be made.

Prerequisite: a course in Canadian constitutional law, for example LAWS 5500, or permission of the Department.

LAWS 5506 [0.5 credit]

Advanced Administrative Law Problems

An in-depth study of selected legal questions involving the activities of public authorities.

Prerequisite: a course in administrative law or permission of the Department.

LAWS 5603 [0.5 credit]

International Law: Theory and Practice

Examines various theoretical perspectives on international law and locates role international law plays in the international system. Topics include basis, creation and sources of international law, international dispute resolution, and international law and world order transformation. (Also listed as INAF 5505.)

LAWS 5900 [0.5 credit]
Tutorials/Directed Readings in Law
Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor.

LAWS 5901 [0.5 credit]
Tutorial/Directed Readings in Law
Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor.

LAWS 5903 [0.5 credit]
Contemporary Topics in Legal Studies
A research seminar which explores a selected topic from current debates in legal studies. Students should check with the Department regarding the topic offered.

LAWS 5904 [0.5 credit]
Contemporary Topics in Legal Studies
A research seminar which explores a selected topic from current debates in legal studies.

LAWS 5908 [1.0 credit]
M.A. Research Essay

LAWS 5909 [2.0 credits]
M.A. Thesis

Selection of Courses in Related Disciplines

In addition to the graduate courses offered by the Department of Law, students in the M.A. program are encouraged to take 0.5 credit in a related discipline, in consultation with the supervisor of graduate studies. Listed below are courses offered by other academic units that can be taken towards the requirements of the M.A. in Legal Studies. This list is not exhaustive and is subject to change.

In certain circumstances (with the approval of the supervisor of graduate studies) up to 1.0 credit may be selected from among those offered at the 4000-level.

Note: Students should be aware that the number of spaces in graduate courses offered by other departments may be limited, and that registration may be conditional upon obtaining the prior approval of the department concerned. It is the student's responsibility to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.

Students are advised that there is no guarantee that all of these courses will be offered in any given year, or in any given term. 1.0 credit courses are scheduled over two terms and students interested in these courses must consult the graduate supervisor. Students should check the current University timetable to ensure course availability and schedule when planning their program.

Canadian Studies
CDNS 5100, CDNS 5200, CDNS 5201

Economics
ECON 5302, ECON 5303, ECON 5308, ECON 5403

Geography
GEOG 5400, GEOG 5401, GEOG 5404

History
HIST 5206, HIST 5300, HIST 5509, HIST 5808

International Affairs
INAF 5203, INAF 5306, INAF 5100, INAF 5305, INAF 5402, INAF 5405, INAF 5505, INAF 5507, INAF 5808

Journalism and Communication
JOUR 5401

Political Science
PSCI 5100, PSCI 5507, PSCI 5509

Psychology
PSYC 5104, PSYC 5107, PSYC 5202

Public Administration
PADM 5002, PADM 5203, PADM 5306, PADM 5607, PADM 5608, PADM 5609, PADM 5804

Sociology and Anthropology
SOCI 5206,SOCI 5300, SOCI 5302, SOCI 5306, SOCI 5308, SOCI 5400, SOCI 5404, SOCI 5405, SOCI 5408, SOCI 5409, SOCI 5504, SOCI 5600, SOCI 5607, SOCI 5608, SOCI 5707

Social Work
SOWK 5101, SOWK 5106, SOWK 5301, SOWK 5302, SOWK 5704

Linguistics and Applied Language Studies

Paterson Hall 215
Telephone: 613-520-2802
Fax: 613-520-6641
carleton.ca/slals

The School

Director: R. Gess
Supervisor of Graduate Studies: D. Woods

The School of Linguistics and Applied Language Studies offers programs of study leading to the degree of Master of Arts in Applied Language Studies. Applied language studies may be distinguished by a focus on language use and the development of language abilities in educational, professional and social contexts. This focus includes:

- The acquisition of additional languages and the development of multilingualism
- Written language and discourse and the critical analysis of their use in various contexts
- The development of writing abilities and literacies
- The teaching and assessment of language abilities and the analysis of the contexts in which these abilities are developed.

Concentration is possible in one of the following fields:

- The Teaching and Acquisition of Additional Languages
- The Nature, Acquisition and Teaching of Written Discourse/Literacies

Students are also able to combine these fields in their course work and research options.

The program is geared toward practitioners in these fields, and to theory- and research-oriented students interested in pursuing doctoral studies in related areas.

The M.A. in Applied Language Studies is a 5.0-credit program. Students may take one of three optional program paths: a thesis option (in which the thesis counts as two full credits), a research essay option (where the research essay counts as one credit), and a course work option.

Additional information may be obtained by consulting the supervisor of graduate studies.

Qualifying-Year Program

Applicants in the following categories may be admitted to a qualifying year program to be determined in accordance with university entrance regulations and the guidance of the supervisor of graduate studies, or advised to apply for the CTESL program as an equivalent to the qualifying year:

- applicants who hold a three-year degree with the equivalent of honours standing (at least B overall);
- applicants who hold an honours degree but lack academic background in relevant disciplines;
- applicants with a slightly lower academic standing (B-) but with relevant professional experience.

At the end of the qualifying year program, the School will determine the student's eligibility to enter the master's program. Courses taken as part of a qualifying year or equivalent are not eligible for advanced standing in the M.A. program.

Master of Arts

Admission Requirements

The normal minimum requirement for admission to the master's program is a B.A.(Honours) degree in a discipline involving the analysis of language or the study of language use or learning; or a 3 year B.A. in a relevant discipline together with a B.Ed. or C.T.E.S.L. Students must have achieved high honours standing (a minimum of B+ in related courses and B overall) in their academic work. Relevant professional experience may also enhance a candidate's application.

For other admission regulations not specific to the School of Linguistics and Applied Language Studies, refer to the General Regulations section of the Graduate Calendar, in particular the subsection on Admission Requirements and Eligibility.

Program Requirements

Students will establish their programs in consultation with the School's supervisor of graduate studies.

Each candidate will select one of the following program paths:

- LALS 5001; LALS 5002 plus 2.0 credits from the School's graduate listing; and a master's thesis (LALS 5909).
- LALS 5001; LALS 5002 plus 3.0 credits from the School's graduate listing; and a research essay (LALS 5908).
- LALS 5001; LALS 5002 plus 4.0 credits from the School's graduate listing.

The choice of thesis, research essay, or credit program path will be made by the student, with the advice of the Supervisor. Relevant factors will include the student's academic goals, professional goals, and background knowledge.

LALS 5001 is normally to be taken in the first fall term after admission to the program.

Permission may be granted for enrolment in 1.0 credit offered in another department.

Graduate students may take courses at the senior undergraduate (4th year) level up to a maximum of 1.0 credit. Permission of the School's graduate supervisor is required. Students may take a combination of senior undergraduate courses and 'piggybacked' courses (fourth-year courses also offered, with different requirements, at the graduate level) up to a maximum of 1.5 credits.

Guidelines for Completion of Master's Degree

It is expected that students will progress steadily towards the completion of requirements for the degree. In particular, it is normally expected that:

- a full-time student will complete 3.0 credits of course work within two terms of study, and an acceptable thesis proposal early in the third term of study; or 4.0 credits of course work within three terms, and an acceptable research essay proposal early in the fourth term; and all degree requirements within six terms of study

- a part-time student will complete 3.0 credits of course work within three years of initial registration, and an acceptable thesis proposal early in the fourth year; or 4.0 credits of course work within four years, and an acceptable research essay proposal early in the fifth year; and all degree requirements within six years of initial registration
- a student who registers in a combination of full-time and part-time study will, in consultation with an adviser, develop a schedule for completion of course requirements and a thesis or research essay proposal, consistent with times to completion stated above and with the overall time limits specified in the General Regulations section in this Calendar

Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

For an updated description of Special Topics offerings, refer to the on-line version of the Linguistics and Applied Language Studies calendar entry at
www.gs.carleton.ca/calendars/current/programs/linguistics.html

LALS 5001 [0.5 credit]
Directions in Applied Language Studies
A survey of current research directions in applied language studies and an introduction to ongoing research in the School. The course introduces students to the scope of theory and practice in the field.

LALS 5002 [0.5 credit]
Inquiry Strategies in Applied Language Studies
A consideration of various approaches to the design of studies and the collection and analysis of data. Naturalistic and quasi-experimental methods will be discussed. The role of statistics in disciplined inquiry, including an introduction to elementary procedures.
Precludes additional credit for LALS 5502.

LALS 5005 [0.5 credit]
Theoretical Foundations for Applied Language Studies
Overview of the works of 20th and 21st-century theorists such as Bakhtin, Bourdieu, Burke, Foucault, Latour and Vygotsky.

LALS 5102 [0.5 credit]
Systemic-Functional Linguistics
Functions of language in the exchange of meanings between people in a wide variety of communicative situations. Semantic and syntactic resources at risk in these different contexts. Interactions between language and the social context. Also offered at the undergraduate level as LALS 4709, for which additional credit is precluded.
Precludes additional credit for LALS 5709 if taken prior to 2007-08.
Prerequisite: restricted to graduate students in Applied Language Studies and Journalism and Communication.

LALS 5103 [0.5 credit]
Major Structures of English
The structure of English language, highlighting important contrasts between English and other languages, and grammatical difficulties for ESL Learners. Also offered at the undergraduate level, with different requirements as LALS 4801, for which additional credit is precluded.
Precludes additional credit for LALS 5801 if taken prior to 2007-08.

LALS 5201 [0.5 credit]

Language Classroom Research

Research into language learning in the classroom; methods for evaluating classroom practices and materials.

LALS 5202 [0.5 credit]

Curriculum in Language Teaching

Current theory and practice in language curriculum development and evaluation in the light of recent research in linguistics, sociolinguistics, language acquisition and language education policy.

LALS 5203 [0.5 credit]

Issues in English Language Teaching/Teacher Education

A research seminar to explore current issues in English language teaching/teacher education.

LALS 5204 [0.5 credit]

Seminar in University Teaching

Theoretical and empirical work related to teaching in higher education. Analysis of instructional discourse, use of language in classroom decision-making, bases of effective practice and methods of instruction. Constructivist principles of teaching and learning. Role of teaching in university scholarship. (Also offered as PSYC 6104.)
Precludes additional credit for LALS 5905 (Section T, 1997-98), LALS 5905 (Section X, 1998-99), LALS 5905 (Section W, 1999-2000), LALS 5905 (Section W, 2000-01), LALS 5905 (Section X, 2001-02) and LALS 5905 (Section W, 2002-03).

LALS 5205 [1.0 credit]

Teaching English as a Second Language: Methodology

Classification of classroom teaching methods and materials; adaptation of teaching materials for particular situations; creation of teaching materials; teaching techniques and strategies.
Also offered at the undergraduate level, with different requirements, as LALS 4205, for which additional credit is precluded. Must be taken concurrently with LALS 5806.

LALS 5207 [0.5 credit]

Pedagogical Grammar in Second and Foreign Language (SL/FL) Teaching

The concept of pedagogical grammar in SL/FL teaching. Critical examination of recent theories of 'focus on form' in communicative language classrooms, and related empirical work.
Precludes additional credit for LALS 5905 (Summer 1999), LALS 5905 (Summer 2002) and LALS 5603 (if taken prior to 2007-08).

LALS 5208 [0.5 credit]

Languages for Specific Purposes (LSP)

Introduction to LSP, a sub-field of applied linguistics tailoring language instruction to specific groups of learners. Developments in strands of LSP (English for Science, Business, etc.). Research and teaching methodology. Emphasis on English for Academic Purposes/English for Specific Purposes research and instruction at Carleton.
Also offered at the undergraduate level with different requirements as LALS 4208, for which additional credit is precluded.

LALS 5209 [0.5 credit]

Social Theories of Language Learning

Social theories of language and language learning. Major theorists and paradigms, recent applications in language learning research and pedagogical implications for language teaching.

LALS 5301 [0.5 credit]

Language and Cognition

Structure and representation of linguistic knowledge in human cognition. Evidence from child language acquisition, language processing and language impairment. Also listed as CGSC 5003, for which additional credit is precluded.

LALS 5302 [0.5 credit]

Language Acquisition

Recent models of first and second language acquisition, with in-depth analysis of theoretical issues of current relevance and related empirical studies.
Precludes additional credit for LALS 5601 if taken prior to 2007-08.

LALS 5303 [0.5 credit]

Linguistic Analysis, Culture and Cognition

Universals of language from a cross-cultural perspective. Study of lesser-known languages leading to critical understanding of universal human concepts and communication practices in culture-specific configurations. Cross-linguistic analysis as a means to general understanding of diversity and universality in human cognition.

LALS 5404 [0.5 credit]

Aspects of Bilingualism

Linguistic, psycholinguistic and cultural issues in bilingualism and bilingual education.
Prerequisite: fourth-year courses in linguistics or permission of the School.
Precludes additional credit for LALS 5701 if taken prior to 2007-08.

LALS 5407 [0.5 credit]

Language Policy and Planning

Interaction of political, social, and cultural factors in the planning and implementation of language policy in international contexts.
Prerequisite: fourth-year courses in linguistics or permission of the School.
Precludes additional credit for LALS 5707 if taken prior to 2007-08.

LALS 5408 [0.5 credit]

Critical Discourse Analysis

Discourse in the structuring of social and cultural change and in a wide range of contexts such as the media and education.
Precludes additional credit for LALS 5905W (1998-99), LALS 5905W (1999-2000), and LALS 5708 (if taken prior to 2007-08).

LALS 5409 [0.5 credit]

Policy and Practice in Literacy and Language Education

Regulation of literacy and language education programs and teaching through public discourse, government policy, and institutional accountability; institutional ethnography as a method for investigating this regulation.
Precludes additional credit for LALS 5704 if taken prior to 2007-08.

LALS 5501 [0.5 credit]

Language Testing and Assessment

Issues in language testing and classroom assessment, including validity theory and current validation research; challenges in test development; washback; models of alternative assessment.

LALS 5504 [0.5 credit]

Evaluation in Applied Language Programs

An examination of various evaluation paradigms and their application to problems of program and curriculum in applied language settings; the connections among and differences between research and evaluation models of inquiry.

LALS 5602 [0.5 credit]

Features and Principles of Academic Discourse

Examination of features and underlying principles of academic writing in various disciplines. Analysis of disciplinary texts in their particular social contexts.
Precludes additional credit for LALS 5905 (2001-02) and LALS 5406 (if taken prior to 2007-08).

LALS 5605 [0.5 credit]

Research and Theory in Workplace Writing

Cognitive, social, and cultural approaches to research and theory in workplace writing from 1980s to the present. Writing as used in accomplishing work and how novices in professional sites learn to write effectively.

LALS 5606 [0.5 credit]

Adult Literacy Practices and Learning

Studies of adult literacy practices within social organization and action, and examination of literacy learning through engagement in social action.

LALS 5607 [0.5 credit]

Research and Theory in Academic Writing

Cognitive, social, and cultural approaches to research and theory in academic writing from 1970s to present. Nature and functions of academic writing, and implications for writing pedagogy.

Precludes additional credit for LALS 5605 if taken prior to 2007-08.

LALS 5702 [0.5 credit]

Qualitative Research Methodologies in Writing Studies

Various qualitative methodologies employed for studying writing in school, workplace, and community. Examples may include case-study research, ethnography, discourse analysis, participatory action research, narrative analysis, mixed methods. Assumptions and principles underlying different methodologies.

LALS 5703 [0.5 credit]

Rhetorical Genre Studies

Overview of recent reconceptualizations of genre as social action; genre-based research into the nature of school and professional discourse; issues relating to genre acquisition and pedagogy.

LALS 5705 [0.5 credit]

Second Language Writing: Research and Theory

Second language writing: research, theory, and pedagogy.

LALS 5706 [0.5 credit]

Social Theories of Learning for Writing Studies

Recent social theories of learning and practice; application of these theories to writing research; pedagogical implications for writing in school and workplace settings.

Precludes additional credit for LALS 5702 (taken prior to 1997-98).

LALS 5802 [0.5 credit]

Learning Across the Disciplines: A Research Practicum

For teachers or graduate student teachers, or tutors. Theories about and research into the role of language in learning and pedagogic situations which optimize that relationship. Also offered at the undergraduate level, with different requirements, as LALS 4402, for which additional credit is precluded.

Precludes additional credit for LALS 5402 if taken prior to 2007-08.

LALS 5806 [0.5 credit]

Practicum in Teaching English as a Second Language: Experience in an ESL Teaching Situation

Integrates the academic dimension of the program with practical work. Observation in ESL classes and possible assistance with teaching materials or classes. Must be taken concurrently with LALS 5205.

Precludes additional credit for LALS 5206 if taken prior to 2007-08.

LALS 5902 [0.5 credit]

Tutorial in Applied Language Studies

A one-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

LALS 5903 [0.5 credit]
Special Topics in the Teaching and Acquisition of Additional Languages
Exploration of topics from current research into the teaching and acquisition of additional languages. Topic to be announced.

LALS 5904 [0.5 credit]
Special Topics in Written Discourse/Literacies
Exploration of topics from current research into the nature, acquisition and teaching of written discourse/literacies. Topic to be announced.

LALS 5905 [0.5 credit]
Special Topics in Applied Language Studies
Exploration of a topic from current research in applied language studies. Topic to be announced.

LALS 5907 [1.0 credit]
Tutorial in Applied Language Studies
A two-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

LALS 5908 [1.0 credit]
Research Essay

LALS 5909 [2.0 credits]
M.A. Thesis

Mass Communication

St. Patrick's Building 344A
Telephone: 613-520-7408
Fax: 613-520-6690
carleton.ca/sjc

The Program

Director of the School: Karim H. Karim
Supervisor of Graduate Studies: André Turcotte

The Mass Communication program of the School of Journalism and Communication offers a program of studies leading to a Master of Arts degree in Communication. Courses covering four areas of concentration are offered:

- the history of communication and media systems
- communication/information technologies and society
- communication and social relations
- communication policy and political economy

Additional information may be obtained by consulting the supervisor of graduate studies.

Qualifying-Year Program

Applicants who lack an Honours degree but who have a 3-year degree with honours standing (a minimum B standing overall) may be considered for admission to a qualifying-year program. Students who complete the qualifying year with high honours standing may be considered for admission to the master's program in the following year. Refer to the General Regulations section of this Calendar for regulations governing the qualifying year.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is a B.A.(Honours) degree or the equivalent, with high honours standing in communication or a related discipline. Related disciplines may include sociology, political science, film studies, and Canadian studies.

Applicants without a background in communication studies may be required to take certain designated courses from the undergraduate mass communication program in addition to their regular program.

Possession of the minimum entrance standing is not in itself, however, assurance of admission into the program.

Program Requirements

Each student, in consultation with the supervisor of graduate studies, will be required to follow a thesis, non-thesis, or a course-only program for a total of 5.0 credits. Two of the four areas of concentration must be chosen.

In selecting their program of studies, all students will be required to take MCOM 5101 and MCOM 5605. Students in the M.A. program are restricted to one directed studies course, MCOM 5808 (0.5 credit). Students may take one optional course (0.5 credit) outside the program, with permission of the supervisor of graduate studies.

All master's students are required to complete:

- MCOM 5101 (1.0 credit)
- MCOM 5605 (0.5 credit)
- a thesis (2.0 credits) and 1.5 credits from the list of optional courses below, or a research essay (1.0 credit) and 2.5 credits chosen from the list of optional courses, or 3.5 credits chosen from the list of optional courses

Optional Courses

- MCOM 5200
- MCOM 5202
- MCOM 5203
- MCOM 5204
- MCOM 5206
- MCOM 5208
- MCOM 5210
- MCOM 5212
- MCOM 5214
- MCOM 5216
- MCOM 5218
- MCOM 5509
- MCOM 5808

Note: students may take up to 0.5 credit outside the program with permission of the supervisor of graduate studies.

Academic Standing

A standing of B- or better must be obtained in each credit counted towards the master's degree.

Doctor of Philosophy

The School of Journalism and Communication offers a program of studies leading to the Doctor of Philosophy degree in Communication. The program focuses on three fields of concentration:

- The history of communication
- The political economy of communication
- The socio-cultural analysis of communication

Admission Requirements

The normal requirement for admission into the doctoral program is a master's degree (or the equivalent) in communication or a cognate field such as journalism studies, with an overall average of B+ or better.

Applicants who have deficiencies in certain areas may be admitted to the Ph.D. Program, but will normally be required to complete additional course work.

Program Requirements

Doctoral candidates must successfully complete the equivalent of 10.0 credits. The specific requirements are as follows:

- MCOM 6000 (1.0 credit)
- 2.0 additional credits from the list of optional courses below; up to 0.5 credit may be taken in a relevant discipline outside of the School; students in the Ph.D. program are restricted to one (0.5 credit) directed studies course (MCOM 6010)
- Comprehensive examinations (2.0 credits)
- A thesis (5.0 credits) which must be defended at an oral examination
- A language requirement as stated below

Optional Courses

All doctoral candidates must complete 2.0 additional credits from the list of optional courses below; 0.5 credit may be taken in a relevant discipline outside of the School, particularly those that address central theoretical and/or methodological issues within the student's chosen field of concentration. Students in the Ph.D. program are restricted to one (0.5 credit) directed studies course (MCOM 6010)

- MCOM 5200
- MCOM 5202
- MCOM 5203
- MCOM 5204
- MCOM 5206
- MCOM 5208
- MCOM 5210
- MCOM 5212
- MCOM 5214
- MCOM 5216
- MCOM 5218
- MCOM 5509
- MCOM 5605
- MCOM 6001
- MCOM 6005
- MCOM 6006
- MCOM 6007
- MCOM 6010
- JOUR 5401
- JOUR 5500

Comprehensive Examinations

In addition to their course requirements, doctoral candidates are required to write two comprehensive examinations each worth 1.0 credit. The first comprehensive examination (MCOM 6900) is closely related to the course materials in the doctoral seminar (MCOM 6000) and is conducted by the instructors of MCOM 6000 in May following completion of the seminar. To be eligible for the first comprehensive, candidates must have a GPA of 9.0 or higher on their previous course work, including MCOM 6000. Students who fail the first comprehensive may be asked to withdraw from the program.

The second comprehensive examination (MCOM 6901) is normally completed during the second year of the program and tests the student's in-depth knowledge of one field of study. It is conducted by the student's supervisor and advisory committee and involves examination of an approved project related to the chosen field. Before taking the second comprehensive examination, students must have completed all of their course work with a GPA of 9.0 or higher and have satisfactorily completed MCOM 6900. The second comprehensive is expected to be completed no later than two years or six terms after initial full-time registration, or four years or 12 terms after initial part-time registration. Students who do not fulfil this requirement within the prescribed time period may be asked to withdraw from the program.

Language Requirement

Students are required to demonstrate an understanding of a language other than English, preferably French. Language testing will be administered by the School and will normally include a demonstration of reasonable understanding, on sight, of material contained in selected samples of scholarly literature in a foreign language and in the field of communication.

Thesis Requirement

A thesis proposal is presented after the comprehensive requirement has been satisfied, and defended at an oral presentation. The thesis, normally equivalent to 5.0 credits, must be successfully defended at an oral examination.

Academic Standing

A standing of B- or better must be obtained in each course counted towards the Ph.D. degree. Students are advised to consult the General Regulations section of the **Graduate Calendar for details of regulations governing graduate programs.**

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

MCOM 5101 [1.0 credit]
Foundations of Communication Studies
Examines the origins and traditions of modern communication studies with attention to theoretical and methodological aspects of developments and debates shaping current communication research.

MCOM 5200 [0.5 credit]
Communication and Citizenship
Examines the role of communication in relation to the emergence, development, and problematization of citizenship within civil society and the public sphere.

MCOM 5202 [0.5 credit]
History and Theory of Persuasion
Examines various efforts to discover and apply techniques of successful persuasion from classical rhetoric to scientific public opinion research with attention to contemporary political, public information, and corporate campaigns.

MCOM 5203 [0.5 credit]
Communication, Technology, and Society
Examines the technological context of social communication in terms of human agency, medium theory, and the idea of progress.

MCOM 5204 [0.5 credit]
Media, Culture, and Policy
Examines policy-making as a form of communication from a variety of perspectives, with a focus on the strategies and negotiations that precede policy representation.

MCOM 5206 [0.5 credit]
Communication, Culture, and Regulation
Examines the role of law, moral regulation, and other social means of control in media and cultural practices in areas such as intellectual property, consumerism, and public health.

MCOM 5208 [0.5 credit]
Entertainment Studies
Examines the ways in which entertainment media, audiences, and popular culture shape and reflect social relations in contexts such as movie theatres, tabloids, fanzines, and fashion.

MCOM 5210 [0.5 credit]
Communication and Taste
Examines classical and contemporary theories of taste and their implications for communication. Attention is paid to the role of communication in shaping taste and its classificatory schemata.

MCOM 5212 [0.5 credit]
Communication and Everyday Life
Examines the role of communication within everyday environments ranging from the psychical domain of the self to the worlds of architecture, sound, and etiquette.

MCOM 5214 [0.5 credit]
Communication and Globalization
Examines globalization and communication in the context of international communication history, cultural imperialism, transnational regulation, media integration, and diasporic networks.

MCOM 5216 [0.5 credit]
Communication and Empire
Examines various interpretations of the role of communication in the development of empires and the modern world order.

MCOM 5218 [0.5 credit]
Special Studies of Media
Examines a particular traditional or non-traditional medium of communication. Topic will vary from year to year.

MCOM 5509 [0.5 credit]
Media, Culture, and Gender
Examines various theoretical debates on the production and reproduction of gender relations through communication processes and institutions, and addresses current research issues in feminist and other gender-based approaches to culture and communication.

MCOM 5605 [0.5 credit]
Approaches to Communication Research
Examines the processes of conducting communication research in the context of writing a thesis or research essay. Considers topic selection, question framing, research design, the use of theory, and specific methodologies such as content analysis, discourse analysis, survey research, ethnography, semiotics, and historical analysis.

MCOM 5808 [0.5 credit]
Directed Studies
Directed research or readings on a topic area not covered in that year's course offerings.

MCOM 5908 [1.0 credit]
Research Essay

MCOM 5909 [2.0 credits]
M.A. Thesis

MCOM 6000 [1.0 credit]
Doctoral Seminar in Communication Studies
A seminar leading to the first comprehensive encompassing the program's three fields of concentration: the history of communication as object and field of study, the political economy of communication, and socio-cultural analysis of communication.

MCOM 6001 [0.5 credit]
Selected Topics in Communication
Examines a newly emerging issue, research method, or theory related to communication. Topic will vary from year to year.

MCOM 6005 [0.5 credit]
Communication and History
Examines the history of communication and its conceptualization from various perspectives as well as the way in which historical events arise through communication.

MCOM 6006 [0.5 credit]
Political Economy of Communication
Examines the history of political economy with particular attention to applications in the field of communication.

MCOM 6007 [0.5 credit]
Communication, Discourse, and Representation
Examines the processes and practices of representation through which meanings arise.

MCOM 6010 [0.5 credit]
Directed Studies
Directed research or readings on a topic area not covered in that year's course offerings.

MCOM 6900 [1.0 credit]
Comprehensive Examination I
Examination normally conducted in May of each year in connection with MCOM6000 and covering the program's three fields of concentration: the history of communication as object and field of study; the political economy of communication; and the socio-cultural analysis of communication. Graded as Satisfactory or Unsatisfactory.

MCOM 6901 [1.0 credit]
Comprehensive Examination II
Examination by the student's thesis supervisor and committee of an approved project related to a particular field of communication research; the field may or may not be related to the student's thesis. Graded as Satisfactory or Unsatisfactory.

MCOM 6909 [5.0 credits]
Ph.D. Thesis

Selection of Courses in Related Disciplines

In addition to courses offered by the Mass Communication program, the following courses may, with the prior approval of the supervisor of graduate studies, be used to complete program requirements. This list is not exclusive and is subject to change. Students should be aware that enrolment in these courses may be limited and that registration may be conditional upon obtaining prior approval of the department concerned.

Note: It is the responsibility of the student to ensure that permission is obtained from the appropriate department prior to registering in any of the department's courses.

Canadian Studies
CDNS 5101, CDNS 5102, CDNS 5201 CDNS 5202, CDNS 5301, CDNS 5302

Economics
ECON 5303

Journalism and Communication
JOUR 5000, JOUR 5500

Political Economy
PECO 5000, PECO 5001

Political Science
PSCI 4003, PSCI 5401

Sociology
SOCI 5205, SOCI 5306, SOCI 5308 SOCI 5309, SOCI 5504, SOCI 5505

Mathematics and Statistics

4314 Herzberg Building
Telephone: 613-520-2152
Fax: 613-520-3536
mathstat.carleton.ca

The School

Students pursuing studies in pure mathematics, applied mathematics, probability and statistics at the graduate level leading to an M.Sc. or a Ph.D. do so in a joint program offered by the School of Mathematics and Statistics at Carleton University and the Department of Mathematics and Statistics at the University of Ottawa under the auspices of the Ottawa-Carleton Institute of Mathematics and Statistics. The Institute is responsible for supervising the programs, regulations, and student admissions, and for providing a framework for interaction between the two departments at the research level.

In addition to the programs administered by the Institute, the School of Mathematics and Statistics at Carleton University offers several other programs.

In cooperation with the Department of Epidemiology and Community Medicine at the University of Ottawa, students may pursue a program leading to an M.Sc. with a Specialization in Biostatistics. For information, see the Ottawa-Carleton Collaborative Program in Biostatistic's section in this Calendar.

In cooperation with the Department of Systems and Computer Engineering and the School of Computer Science at Carleton University, students may pursue a program leading to an M.Sc. in Information and Systems Science. For information see the Information and Systems Science section of this Calendar.

Master of Science

Admission Requirements

The normal requirement for admission to the master's program is an Honours bachelor's degree in mathematics, or the equivalent, with at least high honours standing. Applicants holding a general (three-year) degree with at least high honours standing may be admitted to a qualifying-year program.

Subsequent admission to the regular master's program depends on performance during the qualifying-year program and will be decided no later than one year after admission to the qualifying-year program. Details are outlined in the General Regulations section of this Calendar. Students with outstanding academic performance and research promise while in the M.Sc. program may be permitted to transfer to the Ph.D. program without completing the M.Sc. program.

Program Requirements

The two options for the M.Sc. program are:

- 2.5 credits and a thesis
- 4.0 credits

The courses must be chosen from those at the graduate level except that a student may take up to 1.0 credit of undergraduate courses at the 4000-level to satisfy these requirements. Not all these courses

may be taken in the same field of mathematics; at least 1.0 credit must be in another field. All master's students are required to participate actively in a seminar or project under the guidance of their advisor. A maximum of 1.0 credit taken outside of the School of Mathematics and Statistics at Carleton University or the Department of Mathematics and Statistics at the University of Ottawa may be allowed for credit.

Students who plan to specialize in probability or statistics are strongly advised that during their master's program they include, where possible, the courses STAT 5600, STAT 5501 in mathematical statistics, STAT 4502, STAT 5505 in applied statistics, and STAT 4501, STAT 5701 in probability, together with 1.0 credit further in the School of Mathematics and Statistics. In addition, a graduate course in another field, such as biology, biostatistics, economics, computer science, systems analysis, and stochastic modeling, is highly recommended.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mathematics, or the equivalent, with at least high honours standing. Details are outlined in the General Regulations section of this Calendar.

Program Requirements

Course requirements, which are determined at the time of admission, include a minimum of 3.0 credits and a suitable thesis. Not all of these courses may be taken in the same field of mathematics; at least 1.0 credit must be in another field.

All candidates must take comprehensive examinations, and must satisfy a language requirement. The language requirement is determined by the candidate's advisory committee and normally requires the ability to read mathematical literature in a language considered useful for his/her research or career, and other than the candidate's principal language of study.

Students specializing in mathematics or probability undertake a comprehensive examination in the following areas:

- The candidate's general area of specialization at the Ph.D. level
- Examinations on two topics chosen from applied analysis, discrete applied mathematics, algebra, analysis, probability, topology, and statistics.

Students specializing in statistics must write an examination in the following areas:

- Mathematical statistics which includes multivariate analysis
- An examination in probability, and
- An examination in either (i) applied statistics, or (ii) analysis

In all cases, the examination must be completed successfully within twenty months of initial registration in the Ph.D. program in the case of full-time students, and within thirty-eight months of initial registration in the case of part-time students.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

Selection of Courses

The following undergraduate courses may, with the approval of the School of Mathematics and Statistics, be selected by master's candidates in partial fulfillment of their degree requirements:

Mathematics and Statistics
MATH 4001 Vector Calculus
MATH 4105 Rings and Modules
MATH 4107 Commutative Algebra
MATH 4207 Foundations of Geometry
MATH 4208 Introduction to Differentiable Manifolds
MATH 4405 Analytical Dynamics
MATH 4406 Hydrodynamics and Elasticity
MATH 4407 Tensor Analysis and Relativity Theory
STAT 4501 Probability Theory
STAT 4502 Sampling: Theory and Methods
STAT 4503 Applied Multivariate Analysis
STAT 4506 Non-Parametric Methods
STAT 4508 Stochastic Models
STAT 4509 Stochastic Optimization
MATH 4703 Qualitative Theory of Ordinary Differential Equations
MATH 4802 Introduction to Mathematical Logic
MATH 4803 Topics in Applied Logic
MATH 4804 Design and Analysis of Algorithms
MATH 4806 Numerical Analysis
MATH 4808 Graph Theory and Algorithms

Ottawa-Carleton Institute of Mathematics and Statistics

Director of the Institute: K. Cheung
Associate Director: R. Blute
The School is a member of the Ottawa-Carleton Institute of Mathematics and Statistics (OCIMS) which offers one of the largest graduate programs in mathematics and statistics in Canada. Students have the unique opportunity to take courses at both Carleton University and the University of Ottawa while benefiting from the expertise of a larger pool of professors.

Members of the Institute

The list below of all members of the Institute along with their research interests can be used as a guide to possible supervisors.

The home department of each member of the Institute is indicated by (C) for the School of Mathematics and Statistics, Carleton University and (O) for the Department of Mathematics and Statistics, University of Ottawa.

- Saban Alaca, Number theory (C)
- Mayer Alvo, Nonparametric statistics, sequential analysis (O)
- David Amundsen, Nonlinear wave equations, numerical analysis (C)
- Stephen Astels, Number theory (C)
- Yves Atchadé, Statistics (O)

- Raluca Balan, Stochastic processes, probability theory, mathematical statistics (O)
- Y. Billig, Algebra (C)
- R. Blute, Logic, Category theory (O)
- Y. Bourgault, Numerical methods, mathematical modeling (O)
- S. Boyd, Combinatorial optimization (O)
- Inna Bumagin, Algebra (C)
- W.D. Burgess, Algebra, non-commutative rings (O)
- Lucy Campbell, Geophysical fluid dynamics, partial differential equations (C)
- Charles Castonguay, Demography (O)
- Kevin Cheung, Combinatorial optimization (C)
- Benoit Collins, Random matrices, free probability (O)
- Miklós Csörgó, Probability and statistics (C)
- Daniel Daigle, Algebraic geometry, commutative algebra (O)
- D.A. Dawson, Stochastic processes and probability theory (C)
- Isabelle Déchène, Number theory, cryptography (O)
- Benoit Dionne, Similarity and groups in bifurcation theory (O)
- J.D. Dixon, Group theory, algebra computation (C)
- Vlastimil Dlab, Finite dimensional algebras, representation theory (C)
- P. Farrell, Sampling, discrete data, applied statistics (C)
- Amy Felty, Logics and logical foundations of computing (O)
- Che-Kao Fong, Operator theory (C)
- Zhicheng Gao, Graph theory (C)
- Thierry Giordano, Operator algebras, ergodic theory (O)
- Root Gorelick, Mathematical biology, information technology (C)
- D.E. Handelman, K-theory, operator algebras, ring theory (O)
- Pieter Hofstra, Categorical Logic (O)
- Minyi Huang, Applied probability (C)
- B.G. Ivanoff, Probability, point processes, martingales (O)
- W. Jaworski, Analysis, probability (C)
- Barry Jessup, Rational homotopy, lie algebra cohomology (O)
- Alexander Kitaev, Isomonodromy deformations, Painleve equations (C)
- Daniel Krewski, Applied statistics in medicine (C)
- V. LeBlanc, Differential equations, bifurcation theory, dynamical systems (O)
- J. Levy, Group representations (O)
- Vaclav Linek, Discrete math (C)
- Frithjof Lutscher, Differential equations, dynamical systems (O)
- D.R. McDonald, Applied probability (O)
- Y. McNab, Statistics (C)
- Sam Melkonian, Non-linear differential equations (C)
- Paul Mezo, Algebra and number theory (C)
- S.E. Mills, Applied statistics, statistical methods, inference, data mining (C)
- A.B. Mingarelli, Ordinary differential equations, difference equations (C)
- M. Mojirsheibani, Resampling, classification and pattern recognition (C)
- D.Y. Montuno, Applied probability (C)
- B.C. Mortimer, Group theory, coding theory (C)
- Lucia Moura, Combinatorial algorithms and optimization, combinatorics, (O)
- Jason Nielsen, Statistics (C)
- Erhard Neher, Jordan algebras and groups, lie algebras (O)
- Matthias Neufang, Analysis (C)
- Monica Nevens, Representation theory of padic Lie groups (O)
- Nathan Ng, Analytic number theory (O)
- Arian Novruzi, Partial differential equations, shape optimization, numerical analysis (O)
- Mohamedou Ould Haye, Statistics (C)
- D. Panario, Finite fields, combinatorics, analysis of algorithms (C)
- J.N. Pandey, Generalized functions, partial differential equations (C)
- Paul-Eugène Parent, Algebraic topology, homotopy theory (O)

• Chul Gyu Park, Statistics (C)
• Vladimir Pestov, Topological transformation groups, geometry of large dimensions (O)
• John Poland, Group theory (C)
• Michel Racine, Jordan algebras, algebra, polynomial identities (O)
• Mizanur Rahman, Special functions (C)
• J.N.K. Rao, Sample surveys theory and methods (C)
• Luis Ribes, Group theory (C)
• Wulf Rossmann, Representations of semisimple lie groups (O)
• Damien Roy, Transcendental number theory (O)
• A.K. Md. E. Saleh, Order statistics, mathematical statistics (C)
• Mateja Sajna, Graph theory (O)
• David Sankoff, Mathematical genomics, (O)
• Alistair Savage, Geometric representation theory, lie algebras (O)
• Patrice Sawyer, Spherical functions (O)
• Ioana Schiopu-Kratina, Mathematical statistics (O)
• P.J. Scott, Logic, Category theory (O)
• A. Sebbar, Number theory, quantum groups (O)
• Robert Smith, Mathematical modeling of infectious diseases (O)
• A. Singh, Statistics (C)
• Sanjoy Sinha, Biostatistics, longitudinal data analysis, robust inference, time series analysis (C)
• Benjamin Steinberg, Algebra (C)
• Natalia Stepanova, Statistics (C)
• Brett Stevens, Combinatorics (C)
• I. Stojmenovic, Discrete mathematics, combinatorial algorithms, multiple-value logic, theoretical computer science (O)
• Barbara Szyszkowicz, Probability (C)
• François Theberge, Applied probability (O)
• Remì Vaillancourt, Scientific computation (O)
• G. Walsh, Number theory, diophantine equations (O)
• Qiang (Steven) Wang, Discrete mathematics and algebra (C)
• K. S. Williams, Number theory (C)
• M. Zarepour, Resampling and nonparametric Bayesian inference, time series analysis (O)
• Y. Zhao, Applied probability (C)

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

University of Ottawa course numbers (in parentheses) follow the Carleton course number and credit information.

MATH 5003 [0.5 credit] (MAT 5122)

Banach Algebras

Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element. Special types of Banach algebras: for example, regular algebras with involution, applications.

MATH 5005 [0.5 credit] (MAT 5127)

Complex Analysis

Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.

MATH 5007 [0.5 credit] (MAT 5125)

Real Analysis I (Measure Theory and Integration)
General measure and integral, Lebesgue measure and integration on R, Fubini's theorem, Lebesgue-Radon-Nikodym theorem, absolute continuity and differentiation, LP-spaces. Selected topics such as Daniell-Stone theory. Also offered, with different requirements, as MATH 4007 for which additional credit is precluded.
Prerequisites: MATH 3001 or permission of the School.

MATH 5008 [0.5 credit] (MAT 5126)

Real Analysis II (Functional Analysis)
Banach and Hilbert spaces, bounded linear operators, dual spaces. Topics selected from: weak-topologies, Alaoglu's theorem, compact operators, differential calculus in Banach spaces, Riesz representation theorems. Also offered, with different requirements, as MATH 4003 for which additional credit is precluded.
Prerequisite: MATH 4007 or MATH 5007 (MAT 5125) or permission of the School.

MATH 5009 [0.5 credit] (MAT 5121)

Introduction to Hilbert Space
Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.
Prerequisites: MATH 3001 and MATH 4003.

MATH 5102 [0.5 credit] (MAT 5148)

Group Representations and Applications
An introduction to group representations and character theory, with selected applications.

MATH 5103 [0.5 credit] (MAT 5146)

Rings and Modules
Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.

MATH 5104 [0.5 credit] (MAT 5143)

Lie Algebras
Basic concepts: ideals, homomorphisms, nilpotent, solvable, semi-simple. Representations, universal enveloping algebra. Semi-simple Lie algebras: structure theory, classification, and representation theory.
Prerequisites: MATH 5107 (MAT 5141) and MATH 5109 (MAT 5142) or permission of the School.

MATH 5106 [0.5 credit] (MAT 5145)

Group Theory
Fundamental principles as applied to abelian, nilpotent, solvable, free, and finite groups; representations. Also offered, with different requirements, as MATH 4106, for which additional credit is precluded.
Prerequisite: MATH 3106 or permission of the School.

MATH 5107 [0.5 credit] (MAT 5141)

Algebra I
Groups, Sylow subgroups, finitely generated abelian groups. Rings, field of fractions, principal ideal domains, modules. Polynomial algebra, Euclidean algorithm, unique factorization.
Prerequisite: permission of the School.

MATH 5108 [0.5 credit] (MAT 5147)

Homological Algebra and Category Theory
Axioms of set theory, categories, functors, natural transformations; free, projective, injective and flat modules; tensor products and homology functors, derived functors; dimension theory. Also offered, with different requirements, as MATH 4108 for which additional credit is precluded.
Prerequisite: MATH 3106 and MATH 3158 or permission of the School.

MATH 5109 [0.5 credit] (MAT 5142)

Algebra II

Field theory, algebraic and transcendental extensions, finite fields, Galois groups. Modules over principal ideal domains, decomposition of a linear transformation, Jordan normal form.
Prerequisites: MATH 5107 (MAT 5141) and permission of the School.

MATH 5201 [0.5 credit] (MAT 5150)

Topics in Geometry

Various axiom systems of geometry. Detailed examinations of at least one modern approach to foundations, with emphasis upon the connections with group theory.
Prerequisite: permission of the School.

MATH 5202 [0.5 credit] (MAT 5168)

Homology Theory

The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.
Prerequisite: MATH 4205 or MATH 5205 (MAT 5151).

MATH 5205 [0.5 credit] (MAT 5151)

Topology I

Topological spaces, product and identification topologies, countability and separation axioms, compactness, connectedness, homotopy, fundamental group, net and filter convergence. Also offered, with different requirements, as MATH 4205 for which additional credit is precluded.
Prerequisite: MATH 3001 or permission of the School.

MATH 5206 [0.5 credit] (MAT 5152)

Topology II

Covering spaces, homology via the Eilenberg-Steenrod Axioms, applications, construction of a homology functor. Also offered, with different requirements, as MATH 4206 for which additional credit is precluded.
Prerequisites: MATH 3106, MATH 3158 and MATH 5205 (MAT 5151) or permission of the School.

MATH 5207 [0.5 credit] (MAT 5169)

Foundations of Geometry

A study of at least one modern axiom system of Euclidean and non-Euclidean geometry, embedding of hyperbolic and Euclidean geometries in the projective plane, groups of motions, models of non-Euclidean geometry.
Prerequisite: MATH 3106 (may be taken concurrently) or permission of the School.

MATH 5208 [0.5 credit] (MAT 5155)

Differentiable Manifolds

A study of differentiable manifolds from the point of view of either differential topology or differential geometry. Topics such as smooth mappings, transversality, intersection theory, vector fields on manifolds, Gaussian curvature, Riemannian manifolds, differential forms, tensors, and connections are included.
Prerequisite: MATH 3001 or permission of the School.

MATH 5300 [0.5 credit] (MAT 5160)

Mathematical Cryptography

Analysis of cryptographic methods used in authentication and data protection, with particular attention to the underlying mathematics, e.g. Algebraic Geometry, Number Theory, and Finite Fields. Advanced topics on Public-Key Cryptography: RSA and integer factorization, Diffie-Hellman, discrete logarithms, elliptic curves. Topics in current research.
Prerequisite: undergraduate honours algebra, including group theory and finite fields.

MATH 5301 [0.5 credit] (MAT 5161)

Mathematical Logic

A basic graduate course in mathematical logic. Propositional and predicate logic, proof theory, Gentzen's Cut-Elimination, completeness, compactness, Henkin models, model theory,

arithmetic and undecidability. Special topics (time permitting) depending on interests of instructor and audience.
Prerequisites: Honours undergraduate algebra, analysis and topology or permission of the instructor.

MATH 5305 [0.5 credit] (MAT 5163)
Analytic Number Theory
Dirichlet series, characters, Zeta-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, binary quadratic forms. Also offered at the undergraduate level, with different requirements, as MATH 4305, for which additional credit is precluded.
Prerequisite: MATH 3057 or permission of the School.

MATH 5306 [0.5 credit] (MAT 5164)
Algebraic Number Theory
Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number. Also offered, with different requirements, as MATH 4306 for which additional credit is precluded.
Prerequisite: MATH 3158 or permission of the School.

MATH 5403 (MAT 5187)
Topics in Applied Mathematics

MATH 5405 [0.5 credit] (MAT 5131)
Ordinary Differential Equations
Linear systems, fundamental solution. Nonlinear systems, existence and uniqueness, flow. Equilibria, periodic solutions, stability. Invariant manifolds and hyperbolic theory. One or two specialized topics taken from, but not limited to: perturbation and asymptotic methods, normal forms and bifurcations, global dynamics.
Prerequisite: MATH 3008 or permission of the School.

MATH 5406 [0.5 credit] (MAT 5133)
Partial Differential Equations
First-order equations, characteristics method, classification of second-order equations, separation of variables, Green's functions. Lp and Sobolev spaces, distributions, variational formulation and weak solutions, Lax-Milgram theorem, Galerkin approximation. Parabolic PDEs. Wave equations, hyperbolic systems, nonlinear PDEs, reactiondiffusion equations, infinite-dimensional dynamical systems, regularity.
Prerequisite: MATH 3008 or permission of the School.

MATH 5407 [0.5 credit] (MAT 5134)
Topics in Partial Differential Equations
Theory of distributions, initial-value problems based on two-dimensional wave equations, Laplace transform, Fourier integral transform, diffusion problems, Helmholtz equation with application to boundary and initial-value problems in cylindrical and spherical coordinates. Also offered, with different requirements, as MATH 4701 for which additional credit is precluded.
Prerequisite: MATH 5406 or permission of the School.

MATH 5408 [0.5 credit] (MAT 5185)
Asymptotic Methods of Applied Mathematics
Asymptotic series: properties, matching, application to differential equations. Asymptotic expansion of integrals: elementary methods, methods of Laplace, Stationary Phase and Steepest Descent, Watson's Lemma, Riemann-Lebesgue Lemma. Perturbation methods: regular and singular perturbation for differential equations, multiple scale analysis, boundary layer theory, WKB theory.
Prerequisites: MATH 3057 and at least one of MATH 3008 and MATH 3705, or permission of the School.

STAT 5500 [0.5 credit] (MAT 5177)

Multivariate Normal Theory

Multivariate normal distribution properties, characterization, estimation of means, and covariance matrix. Regression approach to distribution theory of statistics; multivariate tests; correlations; classification of observations; Wilks' criteria.
Prerequisite: STAT 3559.

STAT 5501 [0.5 credit] (MAT 5191)

Mathematical Statistics II

Confidence intervals and pivotals; Bayesian intervals; optimal tests and Neyman-Pearson theory; likelihood ratio and score tests; significance tests; goodness-of-fit-tests; large sample theory and applications to maximum likelihood and robust estimation. Also offered, with different requirements, as STAT 4507 for which additional credit is precluded.
Prerequisite: STAT 4500 or STAT 5600 or permission of the School.

STAT 5502 [0.5 credit] (MAT 5192)

Sampling Theory and Methods

Unequal probability sampling with and without replacement; unified theory for standard errors; prediction approach; ratio and regression estimation; stratification and optimal designs; multistage cluster sampling; double sampling; domains of study; post-stratification; nonresponse; measurement errors; related topics.
Prerequisite: STAT 4502 or permission of the School.

STAT 5503 [0.5 credit] (MAT 5193)

Linear Models

Theory of non full rank linear models; estimable functions, best linear unbiased estimators, hypotheses testing, confidence regions; multi-way classifications; analysis of covariance; variance component models; maximum likelihood estimation, Minque, Anova methods; miscellaneous topics.
Prerequisite: STAT 4500 or STAT 5600 or permission of the School.

STAT 5504 [0.5 credit] (MAT 5194)

Stochastic Processes and Time Series Analysis

Stationary stochastic processes, inference for stochastic processes, applications to time series and spatial series analysis.
Prerequisite: STAT 4501 or permission of the School.

STAT 5505 [0.5 credit] (MAT 5195)

Design of Experiments

Overview of linear model theory; orthogonality; randomized block and split plot designs; latin square designs; randomization theory; incomplete block designs; factorial experiments: confounding and fractional replication; response surface methodology. Miscellaneous topics.
Prerequisite: STAT 3553 and STAT 4504 or STAT 4500 or STAT 5600 or permission of the School.

STAT 5506 [0.5 credit] (MAT 5175)

Robust Statistical Inference

Nonparametric tests for location, scale, and regression parameters; derivation of rank tests; distribution theory of linear rank statistics and their efficiency. Robust estimation of location, scale and regression parameters; Huber's M-estimators, Rank-methods, L-estimators. Influence function. Adaptive procedures. Also offered, with different requirements, as STAT 4506 for which additional credit is precluded.
Prerequisite: STAT 4500 or STAT 5600 or permission of the School.

STAT 5507 [0.5 credit] (MAT 5176)

Advanced Statistical Inference

Pure significance test; uniformly most powerful unbiased and invariant tests; asymptotic comparison of tests; confidence intervals; large-sample theory of likelihood ratio and chi-

square tests; likelihood inference; Bayesian inference; fiducial and structural methods; resampling methods.
Prerequisite: STAT 4507 or STAT 5501 or permission of the School.

STAT 5508 [0.5 credit] (MAT 5172)
Topics in Stochastic Processes
Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures, and infinite particle systems, advanced topics in modeling, population models, etc.
Prerequisites: STAT 3506 or STAT 4501, or permission of the School.

STAT 5509 [0.5 credit] (MAT 5196)
Multivariate Analysis
Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis. Also offered at the undergraduate level, with different requirements, as MATH 4503, for which additional credit is precluded.
Prerequisite: STAT 4500 or STAT 5600 or permission of the School.

STAT 5600 [0.5 credit] (MAT 5190)
Mathematical Statistics I
Statistical decision theory; likelihood functions; sufficiency; factorization theorem; exponential families; UMVU estimators; Fisher's information; Cramer-Rao lower bound; maximum likelihood, moment estimation; invariant and robust point estimation; asymptotic properties; Bayesian point estimation. Also offered, with different requirements, as MATH 4500 for which additional credit is precluded.
Prerequisite: STAT 3559 or permission of the School.

STAT 5601 [0.5 credit] (MAT 5197)
Stochastic Optimization
Topics chosen from stochastic dynamic programming, Markov decision processes, search theory, optimal stopping. Also offered at the undergraduate level, with different requirements, as STAT 4509, for which additional credit is precluded.
Prerequisite: STAT 3506 or permission of the School.

STAT 5602 [0.5 credit] (MAT 5317)
Analysis of Categorical Data
Analysis of one-way and two-way tables of nominal data; multi-dimensional contingency tables, log-linear models; tests of symmetry, marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins, logistic models with binary response; measures of association and agreement.
Prerequisites: STAT 4500 or STAT 5600, STAT 4507 or STAT 5501, or permission of the School.

STAT 5603 [0.5 credit] (MAT 5318)
Reliability and Survival Analysis
Types of censored data; nonparametric estimation of survival function; graphical procedures for model identification; parametric models and maximum likelihood estimation; exponential and Weibull regression models; nonparametric hazard function models and associate statistical inference; rank tests with censored data applications.
Prerequisites: STAT 4500 or STAT 5600, STAT 4507 or STAT 5501 or permission of the School.

STAT 5604 [0.5 credit] (MAT 5173)
Stochastic Analysis
Brownian motion, continuous martingales, and stochastic integration.
Prerequisites: STAT 4501 or STAT 5708 or permission of the School.

MATH 5605 [0.5 credit] (MAT 5165)

Theory of Automata

Algebraic structure of sequential machines, de-composition of machines; finite automata, formal languages; complexity. Also offered, with different requirements, as MATH 4805/COMP 4805 for which additional credit is precluded.

Prerequisite: MATH 2100 or permission of the School.

MATH 5607 [0.5 credit] (MAT 5324)

Game Theory

Two-person zero-sum games; infinite games; multi-stage games; differential games; utility theory; two-person general-sum games; bargaining problem; n-person games; games with a continuum of players. Also offered, with different requirements, as MATH 4807 for which additional credit is precluded.

Prerequisite: MATH 3001 or permission of the School.

MATH 5609 [0.5 credit] (MAT 5301)

Topics in Combinatorial Mathematics

Prerequisite: permission of the School.

STAT 5701 [0.5 credit] (MAT 5198)

Stochastic Models

Markov systems, stochastic networks, queuing networks, spatial processes, approximation methods in stochastic processes and queuing theory. Applications to the modeling and analysis of computer-communications systems and other distributed networks. Also offered, with different requirements, as STAT 4508 for which additional credit is precluded.

Prerequisite: STAT 3506 or permission of the School.

STAT 5702 [0.5 credit] (MAT 5182)

Modern Applied and Computational Statistics

Resampling and computer intensive methods: bootstrap, jackknife with applications to bias estimation, variance estimation, confidence intervals, and regression analysis. Smoothing methods in curve estimation; statistical classification and pattern recognition: error counting methods, optimal classifiers, bootstrap estimates of the bias of the misclassification error.

Prerequisite: permission of the instructor.

STAT 5703 [0.5 credit] (MAT 5181)

Data Mining

Visualization and knowledge discovery in massive datasets; unsupervised learning: clustering algorithms; dimension reduction; supervised learning: pattern recognition, smoothing techniques, classification. Computer software will be used.

Prerequisite: permission of the instructor.

STAT 5704 [0.5 credit] (MAT 5174)

Network Performance

Advanced techniques in performance evaluation of large complex networks. Topics may include classical queueing theory and simulation analysis; models of packet networks; loss and delay systems; blocking probabilities.

Prerequisite: some familiarity with probability and stochastic processes and queueing, or permission of the instructor.

STAT 5708 [0.5 credit] (MAT 5170)

Probability Theory I

Probability spaces, random variables, expected values as integrals, joint distributions, independence and product measures, cumulative distribution functions and extensions of probability measures, Borel-Cantelli lemmas, convergence concepts, independent identically distributed sequences of random variables.

Prerequisites: MATH 3001, and STAT 3558 is strongly recommended, or permission of the School.

STAT 5709 [0.5 credit] (MAT 5171)

Probability Theory II

Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectations, basic properties and convergence theorems for martingales, introduction to Brownian motion.

Prerequisite: STAT 5708 (MAT 5170) or permission of the School.

MATH 5801 [0.5 credit] (MAT 5303)

Linear Optimization

Linear programming problems; simplex method, upper bounded variables, free variables; duality; postoptimality analysis; linear programs having special structures; integer programming problems; unimodularity; knapsack problem.

Prerequisite: course in linear algebra and permission of the School.

MATH 5802 [0.5 credit] (MAT 5325)

Introduction to Information and Systems Science

Introduction to the process of applying computers in problem solving. Emphasis on the design and analysis of efficient computer algorithms for large, complex problems. Applications: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as SYSC 5802, COMP 5802 and ISYS 5802.)

MATH 5803 [0.5 credit] (MAT 5304)

Nonlinear Optimization

Methods for unconstrained and constrained optimization problems; Kuhn-Tucker conditions; penalty functions; duality; quadratic programming; geometric programming; separable programming; integer nonlinear programming; pseudo-Boolean programming; dynamic programming.

Prerequisite: permission of the School.

MATH 5804 [0.5 credit] (MAT 5307)

Topics in Operations Research

MATH 5805 [0.5 credit] (MAT 5308)

Topics in Algorithm Design

MATH 5806 [0.5 credit] (MAT 5180)

Numerical Analysis

Error analysis for fixed and floating point arithmetic; systems of linear equations; eigen-value problems; sparse matrices; interpolation and approximation, including Fourier approximation; numerical solution of ordinary and partial differential equations.

Prerequisite: permission of the School.

MATH/COMP 5807 [0.5 credit] (MAT 5167)

Formal Language and Syntax Analysis

Computability, unsolvable and NP-hard problems. Formal languages, classes of language automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k). Syntax directed translation.

Prerequisites: MATH 5605 or MATH 4805 or COMP 3002, or permission of the School.

MATH 5808 [0.5 credit] (MAT 5305)

Combinatorial Optimization I

Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optimal matching in bipartite graphs.

Prerequisite: permission of the School.

MATH 5809 [0.5 credit] (MAT 5306)

Combinatorial Optimization II

Topics include optimal matching in non-bipartite graphs, Euler tours and the Chinese Postman problem. Other extensions of network flows: dynamic flows, multicommodity flows, and flows

with gains, bottleneck problems. Matroid optimization. Enumerative and heuristic algorithms for the Traveling Salesman and other "hard" problems.
Prerequisite: MATH 5808.

MATH 5818 [0.5 credit] (MAT 5166)
Graph Theory
Paths and cycles, trees, connectivity, Euler tours and Hamilton cycles, edge colouring, independent sets and cliques, vertex colouring, planar graphs, directed graphs. Selected topics from one or more of the following areas: algebraic graph theory, topological graph theory, random graphs.
Prerequisite: MATH 3855 or permission of the School.

MATH 5819 [0.5 credit] (MAT 5107)
Combinatorial Enumeration
Ordinary and exponential generating functions, product formulas, permutations, rooted trees, cycle index, WZ method. Lagrange inversions, singularity analysis of generating functions and asymptotics. Selected topics from one or more of the following areas: random graphs, random combinatorial structures, hypergeometric functions.
Prerequisite: MATH 3855 or permission of the School.

MATH 5821[0.5 credit] (MAT 5341)
Quantum Computing
Space of quantum bits; entanglement. Observables in quantum mechanics. Density matrix and Schmidt decomposition. Quantum cryptography. Classical and quantum logic gates. Quantum Fourier transform. Shor's quantum algorithm for factorization of integers. Also offered at the undergraduate level, with different requirements, as MATH 4821, for which additional credit is precluded.
Prerequisite: MATH 1102, or permission of the School.

MATH 5822 [0.5 credit](MAT 5343)
Mathematical Aspects of Wavelets and Digital Signal Processing
Lossless compression methods. Discrete Fourier transform and Fourier-based compression methods. JPEG and MPEG. Wavelet analysis. Digital filters and discrete wavelet transform. Daubechies wavelets. Wavelet compression. Also offered, with different requirements, as MATH 4822, for which additional credit is precluded. Prerequisites: Linear algebra and Fourier series, or permission of the School.

MATH 5900 [0.5 credit] (MAT 5990)
Seminar

MATH 5901 [0.5 credit] (MAT 5991)
Directed Studies

STAT 5902 [0.5 credit] (MAT 5992)
Seminar in Biostatistics
Students work in teams on the analysis of experimental data or experimental plans. The participation of experimenters in these teams is encouraged. Student teams present their results in the seminar, and prepare a brief written report on their work.

MATH 5903 [0.5 credit]
Project
Intended for students registered in Information and Systems Science and M.C.S. programs. Students pursuing the non-thesis option will conduct a study, analysis, and/or design project. Results will be given in the form of a typewritten report and oral presentation.

STAT 5904 [0.5 credit]
Statistical Internship
This project-oriented course allows students to undertake statistical research and data analysis projects as a cooperative project with governmental or industrial sponsors. Practical

data analysis and consulting skills will be emphasized. The grade will be based upon oral and written presentation of results.
Prerequisite: permission of the Institute.

MATH 5906 (MAT 5993)
Research Internship
This course affords students the opportunity to undertake research in mathematics as a cooperative project with governmental or industrial sponsors. The grade will be based upon the mathematical content and upon oral and written presentation of results.
Prerequisite: permission of the Institute.

MATH/ISYS/SYSC/COMP 5908 [1.5 credits]
M.Sc. Thesis in Information and Systems Science

MATH 5909 [1.5 credits]
M.Sc. Thesis

MATH 6002 [0.5 credit] (MAT 5309)
Harmonic Analysis on Groups
Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.

MATH 6008 [0.5 credit] (MAT 5326)
Topics in Analysis

MATH 6009 [0.5 credit] (MAT 5329)
Topics in Analysis

MATH 6101 [0.5 credit] (MAT 5327)
Topics in Algebra

MATH 6102 [0.5 credit] (MAT 5330)
Topics in Algebra

MATH 6103 [0.5 credit] (MAT 5331)
Topics in Algebra

MATH 6104 [0.5 credit] (MAT 5158)
Lie Groups
Matrix groups: one-parameter groups, exponential map, Campbell-Hausdorff formula, Lie algebra of a matrix group, integration on matrix groups. Abstract Lie groups.
Prerequisites: MATH 5007 and PADM 5107 or permission of the School.

MATH 6201 [0.5 credit] (MAT 5312)
Topics in Topology

MATH 6507 [0.5 credit] (MAT 5313)
Topics in Probability and Statistics

MATH 6508 [0.5 credit] (MAT 5314)
Topics in Probability and Statistics

MATH 6806 [0.5 credit] (MAT 5361)
Topics in Mathematical Logic

MATH 6807 [0.5 credit] (MAT 5162)
Mathematical Foundations of Computer Science
Foundations of functional languages, lambda calculi (typed, polymorphically typed, untyped), Curry-Howard Isomorphism, proofs-as-programs, normalization and rewriting theory, operational semantics, type assignment, introduction to denotational semantics of programs, fixed-point programming.
Prerequisites: honours undergraduate algebra and either topology or analysis, permission of the instructor or some acquaintance with logic.

MATH 6900 [0.5 credit] (MAT 6990)
Seminar

MATH 6901 [0.5 credit] (MAT 6991)
Directed Studies

MATH 6909
Ph.D. Thesis

Mechanical and Aerospace Engineering

Mackenzie Building 3135
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The Department

Chair of the Department: Jonathan Beddoes
Associate Chair (Graduate Studies): Andrei Artemev

The following graduate degree programs are offered by the Department of Mechanical and Aerospace Engineering:

- Masters of Applied Science Aerospace Engineering
- Masters of Applied Science Biomedical Engineering
- Masters of Applied Science Materials Engineering
- Masters of Applied Science Mechanical Engineering
- Masters of Engineering Aerospace Engineering
- Masters of Engineering Materials Engineering
- Master of Engineering Mechanical Engineering
- Doctor of Philosophy Aerospace Engineering
- Doctor of Philosophy Mechanical Engineering

The requirements for completion of the Aerospace, Materials and Mechanical Engineering degrees are summarized in the Ottawa-Carleton Institute for Mechanical and Aerospace Engineering section of this calendar.

The M.A.Sc. in Biomedical Engineering is offered in cooperation with the Department of Systems and Computer Engineering, the School of Computer Science and the Department of Physics. For further information, see the Ottawa-Carleton Institute for Biomedical Engineering section in this Calendar.

Research in the Department spans the spectrum of mechanical and aerospace engineering, with a focus on:

- applied dynamics
- aerodynamics and fluid mechanics
- aero-structures
- bio-medical engineering
- combustion and heat transfer
- materials and manufacturing processes
- solid and fracture mechanics
- robotics, controls, guidance and navigation
- digital image processing
- space and satellite technologies

Cross-disciplinary research within Mechanical and Aerospace Engineering focuses on specific application issues, research on advancing gas turbine technology being one major and longstanding example. The department's gas turbine technology program originated nearly 40 years ago with some of the department's first faculty members, who had extensive gas turbine industrial experience. This

research effort is arguably one of the largest and most effective university-based gas turbine technology research groups today. This research includes the following core topics:

- internal aerodynamics
- combustion
- system design and performance,
- high temperature materials and coatings technology
- repair and overhaul methods and procedures

This research is supported with collaboration from external research institutions, major Canadian and foreign suppliers, manufacturers, users, and repair and overhaul companies.

Other cross-disciplinary application-specific research areas include:

- unmanned aerial vehicle technology including design, performance, aerodynamics, and navigation and control,
- simulation of vehicle performance,
- vehicle simulation for training, including graphics database management, projection, kinematic and dynamic modeling, washout, and control of motion platforms
- fatigue and fracture mechanics research
- bio-medical engineering and design of medical devices
- two-phase flows in applications ranging from heat pipes to refrigeration cycles
- design and implementation of numerical methods for stress analysis, heat transfer, computational fluid dynamics, materials processing and vehicle simulation
- rotorcraft, structures, dynamics, aerodynamics and aeroelasticity

Extensive activity and expertise in computer-aided analysis supports this research, including computational fluid dynamics and finite and boundary element methods, computer-aided design and computer-integrated manufacturing.

The Department maintains extensive laboratories equipped with a wide range of specialized equipment. Research facilities include several wind tunnels including a transonic blowdown wind tunnel, a Bridgman vacuum furnace, fully operational gas turbine engines, servo-hydraulic materials testing equipment, extensive machine shop capability and an air plasma spray facility. To complement this research equipment, faculty maintain strong collaborative research links with many external government and industrial research centres allowing access to additional specialized equipment and facilities.

Several computer networks support departmental research, with an extensive array of design, analysis and simulation software. Access is also available to the High Performance Computing Virtual Laboratory (HPCVL) jointly operated by Carleton University, The Royal Military College, Queen's University and the University of Ottawa. In 2002, HPCVL was ranked among the fastest 200 computers in the world, and is upgraded on an ongoing basis.

Graduate Courses

Not all of the following courses are offered in a given year. Consult the Ottawa-Carleton Joint Institute for Mechanical and Aerospace Engineering (OCIMAE) website for course offerings: www.ocimae.ca.

University of Ottawa course numbers (in parentheses) follow the Carleton course number and credit information.

MECH 5000 [0.5 credit] (MCG 5300)

Fundamentals of Fluid Dynamics

Differential equations of motion. Viscous and inviscid regions. Potential flow: superposition; thin airfoils; finite wings; compressibility corrections. Viscous flow: thin shear layer approximation; laminar layers; transition; turbulence modeling. Convective heat transfer: free versus forced convection; energy and energy integral equations; turbulent diffusion. Also offered at the undergraduate level, with different requirements, as AERO 4302, for which additional credit is precluded.

MECH 5001 [0.5 credit] (MCG 5301)

Theory of Viscous Flows

Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Compressibility, heat transfer, and three-dimensional effects.

MECH 5003 [0.5 credit] (MCG 5303)

Incompressible Non-Viscous Flow

The fundamental equations and theorems for non-viscous fluid flow; solution of two-dimensional and axisymmetric potential flows; low-speed airfoil and cascade theory; wing lifting-line theory; panel methods.

MECH 5004 [0.5 credit] (MCG 5304)

Compressible Non-Viscous Flow

Steady isentropic, frictional, and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory and unsteady, one-dimensional flow.

MECH 5008 [0.5 credit] (MCG 5308)

Experimental Methods in Fluid Mechanics

Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to aerodynamic testing.

MECH 5009 [0.5 credit] (MCG 5309)

Environmental Fluid Mechanics Relating to Energy Utilization

Characteristics of energy sources and emissions into the environment. The atmosphere; stratification and stability, equations of motion, simple winds, mean flow, turbulence structure and dispersion near the ground. Flow and dispersion in groundwater, rivers, lakes and oceans. Physical and analytical modeling of environmental flows.

MECH 5100 [0.5 credit] (MCG 5310)

Performance and Economics of Aircraft

Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance; high lift schemes; operating economics.

MECH 5101 [0.5 credit] (MCG 5311)

Dynamics and Aerodynamics of Flight

Static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance. Also offered at the undergraduate level, with different requirements, as AERO 4308, for which additional credit is precluded.

MECH 5104 [0.5 credit] (MCG 5314)

Ground Transportation Systems and Vehicles

Performance characteristics, handling and directional stability, ride comfort and safety of various types of ground vehicle systems including road vehicles, terrain-vehicle systems, guided transport systems, and advanced ground transport technology.

MECH 5105 [0.5 credit] (MCG 5315)

Orbital Mechanics and Space Control

Orbital dynamics and perturbations due to the Earth's figure, the sun, and the moon with emphasis on mission planning and analysis. Rigid body dynamics applied to transfer orbit and on-orbit momentum management and control of spacecraft. Effects of flexible structures on a spacecraft control system.

MECH 5106 [0.5 credit] (MCG 5121)

Space Mission Analysis and Design

Review of solar system and space exploration. Space mission design and geometry. Analysis of orbit design, transfers, interplanetary trajectories. Effect of environment on spacecraft design. Space propulsion and launch vehicle design. Launch sequence, windows, cost. Reusable launch systems.
Also offered at the undergraduate level, with different requirements, as AERO 4802.
Precludes additional credit for MAAE 4906 (Section B) if taken between 1994-1995 and 2003-2004 inclusive, MECH 5805 taken between 2002-2003 and 2003-2004 inclusive, MAAE 5700 (Section L) taken between 1994-1995 and 1996-1997 inclusive, and MAAE 5805 taken between 1999-2000 and 2001-2002 inclusive.

MECH 5107 [0.5 credit] (MCG 5317)

Experimental Stress Analysis

Introduction to theory of elasticity. Photo-elasticity: types of polariscopes, two- and three-dimensional stress fields, frozen patterns. Photoelastic coatings. Strain gauges; gauge factors, sensitivity, calibration, and temperature compensation. Moire fringes, brittle lacquers, mechanical strain gauges.

MECH 5201 [0.5 credit] (MCG 5321)

Methods of Energy Conversion

Technical, economic and environmental aspects of present and proposed large-scale systems of energy conversion.

MECH 5202 [0.5 credit] (MCG 5122)

Smart Structures

Structural dynamics principles: modal analysis and wave propagation. Linear time invariant systems: feedback, feedforward, SISO, MIMO, digital and adaptive filters. 'Smart' Structures: multifunctional materials, collocation principles, geometric filtering, and control authority. Applications in aero-acoustics and aeroelasticity.
Precludes additional credit for MECH 5807 (if taken 2001-2002 to 2003-2004).

MECH 5300 [0.5 credit] (MCG 5330)

Engineering Acoustics

Review of acoustic waves in compressible fluids; acoustic pressure, intensity and impedance; physical interpretation and measurement; transmission through media; layers, in-homogeneous media, solids; acoustic systems; rooms, ducts, resonators, mufflers, properties of transducers; microphones, loudspeakers, computational acoustics.

MECH 5301 [0.5 credit] (MCG 5331)

Aeroacoustics

The convected wave equation; theory of subsonic and supersonic jet noise; propeller and helicopter noise; fan and compressor noise; boundary layer noise, interior noise; propagation in the atmosphere; sonic boom; impact on environment.

MECH 5302 [0.5 credit] (MCG 5332)

Instrumentation Techniques

An introduction for the non-specialists to the concepts of digital and analog electronics with emphasis on data acquisition, processing and analysis. Topics covered include operational amplifiers, signal processing, digital logic systems, computer interfacing, noise in electronic systems. Hands-on sessions illustrate theory and practice.

MECH 5304 [0.5 credit] (MCG 5334)

Computational Fluid Dynamics of Compressible Flows

Solution techniques for parabolic, elliptic and hyperbolic equations developed for problems of interest to fluid dynamics with appropriate stability considerations. A staged approach to solution of full Euler and Navier-Stokes equations is used. Grid generation techniques appropriate for compressible flows are introduced.

MECH 5400 [0.5 credit] (MCG 5344)

Gas Turbine Combustion

Combustion fundamentals and gas turbine combustor design. Combustion fundamentals include fuel evaporation, chemistry of combustion, chemical kinetics and emissions formation and introduction to computational combustion modelling. Combustor design addresses the interrelationship between operational requirements and combustion fundamentals. Precludes additional credit for MECH 5800 (MCG 5480) when MECH 5800 was offered with this topic.

MECH 5401 [0.5 credit] (MCG 5341)

Turbomachinery

Types of machines. Similarity: performance parameters; characteristics; cavitation. Velocity triangles. Euler equation: impulse and reaction. Radial pumps and compressors: analysis, design and operation. Axial pumps and compressors: cascade and blade-element methods; staging; off-design performance; stall and surge. Axial turbines. Current design practice. Also offered at the undergraduate level, with different requirements, as MECH 4305, for which additional credit is precluded.

MECH 5402 [0.5 credit] (MCG 5342)

Gas Turbines

Interrelationship among thermodynamic, aerodynamic, and mechanical design. Ideal and real cycle calculations. Cycle optimization; turbo-shaft, turbojet, turbofan. Component performance. Off-design performance; matching of compressor, turbine, nozzle. Twin-spool matching.

MECH 5403 [0.5 credit] (MCG 5343)

Advanced Thermodynamics

The course covers three major topics: review of fundamentals from a consistent viewpoint, properties and equations of state, and applications and special topics. The third topic includes an introduction to statistical thermodynamics.

MECH 5407 [0.5 credit] (MCG 5347)

Conductive and Radiative Heat Transfer

Analytical, numerical and analog solutions to steady-state and transient conduction heat transfer in multi-dimensional systems. Radiative heat exchange between black, grey, non-grey diffusive and specular surfaces, including effects of athermanous media.

MECH 5408 [0.5 credit] (MCG 5348)

Convective Heat and Mass Transfer

Analogies between heat, mass and momentum transfer. Forced and free convection relations for laminar and turbulent flows analytically developed where possible and otherwise deduced from experimental results, for simple shapes and in heat exchangers. Mass transfer theory and applications.

MECH 5500 [0.5 credit] (MCG 5350)

Advanced Vibration Analysis

General theory of continuous and discrete multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems, with selected applications from aerospace, civil, and mechanical engineering.

MECH 5501 [0.5 credit] (MCG 5125)

Advanced Dynamics

Developing and applying the governing equations of motion for discrete and continuous mechanical systems. Includes Newton-Euler and Lagrangian formulations; classical and finite element approaches for continuous systems; and linear stability, frequency response, and propagation solution methods.
Precludes additional credit for MECH 5500 (if taken 2001-2002, 2002-2003).

MECH 5502 [0.5 credit] (MCG 5352)

Optimal Control Systems

Review of transfer function and state-space system descriptions. Elements of the optimal control problem. Variational calculus. Optimal state feedback control. Riccati equations. Optimal observers and Kalman-Bucy Filters. Extension to discrete time systems including an introduction to dynamic programming. Practical applications are emphasized throughout the course.

MECH 5503 [0.5 credit] (MCG 5353)

Robotics

The history of and introduction to robotics methodology. Robots and manipulators; homogeneous transformation, kinematic equations, solving kinematic equations, differential relationships, motion trajectories, dynamics. Control; feedback control, compliance, servomotors, actuators, external and internal sensors, grippers and vision systems. Microprocessors and their application to robot control. Programming.

MECH 5504 [0.5 credit] (MCG 5354)

Guidance, Navigation and Control

Guidance system classification, flight control systems, targeting, target tracking, sensing. Modern multivariable control analysis; design requirements, sensitivity, robustness, perturbations, performance analysis. Modern filtering and estimation techniques. Terrestrial navigation; tactical air navigation (TACAN), star trackers Guidance mission and performance. Aircraft, missile and spacecraft guidance and control.

MECH 5505 [0.5 credit] (MCG 5355)

Stability Theory and Applications

Fundamental concepts and characteristics of modern stability definitions. Sensitivity and variational equations; linear variational equations; phase space analysis; Lyapunov's direct method. Autonomous and nonautonomous systems; stability in first approximation; the effect of force type on stability; frequency method.

MECH 5506 [0.5 credit] (MCG 5356)

Neuro and Fuzzy Control

Knowledge-based controllers. Fuzzy control: mathematics, relations, operations, approximate reasoning. Fuzzy knowledge base control and structure. Fuzzification, inference engine, defuzzification. Nonlinear, adaptive fuzzy control systems. Stability, Neuro-control: processing, learning. Adaptation of artificial neural systems: associative memories, algorithms, applications, and network implementation. Neurofuzzy systems: industrial applications.
Precludes additional credit for EACJ 5709 (ELG 5196).

MECH 5507 [0.5 credit] (MCG 5124)

Advanced Kinematics

Algebraic-geometry applications: kinematic calibration of serial and in-parallel robots; kinematic synthesis of planar, spherical, spatial mechanisms. Various DH-parametrisations, Jacobian formulations. Topics in: projective geometry; Cayley-Klein geometries; Pl<0x00FC>cker line coordinates; Gröbner bases; Grassmannians; kinematic mapping; Burmester theory. Emphasis on practical applications.

MECH 5601 [0.5 credit] (MCG 5361)

Creative Problem Solving and Design

Problem-solving processes and how they can be applied in engineering design. Emphasis on learning methodologies rather than accumulating information. Techniques can be successfully applied in any engineering specialty. (Also listed as IDES 5301.)

MECH 5602 [0.5 credit] (MCG 5362)

Failure Prevention (Fracture Mechanics and Fatigue)

Design of engineering structures to ensure against failure due to fatigue or brittle fracture. Nature of fatigue and brittle fracture; selection of suitable material, geometry, and inspection procedures for the load and environmental conditions.

MECH 5603 [0.5 credit] (MCG 5381)

Lightweight Structures

Structural behaviour. Fundamentals of basic elasticity. Energy methods of structural analysis. Bending, shear, and torsion of open and closed multicell structures. Bending of plates. Structural idealization and its effects on open and closed sections. Structural stability.

MECH 5604 [0.5 credit] (MCG 5364)

Computational Metallurgy

Development of microstructure in alloys in solidification processes and post-solidification processing. Nucleation and growth of solid phase. Formation of a dendrite structure, macro and micro segregations. Pore formation in castings. Thermodynamic and kinetics of phase transformations and structure evolution in solid alloys.

MECH 5605 [0.5 credit] (MCG 5365)

Finite Element Analysis I

An introduction to the finite element methodology, with emphasis on applications to heat transfer, fluid flow and stress analysis. The basic concepts of Galerkin's method, interpolation, numerical integration, and isoparametric elements are taught using simple examples.

MECH 5606 [0.5 credit] (MCG 5366)

Finite Element Analysis II

Time marching heat flow problems with linear and nonlinear analysis. Static plasticity. Time-dependent deformation problems; viscoplasticity, viscoelasticity, and dynamic analysis. Isoparametric elements and numerical integration are used throughout.

MECH 5607 [0.5 credit] (MCG 5367)

The Boundary Element Method (BEM)

Integral equations. The BIE for potential theory and for elastostatics in two-dimensions. Boundary elements and numerical integration schemes. Practical applications.

MECH 5609 [0.5 credit] (MCG 5123)

Microstructure and Properties of Materials

Essential microstructural features of metals and alloys: crystal structure, dislocations, grain boundaries. The importance of these features in controlling mechanical properties is emphasized. Analytical techniques observing microstructure in metals and other materials: TEM, SEM, electron diffraction, spectrometry.
Precludes additional credit for MECH 5804 (if taken 2002-2003, 2003-2004)

MECH 5700 [0.5 credit] (MCG 5345)

Surfaces and Coatings

Surface characteristics of solid materials and surface degradation/failure mechanisms including wear, fretting, oxidation, corrosion, and erosion are introduced. Coating methods including PVD, CVD, laser, thermal spray and electrochemical deposition are discussed in the context of failure prevention measures.

MECH 5701 [0.5 credit] (MCG 5369)

Metallic Phases & Transformations

Thermodynamics of crystals, phase diagrams, principles of alloy phases, thermal analysis. Transformation rate and mechanisms. Short and long range diffusional transformations, diffusionless transformations. Phase transformations in engineering systems.
Precludes additional credit for MECH 5608 if taken during 2001-2002 or during 2005-2006.
Prerequisite: MECH 2700 or the equivalent.

MECH 5704 [0.5 credit] (MCG 5374)

Integrated Manufacturing Systems (CIMS)

Topics essential to CIMS including computer graphics, geometric modeling, numerically controlled machining, and flexible manufacturing. The fundamental data structures and procedures for computerization of engineering design, analysis and production. Also offered at the undergraduate level, with different requirements, as MECH 4704, for which additional credit is precluded.

MECH 5705 [0.5 credit] (MCG 5375)

CAD/CAM

Computer aided design and manufacturing methodology through hands-on experience and state-of-the-art software. Topics include mathematical representation, solid modeling, drafting, mechanical assembly, mechanism design and CNC machining. CAD data exchange standards, rapid prototyping, concurrent engineering and design for X are also discussed.

MECH 5800 [0.5 credit] (MCG 5480)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5801 [0.5 credit] (MCG 5489)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5802 [0.5 credit] (MCG 5483)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5803 [0.5 credit] (MCG 5488)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5804 [0.5 credit] (MCG 5384)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5805 [0.5 credit] (MCG 5482)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5806 [0.5 credit] (MCG 5486)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5807 [0.5 credit] (MCG 5387I)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5808 [0.5 credit] (MCG 5376)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5809 [0.5 credit] (MCG 5382)

Special Topics in Mechanical and Aerospace Engineering

Topic will vary from year to year.

MECH 5906 [0.5 credit] (MCG 5395)
Directed Studies

MECH 5908 [1.5 credits] (MCG 5398)
Independent Engineering Study
Students pursuing a master's degree by course work carry out an independent study, analysis, and solution of an engineering problem or design project. The results are given in the form of a written report and presented at a departmental seminar. Carried out under the general direction of a faculty member.

MECH 5909 [2.0 credits]
M.A. Sc. Thesis

MECH 6909 [8.5 credits]
Ph.D. Thesis

Other Courses of Particular Interest

Civil and Environmental Engineering
CIVE 5101, CIVE 5102, CIVE 5103, CIVE 5204, CIVE 5304, CIVE 5602

Mathematics and Statistics
MATH 4806 Numerical Analysis
MATH 5806

Physics
PHYS 4407 Statistical Physics
PHYS 5101

Systems and Computer Engineering
SYSC 5001, SYSC 5004, SYSC 5005, SYSC 5401, SYSC 5402, SYSC 5502, SYSC 5503

Ottawa-Carleton Institute for Mechanical and Aerospace Engineering

Carleton University
Minto 3090
1125 Colonel By Dr.
Ottawa, ON, Canada K1S 5B6
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The Institute

Director of the Institute: A. Artemev
Associate Director of the Institute: A. Fahim

Established in 1983, the Institute combines the research strengths and resources of the Departments of Mechanical and Aerospace Engineering at Carleton University and Mechanical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the Institute in a range of fields of mechanical and aerospace and materials engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the Director of the Institute.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Mechanical and Aerospace Engineering, Carleton University, and by (O) for the Department of Mechanical Engineering, University of Ottawa.

- A.M. Abdel-Latif, *Advanced materials, failure analysis (C-Adjunct)*
- F.F. Afagh, *Structural dynamics and control, solid mechanics, smart structures (C)*
- M. Ahmadi, *Robotic analysis, design and control, machine and biological motion, mechatronics and simulation (C)*
- A. Artemev, *Phase transformations, solidification processes (C)*
- J.C. Beddoes, *Physical metallurgy and metal processing (C)*
- R. Bell, *Finite element analysis, stress analysis, solid mechanics, fracture mechanics (C)*
- Y. Bourgault, *Computational fluid dynamics, numerical methods, finite element, continuum mechanics modeling (O, cross-appointed from Dept. of Mathematics and Statistics)*
- *B. Burlton, Orbital mechanics, space mission design (C)*
- S. C. Cheng, *Heat transfer, numerical methods (O)*
- B. Dhillon, *Reliability (O)*
- I. Dincer, *Energy efficiency, fluidized beds (C-Adjunct)*
- A. Ellery, *Space Robotics and Space Technology (C)*
- J. Etele, *Rocket-based combined cycle engines, low-cost space launch systems (C)*
- A. Fahim, *CAD/CAM, controls (O)*
- M. Ferchichi, *Fluid dynamics (O)*
- D. Feszty, *Low-speed and high-speed unsteady flows, computational fluid dynamics (C)*
- J.E.D. Gauthier, *Gas turbine technologies, combustion (C)*
- J.A. Gaydos, *Thermodynamics, continuum mechanics (C)*
- K. Goheen, *Controls, dynamics (C-Adjunct)*

- J.A. Goldak, *Computer-integrated manufacturing processes, finite element modeling of manufacturing (C)*
- D.J. Gorman, *Vibrations* (O)
- D.C. Groeneveld, *Heat transfer, two phase flow (O-Adjunct)*
- J. Gu, *Transport phenomena in micro-scale processes, direct methanol fuel cells (C)*
- Y. Haddad, *Applied mechanics, materials and design (O)*
- W.L.H. Hallett, *Combustion (O)*
- F. Hamdullahpur, *Fluidized beds, hydrodynamics, cyclone modeling (C)*
- M.J.D. Hayes, *Space robotics, automated optical robot calibration systems, robot mechanical systems, theoretical kinematics (C*)
- X. Huang, *Design and fabrication of advanced thermal barrier coatings (C)*
- A. Jnifene, *Robotics, Vibration control of flexible structures, intelligent control (O*)
- B. Jodoin, *Thermofluids, plasma physics (O)*
- M. Johnson, *Combustion/fluid mechanics (C)*
- T. Kaya, *Fluid Dynamics, heat transfer (C)*
- R.J. Kind, *Aerodynamics of aircraft and turbomachinery* (*C - Adjunct)*
- J. Kofman, *Intelligent systems, computer-vision and imaging, biomedical applications (O*)
- M. Labrosse, *Mechanics of heart valve and cardiovascular tissues, cardiovascular mechnics (O)*
- C. Lague, *Agricultural machinery systems and operations, manure management systems* (O)
- J.F. Laliberte, *Aero-structures, composite materials (C-Adjunct)*
- E. Lemaire, *Biomechanics, rehabilitation engineering (O-Adjunct)*
- M. Lamontagne, *Biomechanics and biomedical engineering (O)(cross-appointed from School of Human Kinetics)*
- R. Langlois, *Flexible multibody dynamics; vehicle dynamics, aircraft/ship dynamic interface analysis, mathematical modeling simulation (C)*
- B.H.K. Lee, *Aerodynamics, aeroelasticity (O-Adjunct)*
- Y. Lee, *Heat transfer, nuclear engineering* (O)
- L. Leung, *Nuclear reactor thermalhydraulics (O-Adjunct)*
- M. Liang, *Production and manufacturing engineering, intelligent systems (O)*
- R. Liu, *Fracture mechanics, fatigue, crack behaviour, closure, composite materials, numerical methods, finite element analysis* (C)
- E.A. Matida, *Pharmaceutical aerosols (inhalation devices), large eddy simulation (C)*
- J.M. McDill, *Adaptive thermal micro structural mechanical finite element analysis for manufacturing processes* (*C*)
- G. McRae, *Corrosion, nuclear materials (C-Adjunct)*
- R.E. Milane, *Combustion, fluid mechanics (O*)
- R. Miller, *Computational materials science, multi-scale modeling of materials, atomistic modeling of crystalline defects (C)*
- M.B. Munro, *Composite materials (O)*
- T. Mussivand, *Medical devices design, evaluation (*in vitro, in vivo, *clinical), artificial heart sensors, valves and prosthetics (C-Adjunct)*
- H. Naguib, *Advanced polymeric materials and processes (O)*
- D.S. Necsulescu, *Control, robotics, reliability (O)*
- M. Nganbe, *Superalloys, ceramic-metal composites, powder metallurgy, surface engineering (O)*
- D. Nikanpour, *Space/satellite materials and thermal control (C-Adjunct)*
- F. Nitzsche, *Aeroelasticity, control, helicopter noise, smart structures (C)*
- P.C. Patnaik, *Aerospace materials (C-Adjunct)*
- M. Radulescu, *Detonations and explosions, high-speed flows, numerical modeling (O)*
- D. Redekop, *Applied mechanics, finite element analysis, robotics (O)*
- F. Robitaille, *Processing and performance: polymer composite materials (O)*

- G. Rouhi, *Mechanics and remodeling of bone, healing and growth mechanisms in bone, stress analysis, continuum mechanics (O)*
- D.L. Russell, *Dynamics, controls, medical device design (C)*
- H.M.J. Saari, *Process modeling of directional solidification (DS) of gas turbine materials (C)*
- J.Z. Sasiadek, *Robotics and automation, guidance, navigation and computer control Systems (C)*
- R.K. Singhal, *Structural dynamics, vibration analysis and testing (O-Adjunct)*
- J.S. Sinkiewicz, *Robotics, guidance, navigation, space (C-Adjunct)*
- S.A. Sjolander, *Aerodynamics, turbo-machinery, wind-tunnel engineering (C)*
- D.A. Staley, *Spacecraft dynamics and control (C-Adjunct*)
- P.V. Straznicky, *Design, light weight structures (C)*
- C.L. Tan, *Solid mechanics, fracture mechanics, boundary integral and finite element methods (C)*
- S. Tavoularis, *Fluid mechanics, experimental techniques (O)*
- F.R. Vigneron, *Vibrations, spacecraft design (C-Adjunct)*
- W. Wallace, *Materials engineering* (C-Adjunct)
- X. Wang, *Fracture mechanics, fatigue and fracture, finite element applications, pressure vessel and piping (C)*
- J.Y. Wong, *Vehicle engineering, transportation technology (C-Adjunct)*
- M.I. Yaras, *Turbomachinery, aerodynamics, computational fluid dynamics (C)*
- S. Zan, *Aerodynamics (C-Adjunct)*
- L. Zhao, *Physical metallurgy and coatings (C-Adjunct)*
- S. Zolfaghari, *Manufacturing, operations and production management (O-Adjunct)*

Master's Degree

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high honours standing in mechanical or aerospace engineering or a related discipline.

Program Requirements

M.A. Sc. - Master's by Thesis

The requirements for course work are specified in terms of credits: one credit is one hour/week for one term (thirteen weeks). The requirements for the master's degree by thesis are:

- Three course credits
- Participation in the Mechanical and Aerospace Engineering seminar series
- Thesis

M.Eng. - Master's by Course Work

The requirements for the master's degree by course work are either: 4.5 course credits plus a project equivalent to 1.0 course credit (MECH 5908 for Carleton University students; MCG 6000 for University of Ottawa students); or 5.0 course credits.

Guidelines for Completion of Master's Degree

Students are expected to complete the master's program within the maximum limits outlined in the Section 13.2 of the General Regulations section of this Calendar.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mechanical or aerospace engineering or a related discipline. Students who have been admitted to the master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

In addition, graduate courses offered by departments in other disciplines may be taken for credit with approval by the department in which the student is registered.

Program Requirements

The requirements for the Ph.D. degree (from the master's degree) are:

1. 1.5 course credits.

2. Participation in the Mechanical and Aerospace Engineering seminar series.

3. Successful completion of the comprehensive examination according to section 18.11 of the General Regulations section of this Calendar.

4. Thesis. The examining board for all theses will include professors from both departments and an external examiner who is a member of neither university.

Students who have been permitted to transfer into the Ph.D. program from a master's program require 4.5 course credits for the Ph.D.

Graduate Courses

Not all of the following courses re offered in a given year. Consult the Ottawa-Carleton Joint Institute for Mechanical and Aerospace Engineering (OCIMAE) website for course offerings.

The following codes identify the department offering the course: 'MECH' Department of Mechanical and Aerospace Engineering, Carleton University, 'MAAJ' Department of Mechanical Engineering, University of Ottawa.

Carleton University
MECH 5000 (MCG 5300) Fundamentals of Fluid Dynamics
MECH 5001 (MCG 5301) Theory of Viscous Flows
MECH 5003 (MCG 5303) Incompressible Non-Viscous Flow
MECH 5004 (MCG 5304) Compressible Non-Viscous Flow
MECH 5008 (MCG 5308) Experimental Methods in Fluid Mechanics
MECH 5009 (MCG 5309) Environmental Fluid Mechanics Relating to Energy Utilization
MECH 5100 (MCG 5310) Performance and Economics of Aircraft
MECH 5101 (MCG 5311) Dynamics and Aerodynamics of Flight
MECH 5104 (MCG 5314) Ground Transportation Systems and Vehicles
MECH 5105 (MCG 5315) Orbital Mechanics and Space Control
MECH 5106 (MCG 5121) Space Mission Analysis and Design
MECH 5107 (MCG 5317) Experimental Stress Analysis
MECH 5201 (MCG 5321) Methods of Energy Conversion

MECH 5202 (MCG 5122) Smart Structures
MECH 5300 (MCG 5330) Engineering Acoustics
MECH 5301 (MCG 5331) Aeroacoustics
MECH 5302 (MCG 5332) Instrumentation Techniques
MECH 5304 (MCG 5334) Computational Fluid Dynamics of Compressible Flows
MECH 5400 (MCG 5344) Gas Turbine Combustion
MECH 5401 (MCG 5341) Turbomachinery
MECH 5402 (MCG 5342) Gas Turbines
MECH 5403 (MCG 5343) Advanced Thermodynamics
MECH 5407 (MCG 5347) Conductive and Radiative Heat Transfer
MECH 5408 (MCG 5348) Convective Heat and Mass Transfer
MECH 5500 (MCG 5350) Advanced Vibration Analysis
MECH 5501 (MCG 5125) Advanced Dynamics
MECH 5502 (MCG 5352) Optimal Control Systems
MECH 5503 (MCG 5353) Robotics
MECH 5504 (MCG 5354) Guidance, Navigation and Control
MECH 5505 (MCG 5355) Stability Theory and Applications
MECH 5506 (MCG 5356) Neuro and Fuzzy Control
MECH 5507 (MCG 5124) Advanced Kinematics
MECH 5601 (MCG 5361) Creative Problem Solving and Design
MECH 5602 (MCG 5362) Failure Prevention (Fracture Mechanics and Fatigue)
MECH 5603 (MCG 5381) Lightweight Structures
MECH 5604 (MCG 5364) Computational Metallurgy
MECH 5605 (MCG 5365) Finite Element Analysis I
MECH 5606 (MCG 5366) Finite Element Analysis II
MECH 5607 (MCG 5367) The Boundary Element Method (BEM)
MECH 5609 (MCG 5123) Microstructure and Properties of Materials
MECH 5700 (MCG 5345) Surfaces and Coatings
MECH 5701 (MCG 5369) Metallic Phases & Transformations
MECH 5704 (MCG 5374) Integrated Manufacturing Systems (CIMS)
MECH 5705 (MCG 5375) CAD/CAM
MECH 5800 (MCG 5480) Special Topics in Mechanical and Aerospace Engineering
MECH 5801 (MCG 5489) Special Topics in Mechanical and Aerospace Engineering
MECH 5802 (MCG 5483) Special Topics in Mechanical and Aerospace Engineering
MECH 5803 (MCG 5488) Special Topics in Mechanical and Aerospace Engineering
MECH 5804 (MCG 5384) Special Topics in Mechanical and Aerospace Engineering
MECH 5805 (MCG 5482) Special Topics in Mechanical and Aerospace Engineering
MECH 5806 (MCG 5486) Special Topics in Mechanical and Aerospace Engineering
MECH 5807 (MCG 5387) Special Topics in Mechanical and Aerospace Engineering
MECH 5808 (MCG 5376) Special Topics in Mechanical and Aerospace Engineering
MECH 5809 (MCG 5382) Special Topics in Mechanical and Aerospace Engineering

University of Ottawa
MAAJ 5001 (MCG 5101) Theory of Elasticity
MAAJ 5002 (MCG 5102) Advanced Stress Analysis
MAAJ 5003 (MCG 5103) Theory of Perfectly Plastic Solids
MAAJ 5004 (MCG 5104) Theory of Plates and Shells
MAAJ 5005 (MCG 5105) Continuum Mechanics
MAAJ 5006 (MCG 5106) Advanced Topics in Elasticity
MAAJ 5007 (MCG 5107) Advanced Dynamics with Applications
MAAJ 5008 (MCG 5108) Finite Element Analysis
MAAJ 5009 (MCG 5109) Advanced Topics in Finite Element Analysis
MAAJ 5100 (MCG 5110) Micromechanics of Solids
MAAJ 5101 (MCG 5111) Gas Dynamics
MAAJ 5104 (MCG 5114) Analysis and Design of Pressure Vessels
MAAJ 5015 (MCG 5115) Non-Linear Optimization

MAAJ 5107 (MCG 5117) Introduction to Composite Materials
MAAJ 5108 (MCG 5118) Introduction to Plasticity
MAAJ 5109 (MCG 5119) Fracture Mechanics
MAAJ 5206 (MCG 5126) Deformation of Materials
MAAJ 5209 (MCG 5129) Hot Working of Metals
MAAJ 5301 (MCG 5131) Heat Transfer by Conduction
MAAJ 5302 (MCG 5132) Heat Transfer by Convection
MAAJ 5303 (MCG 5133) Heat Transfer by Radiation
MAAJ 5304 (MCG 5134) Heat Transfer by Phase Change
MAAJ 5306 (MCG 5136) Special Studies in Fluid Mechanics and Heat Transfer
MAAJ 5307 (MCG 5137) Special Studies in Solid Mechanics and Materials
MAAJ 5308 (MCG 5138) Advanced Topics in Mechanical Engineering
MAAJ 5401 (MCG 5141) Statistical Thermodynamics
MAAJ 5408 (MCG 5551) Théorie d'Ecoulement Visqueux
MAAJ 5409 (MCG 5552) Théorie de Turbulence
MAAJ 5500 (MCG 5557) Méthodes Numériques en Mécaniques des Fluides
MAAJ 5501 (MCG 5151) Laminar Flow Theory
MAAJ 5502 (MCG 5152) Theory of Turbulence
MAAJ 5505 (MCG 5155) Inviscid Flow Theory
MAAJ 5506 (MCG 5156) Measurement in Fluid Mechanics
MAAJ 5507 (MCG 5157) Numerical Computation of Fluid Dynamics and Heat Transfer
MAAJ 5508 (MCG 5158) Industrial Fluid Mechanics
MAAJ 5509 (MCG 5159) Advanced Production Planning and Control
MAAJ 5601 (MCG 5161) Environmental Engineering
MAAJ 5608 (MCG 5168) Industrial Organization
MAAJ 5609 (MCG 5169) Advanced Topics in Reliability Engineering
MAAJ 5700 (MCG 5170) CAD/CAM
MAAJ 5701 (MCG 5171) Applied Reliability Theory
MAAJ 5702 (MCG 5172) Introduction to Management of Automation (Robotics and Numerical Control)
MAAJ 5703 (MCG 5173) Systems Engineering and Integration
MAAJ 5706 (MCG 5176) Industrial Control Systems
MAAJ 5707 (MCG 5177) Robot Mechanics
MAAJ 5708 (MCG 5178) Advanced Topics in CAD/CAM
MAAJ 5709 (MCG 5179) Manufacturing System Analysis
MAAJ 5800 (MCG 5180) Fibre Composite Materials II
MAAJ 5801 (MCG 5181) Advanced Vibrations
MAAJ 5802 (MCG 5182) Theory of Elastic Instability
MAAJ 5804 (MCG 5184) Mechatronics
MAAJ 5805 (MCG 5185) Multivariable Digital Control
MAAJ 5806 (MCG 5186) Non-Linear Discontinous Dynamics and Control
MAAJ 5901 (MCG 5191) Combustion in Premixed Systems
MAAJ 5902 (MCG 5192) Combustion in Diffusion Systems

School for Studies in Art and Culture: Music

St. Patrick's Building 423
Telephone: 613-520-5770
Fax: 613-520-3905
carleton.ca/artandculture/music

The School

Director: Bryan Gillingham

The School for Studies in Art and Culture offers a program of study and research leading to the degree of Master of Arts in Music and Culture. This program is designed to offer students a thorough grounding in new, interdisciplinary approaches to musicology. The primary objective is to offer students a forum where new perspectives in musicology can be explored in a critical and integrated manner. This exploration will be grounded in the specifics of music but conducted from within a range of theoretical approaches: including sociology, linguistics, critical theory, feminism, cultural studies, and ethnomusicology.

Qualifying-Year Program

Applicants without a B.Mus. or B.A. Honours degree in Music, or a related discipline, but who have a three-year degree with a minimum average of B+, may be admitted to a qualifying year program. Students who complete the qualifying year requirements with a minimum average of B+ will be considered for admission to the Master's program.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program in Music and Culture is either a B.Mus. degree or a B.A. Honours degree in Music with a minimum B+ average. Applicants with a B.A. Honours in a related discipline (e.g., Mass Communication, Women's Studies, Philosophy, or Cultural Studies), with a minimum average of B+, will also be considered provided the applicant can demonstrate a strong background in some form of music. Applicants without the requisite background in cultural/theoretical issues may be required to take a maximum of two full credits from designated courses at the undergraduate level in Music in addition to their normal M.A. program requirements. There are no performance requirements for admission to this degree program.

Program Requirements

The Master's degree in Music and Culture requires the satisfactory completion of a total of 5.0 credits, distributed according to one of the following two options (students are required to choose one option over the other by March 1st of the first year of study):

Thesis Program

- 1.5 credits required course work (MUSI 5000, MUSI 5002 and MUSI 5004)
- 1.5 credits additional course work chosen from available elective courses
- 2.0 credits, Thesis

Research Essay Program

- 1.5 credits required course work (MUSI 5000, MUSI 5002 and MUSI 5004)
- 2.5 credits of additional course work chosen from available elective courses
- 1.0 credit, Research Essay

Subject to the approval of the graduate supervisor, 0.5 credit may be taken outside the program in a related discipline (such as Philosophy, Women's Studies, etc.)

Deadlines

Thesis Proposal

Full-time students normally will submit their thesis (or research essay) topic to the thesis proposal board no later than April 30th of the first year of registration for students enrolled full-time, and no later than the middle of the fifth term of registration for students enrolled part-time. Thesis

Regulations governing requirements for the Master's thesis, including deadlines for submission, are outlined in the General Regulations section of this Calendar.

Language Requirements

Students are required to demonstrate a reading knowledge of French (or another language related to their research, to be approved by the Music and Culture graduate supervisor).

Academic Standing

A standing of B- or better must be obtained in each course counted towards the Master's degree.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at: central.carleton.ca

MUSI 5000 [0.5 credit]
Music and Cultural Theory I: Intellectual Histories
Major intellectual trends relevant to cultural theory and their application to the study of music. Topics may include: Marxism and critical theory, anthropological and sociological theory, philosophical aesthetics, psychoanalysis, feminism and gender theory, post-colonial studies, and cultural studies.
Precludes additional credit for MUSI 5001 (no longer offered).

MUSI 5002 [0.5 credit]
Research Methods in Music and Culture
The research process, including the phases of conceptualization, framing, and research design. Topics may include: critiques of existing musical and cultural methods, issues related to the application of interdisciplinary methodologies to musical objects of study, and the relationship of method to theory and epistemology.

MUSI 5004 [0.5 credit]
Music and Cultural Theory II: Current Debates
Selected debates within contemporary theory and culture and their relevance to music. The focus will be on a limited range of debates and issues selected by the instructor for in-depth

discussion and analysis. Topics will vary from year to year
Prerequisite: MUSI 5000 or permission of the School.

MUSI 5006 [0.5 credit]
Music and Identity
Music as a medium for the construction and maintenance of cultural identities, including the relationship between music and traditional cultures, geography, the nation state, urban subcultures, gender and sexuality, race, class, and ethnicity.

MUSI 5007 [0.5 credit]
Music and Visual Culture
The relationships between musical and visual cultural, including traditional arts, fine art painting, film, television, and digital gaming and interactive media, and the ways in which meanings are dependent upon the various connections between them.

MUSI 5008 [0.5 credit]
Technologies of Music
The role that technologies, including musical instruments, notation, sound recording, and digital media, play in the concepts and practices associated with music. Topics include: technology as material culture, technology and musical practices, and the increasing importance of technology in contemporary music and culture.

MUSI 5009 [0.5 credit]
Music, Meaning and Representation
Theories of meaning and representation as applied to music. Major source traditions and critiques to be considered include: semiotics and structuralism, analytic philosophy, formalism, cognitive theory, and post-structuralism.

MUSI 5010 [0.5 credit]
History of Genres
Theories of genre, including theories derived from literary theory and film studies, and their application to the history of music. Topics may include relationships between genre and musical style, production and reception, social contexts, markets, and the legitimization and organization of knowledge.

MUSI 5011 [0.5 credit]
Music and Social Institutions
Historical relationships between music and society, including that of Western art music to sacred and secular institutions; the rise of the cultural industries (sound recording, radio and film); the relationship of science, the arts, and the academy; and state policies of arts funding and multiculturalism.

MUSI 5012 [0.5 credit]
Repertoires, Genres and Canons
A study of the organizational and hierarchical principles whose role is to differentiate, categorize, and legitimize music making within specific historical and social conditions. Topics may include musical canons and their relationship to issues of class, nationalism, taste cultures, and the development of musicology itself.

MUSI 5013 [0.5 credit]
Music and Performance
Music as a form of social practice rooted in traditions of performance. The variable, multimodal character of music as understood through theories of performance and gesture drawn from the histories and literatures of music, theatre, and dance (in art, popular, and non-Western forms).

MUSI 5014 [0.5 credit]
History of Canadian Music: Notated and Liturgical Music
Selected aspects of notated Canadian music from 1600 to the present; liturgical music; social and economic conditions of Canadian musical life; regional studies; individual composers and

performers.
Precludes additional credit for MUSI 5100 (no longer offered).

MUSI 5015 [0.5 credit]
Ethnomusicology of Canadian Traditions
Issues of anthropological, sociological, and analytical significance are examined in the context of selected developments in folklore and ethnomusicological research on English- and French-language Canadian traditions. Also offered at the undergraduate level, with different requirements, as MUSI 4103, for which additional credit is precluded.
Precludes additional credit for MUSI 5101 (no longer offered).

MUSI 5016 [0.5 credit]
Music of Canada's First Peoples
The context and significance of musical expressions for representative Nations in each of the Canadian geographical regions, Maritime, Eastern Nomadic, Eastern Sedentary, Plains, Western Subarctic, Plateau, Northwest Coast, and Arctic, from pre-Contact to the present. Also offered at the undergraduate level, with different requirements, as MUSI 4104, for which additional credit is precluded.
Precludes additional credit for MUSI 5102 (no longer offered).

MUSI 5200 [0.5 credit]
Special Topics in Music and Cultural Theory
Selected topics focusing on aspects of music and cultural theory not available in regular program offerings. Topic will vary from year to year.

MUSI 5201 [0.5 credit]
Special Topics in Music Genres
Selected topics focusing on specific genres of music not available in regular program offerings.
Topic will vary from year to year.

MUSI 5300 [0.5 credit]
Practicum in Music
Practical experience in music-specific projects such as music recording, librarianship, concert management, research, multimedia creation, etc., at local institutions. A maximum of 1.0 credit of practicum may be used in fulfilment of M.A. requirements.
Prerequisite: permission of the School.

MUSI 5900 [0.5 credit]
Directed Readings and Research
Tutorials designed to permit students to pursue research on topics in music and culture chosen in consultation with a member of the faculty. A maximum of 1.0 credit of directed studies may be used in fulfilment of M.A. requirements.
Prerequisite: permission of the School.

MUSI 5908 [1.0 credit]
Research Essay

MUSI 5909 [2.0 credits]
M.A. Thesis

Neuroscience

Life Sciences Research Building 325
Telephone: 613-520-4020
Fax: 613-520-4052
carleton.ca/neuroscience

The Institute

Director: H. Anisman

Neuroscience is a dynamic academic discipline that includes physiological, anatomical, biochemical, and behavioural studies of the nervous system. At Carleton University, graduate neuroscience research and training are coordinated by the Institute of Neuroscience. Both M.Sc. and Ph.D. degrees, with a Specialization in Behavioural Neuroscience, are offered through either the Departments of Psychology or Biology with supervision by one of the faculty members of the Institute.

Members of the Institute

- A. Abizaid, *Sensory and hormonal control of feeding, reproduction, and behavioural rhythms*
- H. Anisman, *Stress, brain-immune interactions, depression*
- R. Bergeron, *Learning and memory neurodegeneration (Adjunct)*
- W. Bowers, *Behavioural toxicology (Adjunct)*
- J. Cheetham, *Membrane biochemistry, neurotransmitter release*
- S. Hayley, *Parkinson's disease, interactions between brain and immune system*
- M. Holahan, *Neurobiology of learning and memory, brain aging*
- J. Kelly, *Central auditory system, electrophysiology and behaviour*
- D. McIntyre, *Epilepsy, kindling, learning and memory*
- Z. Merali, *Peptides, feeding behaviour* (Adjunct)
- B. Pappas, *Brain Development, dementia, Ischemia*
- M. Poulter, *Electrophysiology, neurochemistry, molecular (Adjunct)*
- J. Stead, *Gene expression in depression and during brain development*
- W. Willmore, *Hypoxia, stroke, ischemia and Alzheimer's disease*
- S. Hui Wu, *Auditory brainstem, brain slice neurophysiology*
- J. Yack, *Neuroethology*
- R.M. Zacharko, *Intracranial self-stimulation, stress, depression, dopamine, anhedonia*

Specialization in Behavioural Neuroscience

Coordinator of the Specialization: H. Anisman

Application for admission, scholarships, and teaching assistantships should be made through either the Departments of Psychology or Biology, whichever is most appropriate to a student's research interest, and should indicate the intention to specialize in behavioural neuroscience. This specialization is a collaboration of the Departments of Psychology and Biology at Carleton University, the School of Psychology at the University of Ottawa and the Institute of Mental Health Research (Psychiatry) at the University of Ottawa. It is intended to augment the research and training which the student receives and to provide opportunity in clinical neuroscience.

Master's Program

Admission Requirements

The requirements for admission to the master's neuroscience specialization are as follows:

- Prior admission to the master's program of the Psychology or Biology department.
- A letter of recommendation to the Director of the Institute from a faculty member of the Institute of Neuroscience, indicating the willingness of the faculty member to supervise the candidate's research program.

Students with less than a high honours average in their undergraduate and graduate courses will not normally be recommended for admission.

Program Requirements

- Fulfilment of the requirements of the master's program of either Psychology or Biology Department;
- Successful completion of PSYC 5200 (BIOL 5304);
- Thesis research must concern a neuroscience topic and be supervised by a member of the Institute.

Doctor of Philosophy

Admission Requirements

Admission requirements to the Ph.D. neuroscience specialization are as follows:

- Successful completion of PSYC 5200 or equivalent;
- Prior admission to the Ph.D. program of the Psychology or Biology department;
- A letter of recommendation from a participating faculty member of the neuroscience specialization, indicating the willingness of the faculty member to supervise the candidate's research program;
- Students with less than a high honours standing in their undergraduate and graduate courses will not normally be recommended for admission.

Program Requirements

Fulfilment of the requirements of the Ph.D. program of either the Psychology or Biology Department.

A credit in Neuroscience Techniques (PSYC 6204) may be substituted for one of the following 0.5-credit courses normally required to satisfy the Psychology Ph.D. program requirements in statistics: PSYC 5401, PSYC 5402, PSYC 5403, PSYC 5406.

Successful completion of PSYC 6202 and PSYC 6203 (BIOL 6305 and BIOL 6306), and at least one credit in PSYC 6204 (BIOL 6204).

Thesis research must concern a neuroscience topic and be supervised by a member of the Institute.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Neuroscience courses are available through the primary departments. Course offerings vary slightly from year to year and a complete listing can be obtained from the specialization coordinator.

Following are the core courses of the curriculum:

PSYC 5200 [1.0 credit] (BIOL 5304)
Basics of Neuroscience
A comprehensive neuroscience course from cellular levels to neural systems and behaviours presented through a series of seminars and colloquia. Topics will include aspects of neuroanatomy, neurophysiology, neuro-pharmacology and behavioural and cognitive neuroscience. Also listed as PSY 6201 at the University of Ottawa.

PSYC 6202 [0.5 credit] (BIOL 6305)
Advanced Seminar in Neuroscience I
A comprehensive pro-seminar series, covering issues ranging from cellular and molecular processes through to neural systems and behaviours as well as psychopathology. Precludes additional credit for PSYC 6200 [1.0].
Prerequisite: PSYC 5200.

PSYC 6203 [0.5 credit] (BIOL6306)
Advanced Seminar in Neuroscience II
A comprehensive proseminar series, covering issues ranging from cellular and molecular processes through to neural systems and behaviours as well as psychopathology. Precludes additional credit for PSYC 6200 [1.0].
Prerequisite: PSYC 5200.

PSYC 6204 [0.5 credit] (BIOL 6204)
Neuroscience Techniques
Completion of a research project carried out under the supervision of a neuroscience faculty member. The student will learn a new neuroscience technique and apply it to a research objective. May be repeated for different projects. Students must obtain approval from the Director of the Neuroscience Specialization.

PSYC 6300 [0.5 credit]
Special Topics in Psychology
An in-depth study of current topics in neuroscience. Course content varies yearly and has recently included cognitive neuroscience, neuropharmacology, neurodegeneration, behavioural medicine and molecular neuroscience.

Philosophy

Paterson Hall 3A46
Telephone: 613-520-2110
Fax: 613-520-3962
carleton.ca/philosophy

The Department

Chair of the Department: Geraldine Finn
Supervisor of Graduate Studies: Richard Manning

The Department of Philosophy offers programs of study leading to the degree of Master of Arts.

Qualifying-Year Program

Applicants who do not hold an Honours degree (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the General Regulations section of this Calendar.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an Honours B.A. degree (or the equivalent) in Philosophy, with at least B+ standing (or the equivalent). Qualifying-year and M.A. applicants from an institution other than Carleton University must submit two papers.

Program Requirements

The specific program requirements for master's candidates are the following:

- PHIL 5800 (1.0 credit);
- A thesis equivalent to 2.0 credits, which must be defended at an oral examination; or a research essay equivalent to 1.0 credit;
- 2.0 credits (or 3.0 in the case of students following the research essay option)(including up to 1.0 credit by tutorial), in at least three of the following study areas: studies in the history of philosophy; studies in the work of an individual philosopher; studies in logic, epistemology, or metaphysics; studies in selected problems in philosophy.

Guidelines for Completion of Master's Degree

Full-time students enrolled in the 5.0 credit M.A. program are expected to complete PHIL 5800 and 2.0 credits by the end of the second term of study. The thesis or research essay approval form should be submitted by the end of the fourth week of the third term of study. Those students choosing the research essay option should complete 1.0 additional credits by the end of the third term of study. All full-time students are expected to submit the thesis or research essay by the end of the fourth term of study.

Part-time students enrolled in the 5.0 credit M.A. program are expected to complete PHIL 5800 and 2.0 credits by the end of the third year of study. The thesis or research essay approval form should be submitted by the end of the second month of the fourth year of study. Those students choosing the research essay option should complete 1.0 additional credit by the end of the fourth year of study. All part-time students are expected to submit the thesis or research essay by the end of the fifth year of study.

Other Courses

A maximum of 1.0 credit may be selected from courses offered at the 4000-level, or in a related field, or at another university.

Each year, the department offers 4000-level undergraduate 0.5 credit courses, which are open to students in the qualifying year and, with permission, to students in the M.A. program. Consult the Undergraduate Calendar for course information.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

PHIL 5000 [0.5 credit]
Special Topic in Philosophy
A detailed study of a special topic in philosophy. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4100, for which additional credit is precluded when topics are the same.

Tutorial Courses

PHIL 5004 [0.5 credit]
Tutorial in the History of Philosophy I
Detailed study of a period or issue in the history of philosophy.

PHIL 5005 [0.5 credit]
Tutorial in the History of Philosophy II
Detailed study of a period or issue in the history of philosophy.

PHIL 5104 [0.5 credit]
Tutorial in the Work of an Individual Philosopher I
A critical and systematic study of the work of an individual philosopher.

PHIL 5105 [0.5 credit]
Tutorial in the Work of an Individual Philosopher II
A critical and systematic study of the work of an individual philosopher.

PHIL 5204 [0.5 credit]
Tutorial in Logic, Epistemology, or Metaphysics I
An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

PHIL 5205 [0.5 credit]
Tutorial in Logic, Epistemology, or Metaphysics II
An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

PHIL 5304 [0.5 credit]
Tutorial in Selected Problems of Philosophy I
An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

PHIL 5305 [0.5 credit]

Tutorial in Selected Problems of Philosophy II

An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

Seminar Courses

PHIL 5200 [0.5 credit]

Topics in Philosophy of Mind or Philosophy of Language

A detailed study of an issue or the work of selected philosophers in the general area of philosophy of mind and/or philosophy of language. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4210 or PHIL 4220, for which additional credit is precluded when topics are the same.

PHIL 5250 [0.5 credit]

Topics in Logic, Epistemology, Metaphysics or Philosophy of Science

A detailed study of an issue or the work of selected philosophers in the general areas of logic, epistemology, metaphysics or philosophy of science. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4230, for which additional credit is precluded when topics are the same.

PHIL 5300 [0.5 credit]

Topics in Value Theory

A detailed study of an issue or the work of selected philosophers in the general area of value theory. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4300, for which additional credit is precluded when topics are the same.

PHIL 5350 [0.5 credit]

Topics in Ethics or Political Philosophy

A detailed study of an issue or the work of selected philosophers in the general areas of ethics or political philosophy. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4320 or PHIL 4330, for which additional credit is precluded when topics are the same.

PHIL 5500 [0.5 credit]

Topics in Contemporary Philosophy

A detailed study of an issue or the work of selected philosophers in contemporary philosophy. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4007 or PHIL 4008, for which additional credit is precluded when topics are the same.

PHIL 5600 [0.5 credit]

Topics in the History of Philosophy

A detailed study within the history of philosophy: a period, an issue or the work of selected philosophers. Topics may vary from year to year. Also offered at the undergraduate level, with different requirements, as PHIL 4003, PHIL 4004, PHIL 4005, or PHIL 4006, for which additional credit is precluded when topics are the same.

PHIL 5800 [1.0 credit]

Graduate Seminar

The first term will be devoted to a single issue or group of interrelated issues. In the second term, a variety of topics will be discussed. Issues covered in this course will vary from year to year.

PHIL 5908 [1.0 credit]
Research Essay

PHIL 5909 [2.0 credits]
M.A. Thesis

Physics

3302 Herzberg Building
Telephone: 613-520-4320
Fax: 613-520-4061
www.physics.carleton.ca

The Ottawa-Carleton Institute for Physics

Director of the Institute: Gerald Oakham
Associate Director: Ivan L'Heureux

Students pursuing studies in physics at the M.Sc. and Ph.D. levels in the Ottawa area do so in a cooperative program that combines the resources of the Departments of Physics of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the Institute, which include criteria related to academic performance, research experience, and referees' appraisals. The choice of program and/or research project and supervisor will determine the student's primary campus location.

At Carleton, the research areas of physics available for programs leading to the M.Sc. or the Ph.D. degree include particle physics and medical physics. In particle physics, both theoretical and experimental programs are available. At the University of Ottawa, the research interests include condensed matter physics, biophysics, non-linear dynamics, statistical mechanics, materials science, photonics, and surface physics. The graduate courses offered on the two campuses match this complementarity of research interests, and the courses listed below are therefore grouped to reflect the different emphases on the two campuses.

In addition, the M.Sc. degree in the area of physics in modern technology is offered at both campuses. This program requires a work term placement rather than a thesis.

A program leading to the M.A.Sc. in Biomedical Engineering is offered by Carleton University's Department of Physics, in cooperation with the Department of Systems and Computer Engineering, the Department of Mechanical and Aerospace Engineering, the School of Information Technology and Engineering, and the Department of Chemical Engineering at the University of Ottawa. For further information, refer to the Ottawa-Carleton Institute for Biomedical Engineering section of this Calendar.

The list below of all members of the Institute along with their research interests can be used as a guide to possible supervisors. For students in the medical physics stream, research supervision may be provided by members of other institutions in the area, such as hospitals, cancer clinics, and government laboratories.

Requests for information and completed applications should be sent to the Director or Associate Director of the Institute. Detailed information is available at our Web site.

Members of the Institute

The home department of each member of the Institute is indicated by (C) for the Department of Physics, Carleton University and (O) for the Department of Physics, University of Ottawa.

- J.C. Armitage, *Photonics (C)*

- D. Asner, *Experimental high energy physics (C)*
- X. Bao, *Photonics (O)*
- A. Bellerive, *Experimental particle physics (C)*
- R. Bhardwaj, *Ultrafast photonics (O)*
- T. Brabec, *Photonics (O)*
- I. Cameron, *Medical physics (C-Adjunct)*
- B. Campbell, *Theoretical particle physics (C)*
- S. Charbonneau, *Semiconductor physics (O-Adjunct)*
- K. Chen, *Computational materials science (O-Adjunct)*
- L. Chen, *Theoretical condensed matter*, *photonics (O)*
- *B. Clark,* Medical physics (C-*Adjunct*)
- P. Corkum, *Photonics (O)*
- J. Cygler, *Medical physics (C-Adjunct)*
- A. Czajkowski, *Photonics, infrared frequency standards (O)*
- R. deKemp, *Medical physics (C-Adjunct)*
- S. Desgreniers, *High pressure physics (O)*
- M. Dixit, E*xperimental high energy physics (C-Adjunct)*
- S. Fafard, *Semiconductor physics (O-Adjunct)*
- P. Finnie, *Semiconductor physics (O-Adjunct)*
- E. Fortin, *Semiconductor physics (O)*
- L.H. Gerig, *Medical physics (C-Adjunct)*
- J. Giorgi, *Fuel cells, catalysis, surface science (O-Cross-appointed)*
- S. Godfrey, *Theoretical particle physics (C)*
- K. Graham, *Experimental particle physics (C)*
- J. Harden, *Biological physics, soft condensed matter (O)*
- C.K. Hargrove, *Experimental high energy physics (C-Adjunct)*
- P. Hawrylak, *Theoretical condensed matter (O-Adjunct)*
- R.J. Hemingway, *Experimental high energy physics (C-Adjunct)*
- K. Hinzer, *Optoelectronics (O-Cross-appointed)*
- R.J.W. Hodgson, *Theoretical nuclear physics (O)*
- B.J. Jarosz, *Medical physics (C)*
- P.C. Johns, *Medical physics (C)*
- Béla Joós, *Theoretical condensed matter and biological physics (O)*
- M. Kaern, *Cellular and molecular medicine (O-Cross-appointed)*
- P. Kalyniak, *Theoretical particle physics (C)*
- I. Kawrakow, *Medical physics (C-Adjunct)*
- G. Lamarche, *Low temperature physics (O-Adjunct)*
- M.A.R. LeBlanc, *Superconductivity (O)*
- P. Lu, *Photonics (O-Adjunct)*
- I. L'Heureux, *Nonequilibrium processes in nonlinear systems (O)*
- H. Logan, *Theoretical partical physics (C)*
- A. Longtin, *Nonlinear dynamics, biophysics (O)*
- M. McEwen, *Medical physics (C-Adjunct)*
- S. Mihailov, *Photonics (O-Adjunct)*
- R.Munger, *Medical photonics (O-Cross-appointed)*
- C. Ng, *Medical physics (C-Adjunct)*
- F.G. Oakham, *Experimental high energy physics (C)*
- A. Pelling, *Biological physics (O)*
- P. Piercy, *Condensed matter physics (O)*
- G.P. Raaphorst, *Medical physics (C-Adjunct)*
- L. Ramunno, *Theoretical and computational nanophotonics (O)*
- D.G. Rancourt, *Solid state magnetism (O)*
- S. Raymond, *Semiconductor physics (O)*

- D.W.O. Rogers, *Medical physics (C)*
- C. Ross, *Medical physics (C-Adjunct)*
- H. Schriemer, *Heterogeneous photonic nanosystems (O-Cross-appointed)*
- W.D. Sinclair, *Neutrino physics (C)*
- G.W. Slater, *Polymer physics (O)*
- Z.M. Stadnik, *Electronic structure and magnetism (O)*
- A. Stolow, *Photonics (O-Adjunct)*
- M.K. Sundaresan, *Theoretical particle physics (C)*
- J. Tse, *Theoretical material sciences (O-Adjunct)*
- Y. Varshni, *Theoretical atomic and condensed matter physics (O)*
- D. Villeneuve, *Femtosecond science* (O-Adjunct)
- M. Vincter, *Experimental particle physics (C)*
- R. Wassenaar, *Medical physics (C-Adjunct)*
- P.J.S. Watson, *Theoretical particle physics (C)*
- R.G. Wells, *Medical physics (C-Adjunct)*
- D. Wilkins, *Medical physics (C-Adjunct)*
- R. Wilkins, *Medical physics (C-Adjunct)*
- R. Williams, *Semiconductor physics (O-Adjunct)*
- T. Xu, *Medical physics (C)*

Master of Science

An Honours B.Sc. in Physics or a closely related field at a standard acceptable to the two universities is normally required for admission to the M.Sc. program. The admissions committee may require students to take an orientation examination during the first weeks of residence. The results of this examination may indicate the need for a student to register in undergraduate courses to fill gaps in his/her knowledge. It is strongly recommended that all students have had at least one course in computing.

Program Requirements

The options for the M.Sc. program are described below. Normally the requirements for the research M.Sc. with thesis consist of:

- 2.5 credits of course work
- A thesis (2.5 credits) defended at an oral examination
- Participation in the seminar series of the Institute

Students with academic preparation particularly well suited for their chosen field of study may have their course credit requirements reduced to 2.0 credits. In this case, a 3.0-credit thesis will be required.

The minimum number of courses is 1.5 credits. At least 1.0 credit must consist of lecture courses at the graduate level. The courses PHYS 5900 and PHYS 5901 are courses on Selected Topics, normally given as directed studies, and cannot fulfil this lecture course requirement. Most students will be expected to take PHYS 5002, or another equivalent computing physics course. Students in experimental or theoretical particle physics streams will normally include PHYS 5601, PHYS 5602, PHYS 5701 and PHYS 5702 among their courses.

For the medical physics stream the three areas of specialization are: imaging, therapy, and biophysics. All students are required to take PHYS 5203 and 0.5 credit appropriate physics course from an area of physics other than medical physics. In addition:

- For imaging, PHYS 5204 is required
- For therapy, PHYS 5206 is required
- For biophysics, 0.5 credit chosen from PHYS 5207, cell biology, physiology or anatomy is required

Students with a medical/health physics background may have the selection of required courses adjusted to reflect their preparation and may receive advanced standing for equivalent courses.

A selection from PHYS 5208, PHYS 5209, or, (with approval) other appropriate courses in physics, engineering, computer science, business or law can be used to complete the program.

In special cases, the requirements may also be met by taking 5.0 credits of course work. 1.0 credit must be the selected topics course PHYS 5900.

Students in the physics in modern technology stream must successfully complete the following requirements:

- 3.0 credits of course work
- PHYS 5905
- Students will normally include two of PHYS 5002, PHYJ 5003, PHYJ 5004, PHYJ 5005 among their courses.

Students enrolled in the physics in modern technology stream are required to complete a work term rather than a research thesis. Students in this stream who wish to pursue a research degree should consult with the graduate supervisor. Although every effort is made to find a work term position for every student enrolled in the physics in modern technology stream, no guarantee of employment can be made. To minimize the likelihood of a work term position not being found, enrolment will be limited to reflect the availability of work term placements. In the event that a work term placement cannot be found, students may fulfil the M.Sc. requirements with courses only as described above.

Candidates admitted to the M.Sc. program with more than the minimum course requirements may be permitted to credit towards the degree a maximum of 1.0 credit at the senior undergraduate level. This maximum does not apply to qualifying-year students.

Guidelines for Completion of Master's Degree

With the exception of those students in the physics in modern technology stream, full-time master's candidates are expected to complete all requirements in six terms of registered full-time study. Part-time master's candidates are expected to complete their degree requirements within an elapsed period of three to four calendar years after the date of initial registration.

Students in the physics in modern technology stream are normally expected to complete all their requirements in three successive terms of registered full-time study.

Doctor of Philosophy

Admission Requirements

An M.Sc. in Physics, or a closely related field, is normally required for admission into the Ph.D. program. Students who have been admitted to the M.Sc. program may be permitted to transfer into the Ph.D. program if they demonstrate academic abilities for advanced research in their field.

In exceptional cases, an outstanding student who has completed the honours B.Sc. will also be considered.

Program Requirements (from M.Sc.)

The normal requirements for the Ph.D. degree (after M.Sc.) are:

- A minimum of 2.0 credits of course work at the graduate level
- Students who lack any of the relevant courses recommended for the M.Sc. program will be expected to have completed them (or the equivalents) by the end of their Ph.D. program. In addition, students in experimental or theoretical particle physics should complete PHYS 6601 and PHYS 6602, and students in medical physics should complete PHYS 5209.
- A comprehensive examination designed to demonstrate overall ability in physics and in the candidate's research area, normally within the first year of study. This takes the form of a written examination followed, if necessary, by an oral examination.
- A thesis (8.0 credits) which will be defended at an oral examination. The examining board for all theses will include members of the Institute from both Departments of Physics. The external examiner of the thesis will be external to both Departments of Physics.
- Participation in the seminar series of the Institute

Guidelines for Completion of Doctoral Degree

Full-time Ph.D. candidates admitted on the basis of an M.Sc. are expected to complete all requirements within an elapsed period of four to five years after the date of initial registration. Part-time Ph.D. candidates are expected to complete all requirements within an elapsed period of six years after the date of initial registration.

Residence Requirements

For the M.Sc. degree:

- At least one year of full-time study (or equivalent)

For the Ph.D. degree (from B.Sc.):

- At least three years of full-time study (or equivalent)

For the Ph.D. degree (from M.Sc.):

- At least two years of full-time study (or equivalent)

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

University of Ottawa course numbers (in parentheses) follow the Carleton course number and credit information.

The following course is offered either at Carleton or the University of Ottawa:

PHYS 5701 [0.5 credit] (PHY 5170)

Intermediate Quantum Mechanics with Applications

Angular momentum and rotation operations; Wigner and Racah coefficients; several and many electron problem in atoms; variational and Hartree-Fock formalism; introduction to second quantized field theory; scattering theory.

Prerequisites: PHYS 4707 and PHYS 4708 or permission of the Department.

The following courses are offered only at Carleton:

PHYS 5002 [0.5 credit] (PHY 5344)

Computational Physics

Computational methods used in analysis of experimental data. Introduction to probability and random variables. Monte Carlo methods for simulation of random processes. Statistical methods for parameter estimation and hypothesis tests. Confidence intervals. Multivariate data classification. Unfolding methods. Examples taken primarily from particle and medical physics. Also offered at the undergraduate level, with different requirements, as PHYS 4807, for which additional credit is precluded.

Prerequisite: an ability to program in FORTRAN, Java, C, or C++ or permission of the Department.

PHYS 5101 [0.5 credit] (PHY 8111)

Classical Mechanics and Theory of Fields

Hamilton's principle; conservation laws; canonical transformations; Hamilton-Jacobi theory; Lagrangian formulation of classical field theory.

Prerequisite: permission of the Department.

PHYS 5201 [0.5 credit]

Introduction to Medical Imaging Principles and Technology

Basic principles and technological implementation of x-ray, nuclear medicine, magnetic resonance imaging (MRI), and other imaging modalities used in medicine. Contrast, resolution, storage requirements for digital images. Applications outside of medicine, future trends.

Precludes additional credit for BIOM 5201.

Prerequisite: permission of the Physics Department.

PHYS 5202 [0.5 credit] (PHY 8122)

Special Topics in Molecular Spectroscopy

Topics may include: electronic spectra of diatomic and triatomic molecules and their interpretation using molecular orbital diagrams; Raman and resonance Raman spectroscopy; symmetry aspects of vibrational and electronic levels of ions and molecules in solids; the presence of weak and strong resonant laser radiation. (Also listed as CHEM 5009/CHM 8150).

Prerequisite: permission of the Department.

PHYS 5203 [0.5 credit] (PHY 5161)

Medical Radiation Physics

Interaction of electromagnetic radiation with matter. Sources: X-ray, accelerators, radionuclide. Charged particle interaction mechanisms, stopping powers, kerma, dose. Introduction to dosimetry. Units, measurements, dosimetry devices.

Prerequisite: permission of the Department.

PHYS 5204 [0.5 credit] (PHY 5112)

Physics of Medical Imaging

Physical foundation of and recent developments in transmission X-ray imaging, computerized tomography, nuclear medicine, magnetic resonance imaging, and ultrasound, for the specialist imaging physicist. Image quality, contrast, resolution, SNR, MTF, DQE. Introduction to image processing, system performance assessment.

Prerequisites: PHYS 5203 and PHYS 4203, or permission of the Department.

PHYS 5206 [0.5 credit] (PHY 5164)

Medical Radiotherapy Physics

Radiation therapy process and physics. Ion chamber dosimetry, Monte Carlo techniques of radiation transport, cavity theories, external beam therapy, brachytherapy, dosimetry protocols, detectors used in radiation therapy. Treatment planning, monitor unit calculations, intensity-modulated radiation therapy. Novel and alternate techniques.
Prerequisite: PHYS 5203 or permission of the Department.

PHYS 5207 [0.5 credit] (PHY 5165)

Radiobiology

Physics and chemistry of radiation interactions. Cell biology, DNA damage and repair, survival curves and models, radiosensitivity, oxygen effect. Linear energy transfer, relative biological effectiveness. Whole body radiation effects, radioprotectors, radiosensitizers. Hyperthermia. Molecular techniques in radiobiology. Model tumour systems.
Prerequisite: PHYS 5203 must have been taken, or be taken concurrently, or permission of the Department.

PHYS 5208 [0.5 credit] (PHY 5163)

Radiation Protection

Dose quantities, effects of radiation exposure, fetal risks, scientific basis for protection, dose limits. Background radiation, dose from internal radionuclides. Doses in radiology, incidents in radiation therapy. Shielding design, working with radioactive materials. Instruments and measurement. Radiation protection organizations.
Prerequisite: PHYS 5203 or permission of the Department.

PHYS 5209 [0.5 credit] (PHY 5166)

Medical Physics Practicum

Experience with current clinical medical imaging and cancer therapy equipment, and dosimetry and biophysics instrumentation. The course requires completion of experimental projects on medical imaging, radiotherapy, dosimetry, and biophysics, conducted at local clinics and NRC laboratories.
Prerequisites: PHYS 5203. Also, as appropriate to the majority of projects undertaken, one of PHYS 5204, PHYS 5206, PHYS 5207, or other biophysics course, or permission of the Department.

PHYS 5291 [0.5 credit] (PHY 5167)

Advanced Topics in Medical Physics

Topics may include medical imaging physics, cancer therapy physics, medical biophysics, or radiation protection and health physics. Prerequisites: PHYS 5203 plus, as appropriate to the particular advanced topic offered, at least one of PHYS 5204, PHYS 5206, PHYS 5207; or permission of the Department.

PHYS 5302 [0.5 credit] (PHY 8132)

Classical Electrodynamics

Covariant formulation of electrodynamics; Lenard-Wiechert potentials; radiation reaction; plasma physics; dispersion relations.
Prerequisite: PHYS 4307 or equivalent, or permission of the Department.

PHYS 5318 [0.5 credit] (PHY 5318)

Modern Optics

Electromagnetic wave propagation; reflection, refraction; Gaussian beams; guided waves. Laser theory: stimulated emission, cavity optics, gain and bandwidth, atomic and molecular lasers. Mode locking, Q switching. Diffraction theory, coherence, Fourier optics, holography, laser applications. Optical communication systems, nonlinear effects: devices, fibre sensors, integrated optics.
Also offered at the undergraduate level, with different requirements, as PHYS 4208 for which additional credit is precluded.
Prerequisite: permission of the Department.

PHYS 5601 [0.5 credit] (PHY 5966)

Experimental Techniques of Nuclear and Elementary Particle Physics

The interaction of radiation and high energy particles with matter; experimental methods of detection and acceleration of particles; use of relativistic kinematics; counting statistics.
Prerequisites: PHYS 4307 or equivalent, and PHYS 4707; or permission of the Department.

PHYS 5602 [0.5 credit] (PHY 5967)

Physics of Elementary Particles

Properties of leptons, quarks, and hadrons. The fundamental interactions. Conservation laws; invariance principles and quantum numbers. Resonances observed in hadron-hadron interactions. Three body phase space. Dalitz plot. Quark model of hadrons, mass formulae. Weak interactions; parity violation, decay of neutral kaons; CP violation; Cabibbo theory. Also offered at the undergraduate level, with different requirements, as PHYS 4602, for which additional credit is precluded.
Prerequisite: PHYS 4707 or permission of the Department.

PHYS 5604 [0.5 credit] (PHY 8164)

Intermediate Nuclear Physics

Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models. Scattering theory. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation.
Prerequisite: PHYS 4608 or permission of the Department.

PHYS 5702 [0.5 credit] (PHY 8172)

Relativistic Quantum Mechanics

Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electro-dynamics with some second quantization. Gauge theories. May include introduction to Standard Model.
Prerequisite: PHYS 5701 and permission of the Department.

PHYS 5801 [0.5 credit] (PHY 5140)

Methods of Theoretical Physics I

This course and PHYS 5802 are designed for students who wish to acquire a wide background of mathematical techniques. Topics can include complex variables, evaluation of integrals, approximation techniques, dispersion relations, Pade approximants, boundary value problems, Green's functions, integral equations.

PHYS 5802 [0.5 credit] (PHY 5141)

Methods of Theoretical Physics II

This course complements PHYS 5801.Topics include group theory, discussion of SU2, SU3, and other symmetry groups. Lorentz group.

PHYS 5900 [1.0 credit] (PHY 8290)

Selected Topics in Physics (M.Sc.)

A student may, with the permission of the Department, take more than one selected topic, in which case each full course is counted for credit.
Prerequisite: permission of the Department.

PHYS 5901 [0.5 credit] (PHY 8191)

Selected Topics in Physics (M.Sc.)

Prerequisite: permission of the Department.

PHYS 5905 [1.0 credit] (PHY 5495)

Physics in Modern Technology Work Term

Experience for students enrolled in the physics in modern technology stream. To receive course credit, students must receive satisfactory evaluations for their work term employment. Written and oral reports describing the work term project are required.
Prerequisites: Registration in the physics in modern technology stream of the M.Sc. program and permission of the Department.

PHYS 5909 (PHY 7999)
M.Sc. Thesis
Prerequisite: permission of the Department.

PHYS 6601[0.5 credit] (PHY 8165)
Particle Physics Phenomenology
This course covers much of the required knowledge for research in particle physics from both the experimental and theoretical points of view. Topics may include: standard model, parton model, quark model, hadron spectroscopy, and tests of QCD.
Prerequisite: PHYS 5602 or permission of the Department.

PHYS 6602 [0.5 credit] (PHY 8166)
Advanced Topics in Particle Physics Phenomenology
This course will consist of a variety of seminars and short lecture courses, and will cover topics of immediate interest to the research program of the department.
Prerequisite: PHYS 6601 or permission of the Department.

PHYS 6701 [0.5 credit] (PHY 8173)
Quantum Field Theory
Relativistic quantum field theory; second quantization of Bose and Fermi fields; reduction and LSZ formalism; perturbation expansion and proof of renormalizability of quantum field theories; calculations of radiative corrections and applications.
Prerequisites: PHYS 5701 and PHYS 5702, or permission of the Department.

PHYS 6900 [1.0 credit] (PHY 8490)
Selected Topics in Physics (Ph.D.)
Prerequisite: permission of the Department.

PHYS 6901 [0.5 credit] (PHY 8391)
Selected Topics in Physics (Ph.D.)
Prerequisite: permission of the Department.

PHYS 6909 (PHY 9999)
Ph.D. Thesis
Prerequisite: permission of the Department.
The following courses are offered only at the University of Ottawa:

PHYJ 5001 [0.5 credit] (PHY 5130)
Experimental Characterization Techniques in Materials Science, Physics, Chemistry, and Mineralogy
Survey of experimental techniques used in materials science, condensed matter physics, solid state chemistry, and mineralogy to characterize materials and solid substances. Diffraction. Spectroscopy. Microscopy and imaging. Other analytic techniques.
Prerequisite: permission of the Department.

PHYJ 5003 [0.5 credit] (PHY 5342)
Computer Simulations in Physics
Advanced numerical methods to study large scale problems in the natural sciences; molecular dynamics, Langevin dynamics, Brownian dynamics methods. The use of different thermodynamic ensembles to compute experimentally relevant physical properties, and work with non-equilibrium situations. Methods to handle very large problems on parallel computers.
Prerequisite: PHY 3355 (PHY 3755), PHY 3370 (PHY 3770) and familiarity with FORTRAN, Pascal or C.

PHYJ 5004 [0.5 credit] (PHY 5340)
Computational Physics I
Deterministic numerical methods in physics. Interpolation methods. Numerical solutions of Newton's, Maxwell's and Schrödinger's equations. Molecular dynamics. Non-linear dynamics. Numerical solutions of partial differential equations in physics. Finite elements. This course cannot be combined for credit with PHY 4340 (PHY 4740).

PHYJ 5005 [0.5 credit] (PHY 5341)

Computational Physics II

Interpolation, regression and modeling. Random number generation. Monte Carlo methods. Simulations in thermo-statistics. Fractals, percolation, cellular automation. Stochastic methods. This course cannot be combined for credit with PHY 4341 (PHY 4741).

PHYJ 5006 [0.5 credit] (PHY 5362)

Computational Methods in Material Sciences

Introduction to modern computational techniques used in material science research. Classical molecular dynamics, classical and quantum Monte Carlo methods, plane-wave based electronic band structure calculations, Carr-Parrinello quantum molecular dynamics. Applications to condensed matter systems: basic simulation techniques, force-field based methods, first-principles quantum mechanical methods.
Prerequisite: permission of the Department.

PHYJ 5102 [0.5 credit] (PHY 5361)

Nonlinear Dynamics in the Natural Sciences

Differential and difference equations, Fourier series and data analysis, stability analysis, Poincaré maps, local bifurcations, routes to chaos and statistical properties of strange attractors. Applications of these concepts to specific problems in condensed matter physics, molecular physics, fluid mechanics, dissipative structures, and evolutionary systems.
Prerequisite: permission of the Department.

PHYJ 5308 [0.5 credit] (PHY 5384)

Physics of Fiber Optic Systems

Physics of electromagnetic waves in fiber-optic systems. Laser modulation, chirp effects, noise. Amplitude, frequency, phase modulation. Optical dispersion (chromatic dispersion, polarization mode dispersion and polarization-dependent losses). Fibre losses and nonlinear effects. Optical detectors, receivers, signal to noise ratio, power penalties. Overall system design.

PHYJ 5322 [0.5 credit] (PHY 5322)

Biological Physics

Biological phenomena studied using techniques of physics. Key components of cells. Physical concepts relevant to cellular phenomena: Brownian dynamics, fluids, suspensions, entropy driven phenomena, chemical forces and self-assembly. Biological molecules. Enzymes. Molecular motors. Nerve impulses. Also offered, with different requirements, as PHY 4322. Precludes additional credit for PHY 4322.

PHYJ 5330 [0.5 credit] (PHY 5330)

Fibre Optics Communications

Optical fibres: description, modes, losses. optical transmitters: light-emitting diodes, semiconducting lasers. Optical receivers: design, noise, sensitivity, degradation, performance. System design and performance. Optical amplifiers: dispersion management, pre-compensation schemes, post-compensation techniques, dispersion compensating fibres, optical filters, fibre Bragg gratings, soliton generation, long-haul lightwave systems, high-capacity systems.
Precludes additional credit for ELG 5103.

PHYJ 5331 [0.5 credit] (PHY 5331)

Fibre Optics Sensors

Fundamental properties of optical fibres. Light sources and detectors for optical fibre applications. Fibre optics sensors based on the Mach-Zehnder, Michelson and Fabry-Perot Interferometers, Bragg gratings. signal detection schemes. Distributed sensing and multiplexing. Applications for optical fibre sensors. Temperature and strain measurements.

PHYJ 5332 [0.5 credit] (PHY 5332)

Nonlinear Optics

Nonlinear optical susceptibility; wave equation description of nonlinear optics processes: second harmonic generation, intensity dependent refractive index, sum- and frequency-generation, parametric amplification; quantum mechanical theory of nonlinear optics; Brillouin and Raman scattering; the electro-optic effect; nonlinear fibre optics and solitons.

PHYJ 5333 [0.5 credit] (PHY 5333)

Mode Locked Lasers

Concept and realization of mode locking. Mode locked lasers including Q-switch. Ultrafast pulse generation and measurement. Soliton generation: dispersion and self-phase modulation. Applications to science and technology.

PHYJ 5401 [0.5 credit] (PHY 5100)

Solid State Physics I

Periodic structures, Lattice waves. Electron states. Static properties of solids. Electron-electron interaction. Dynamics of electrons. Transport properties. Optical properties.
Prerequisite: permission of the Department.

PHYJ 5402 [0.5 credit] (PHY 5110)

Solid State Physics II

Elements of group theory. Band structure, tight binding and other approximations, Hartree-Fock theory. Measuring the Fermi surface. Boltzmann equation and semiconductors. Diamagnetism, paramagnetism and magnetic ordering. Superconductivity.
Prerequisite: permission of the Department.

PHYJ 5403 [0.5 credit] (PHY 5151)

Type I and II Superconductors

Flux flow and flux cutting phenomena. Clem general critical state model. Flux quantization, Abrikosov vortex model and Ginzburg-Landau theory. Superconducting tunnelling junctions (Giaevar and Josephson types).
Prerequisite: PHY 4370 or permission of the Department.

PHYJ 5404 [0.5 credit] (PHY 6371)

Topics in Mössbauer Spectroscopy

Recoilless emission/absorption, anisotropic Debye-Waller factors, second order Doppler shifts. Mössbauer lineshape theory with static and dynamic hyperfine interactions. Distributions of static hyperfine parameters. Physics of the hyperfine parameters: origin of the hyperfine field, calculations of electric field gradients. Applications of Mössbauer spectroscopy.
Prerequisite: permission of the Department.

PHYJ 5407 [0.5 credit] (PHY 5380)

Semiconductor Physics I

Brillouin zones and band theory. E-k diagram, effective mass tensors, etc. Electrical properties of semiconductors. Conduction, hall effect, magneto-resistance. Scattering processes. Multivalley models and non-parabolic bands.
Prerequisite: PHY 4380 or permission of the Department.

PHYJ 5408 [0.5 credit] (PHY 5381/PHY 5781)

Semiconductor Physics II: Optical Properties

Optical constants and dispersion theory. Optical absorption, reflection and band structure. Absorption at band edge and excitons. Lattice, defect and free carrier absorption, Magneto-optics. Photo-electronic properties, luminescence, detector theory. Experimental methods.
Prerequisite: PHY 4380 or permission of the Department.

PHYJ 5409 [0.5 credit] (PHY 5951)

Low Temperature Physics II

Helium 3 and Helium 4 cryostats. Dilution refrigerators. Theory and techniques of adiabatic demagnetization. Thermometry at low temperatures. Problems of thermal equilibrium and of thermal isolation. Properties of matter at very low temperature.
Prerequisite: PHY 4355 or permission of the Department.

PHYJ 5502 [0.5 credit] (PHY 5740)

Physique Numérique I

Méthodes numériques déterministes en physique. Techniques d'interpolation. Solutions numérique des équations de Newton, de Maxwell et de Schrödinger. Dynamique moléculaire. Dynamique non-linéaire. Solutions numériques des équations aux dérivées partielles en physique. Éléments finis.
Prerequisite: permission of the Department.

PHYJ 5503 [0.5 credit] (PHY 5741)

Physique Numérique II

Interpolation, régression et modeler. Nombres aléatoires. Techniques de Monte-Carlo. Simulations thermo-statistiques. Percolation, fractales, et automisation cellulaire. Méthodes numériques stochastiques.
Prerequisite: permission of the Department.

PHYJ 5504 [0.5 credit] (PHY 5387)

Physics of Materials

Microscopic characteristics related to the physical properties of materials. Materials families: metals and alloys, ceramics, polymers and plastics, composites, layered materials, ionic solids, molecular solids, etc. Specific materials groups. Equilibrium phase diagrams and their relation to microstructure and kinetics. Experimental methods of characterization. Interactions and reactions.
Prerequisite: PHY 4382 or equivalent. Cannot be combined with PHY 4387.

PHYJ 5505 [0.5 credit] (PHY 5355)

Statistical Mechanics

Ensemble theory. Interacting classical and quantum systems. Phase transitions and critical phenomena. Fluctuations and linear response theory. Kinetic equations.
Prerequisites: PHY 4370 and PHY 3355 or permission of the Department.

PHYJ 5506 [0.5 credit] (PHY 5742)

Simulations numériques en physique

Un cours ayant but d'étudier des méthodes numériques avancées employées dans les problèmes à grande échelle dans les sciences naturelles. Emploi d'ensembles thermo-dynamiques différents, calculs de propriétés physiques expérimentalement pertinentes, et extension aux situations hors d'équilibre. Techniques pour ordinateurs parallèles.
Prerequisite: permission of the Department.

PHYJ 5507 [0.5 credit] (PHY 5922)

Advanced Magnetism

Study of some experimental and theoretical aspects of magnetic phenomena found in ferro-, ferri-, antiferro-magnetic and spin glass materials. Topics of current interest in magnetism.
Prerequisite: PHY 4385 and permission of the Department.

PHYJ 5508 [0.5 credit] (PHY 5320)

Introduction to the Physics of Macromolecules

Chemistry of macromolecules and polymers; random walks and the static properties of polymers; experimental methods; the Rouse model and single chain dynamics; polymer melts and viscoelasticity; the Flory-Huggins theory; the reptation theory; computer simulation algorithms; biopolymers and copolymers.
Prerequisite: permission of the Department.

PHYJ 5509 [0.5 credit] (PHY 5347)

Physics, Chemistry and Characterization of Mineral Systems

The materials science of mineral systems such as the network and layered silicates. In-depth study of the relations between mineralogically relevant variables such as: atomic structure, crystal chemistry, site populations, valence state populations, crystallization conditions. Interpretation and basic understanding of characterization tools.
Prerequisite: permission of the Department.

PHYJ 5703 [0.5 credit] (PHY 6170)

Advanced Quantum Mechanics II

Systems of identical particles and many-body theory. Lattice and impurity scattering. Quantum processes in a magnetic field. Radiative and non-radiative transitions. Introduction to relativistic quantum mechanics.
Prerequisite: PHY 5170 and permission of the Department.

PHYJ 5722 [0.5 credit] (PHY 5722)

Physique Biologique

Application des méthodes de la physique à l'etude des phénomènes biologiques. Composantes principales d'une cellule. Concepts physiques pertinents aux phénomènes cellulaires : dynamique brownienne, liquides, suspensions, phénomènes d'origine entropique, forces chimiques et auto-assemblage. Molécules biologiques. Enzymes. Moteurs moléculaires. Impulsions nerveuses. Offert également, avec des exigences différentes, sous la cote PHY 4722. Precludes additional credit for PHY 4722.

PHYJ 6406 [0.5 credit] (PHY 6382)

Physics of Semiconductor Superlattices

Fundamental physics of two-dimensional quantized semiconductor structures. Electronic and optical properties of superlattices and quantum wells. Optical and electronic applications. This course is intended for students registered for the Ph.D. in semiconductor physics research.
Prerequisite: advanced undergraduate or graduate course in solid state physics and permission of the Department.

PHYJ 6407 [0.5 credit] (PHY 6782)

Physique des super-réseaux à semi-conducteurs

Physique fondamentale des structures quantiques bi-dimensionnelles à semiconducteurs. Propriétés électroniques et optiques des super-réseaux et puits quantiques. Applications à l'électronique et à l'optique. Ce cours est destiné aux étudiants et aux étudiantes inscrits au doctorat en physique des semiconducteurs.
Prerequisite: permission of the Department.

Political Economy

Loeb Building A818
Telephone: 613-520-7414
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carleton.ca/polecon

The Institute

Director of the Institute: Rianne Mahon

The Institute of Political Economy, established in 1989, developed out of the Graduate Summer School of Political Economy, which was formed in 1983. The summer school was built on the strong tradition of interdisciplinary studies at Carleton, and on the interests of numerous faculty at Carleton involved in political economy. Distinguished international scholars have been attracted to teach in the summer school. Through the Institute, these distinguished visitors will now be in residence during the normal academic year, in addition to the summer program.

The Institute offers a program of study and research leading to the degree of Master of Arts in Political Economy, the only program of its kind in Canada. Its interdisciplinary program is designed to offer students both an exposure to the core concepts of political economy and an opportunity to develop individual areas of research concentration.

The program focuses on investigating the relationship between the economy and politics as they affect the social and cultural life of societies, and secondly, focuses on the historical processes whereby social change is located in the interaction of the economic, political, cultural, and ideological moments of social life.

Carleton University has developed a strong tradition in political economy. Faculty members from most of the social sciences and history participate regularly in the Institute. The program's curriculum includes courses with a political economy orientation that are offered by other departments, schools, and institutes. The Master of Arts in Political Economy is an opportunity for students to study political economy from the perspective of different disciplines within a single program.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is B.A.(Honours), with at least high honours standing, in one of the disciplines represented in the Institute. Prospective applicants without such qualifications may be considered for admission if they have both a strong academic record and relevant work experience.

Program Requirements

The Master of Arts in Political Economy is a 5.0 credit program, one of which may be at the 4000- (honours undergraduate) level. Each candidate, in consultation with the Institute, must select and follow one of two optional patterns:

- 3.0 credits, a thesis equivalent to 2.0 credits, and an oral examination of the thesis
- 4.0 credits, a research essay equivalent to 1.0 credit, and an oral examination of the research essay

Whichever pattern is selected, all students in the Institute are required to take PECO 5000 and PECO 5001, two 0.5-credit seminars offered by the Institute.

Academic Standing

All master's candidates must maintain B standing or better (GPA of 8.0). A candidate may, with the recommendation of the Institute and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in 0.5 credit.

Collaborative Ph.D. with a Specialization in Political Economy

The Collaborative Ph.D. with a Specialization in Political Economy is especially designed for doctoral students in participating programs in the Faculties of Arts and Social Science and Public Affairs and Management who wish to enrich their training in a particular discipline or area of study by developing a political economy approach through interdisciplinary dialogue.

Program Coordinator P.R. Mahon, Director

Institute of Political Economy

Supporting Units

The following units participate in the Collaborative Program in Political Economy:

- School of Canadian Studies
- Department of Geography
- Department of History
- Department of Political Science
- School of Public Policy and Administration
- Department of Sociology and Anthropology

The program is managed by the Program Committee, comprised of representatives from the supporting units. The Program Committee is responsible for admitting students into the Collaborative Program and the Coordinator administers the program.

Members of the Collaborative Program

- H. Armstrong, Department of Sociology and Anthropology
- J. Chevalier, Department of Sociology and Anthropology
- J. Clapp, School of Canadian Studies
- W. Clement, Department of Sociology and Anthropology
- B. Curtis, Department of Sociology and Anthropology
- S. Dalby, Department of Geography
- D. Dean, Department of History
- J. DeBardeleben, Department of Political Science
- G. B. Doern, School of Public Policy and Administration
- M. Dolan, Department of Political Science
- P. Dutkiewicz, Department of Political Science
- L. Freeman, Department of Political Science
- C. Gabriel, Department of Political Science
- N. Hillmer, Department of History

- A. Hunt, Department of Sociology and Anthropology
- F. Klodawsky, Department of Geography
- P. Litt, School of Canadian Studies and Department of History
- L. Macdonald, Department of Political Science
- F. Mackenzie, Department of Geography
- R. Mahon,School of Public Policy and Administration, Department of Sociology and Anthropology
- D. Marshall,Department of History
- L. Mills, School of Public Policy and Administration
- D. Muise,Department of History
- R. Paehlke, School of Canadian Studies
- F. Rocher, School of Canadian Studies
- B. Rutherford, Department of Sociology and Anthropology
- P. Ryan, School of Public Policy and Administration
- J. Sangster, School of Canadian Studies
- J. Siltanen, Department of Sociology and Anthropology
- D. Stasiulis, Department of Sociology and Anthropology
- D. Swartz, School of Public Policy and Administration
- I. Wallace, Department of Geography
- W. Walters, Department of Political Science
- R. Warskett, Department of Sociology and Anthropology

Application to the Program

Students who are enrolled in a doctoral program in one of the participating units may apply to the Institute of Political Economy for admission to the Collaborative Program. Admission to the program is determined by the Program Committee and will normally take place before the end of the first year of registration in one of the participating doctoral programs.

Admission Requirements

Admission requirements to the Collaborative Ph.D. with a Specialization in Political Economy are:

Registration in the Ph.D. program of one of the participating units;

Registration in, or successful completion of, at least one course or comprehensive field with political economy content. This will normally be a course offered by the student's home unit but could also be selected from appropriate courses in other units. See Selection of Courses for a list of acceptable courses;

Selection of a thesis topic with political economy content. The Program Committee will determine, in consultation with the supervisor, if the political economy content of the thesis meets the requirements of the Collaborative Program.

Degree Requirements

Students enrolled in the Collaborative Program in Political Economy must meet the requirements of their respective home units as well as those of the Collaborative Program. The requirements of the Collaborative Program do not, however, add to the number of credits students are required to accumulate by their home unit and the credit value of the degree remains the same.

The requirements of the Collaborative Program are:

1. PECO 6000 (0.5 credit) Political Economy: Core Concepts

2. In addition, the following requirement(s) specific to the doctoral programs of the supporting units:

- Canadian Studies: a relevant political economy course from the approved list (0.5 credit) or the comprehensive in the major field of Policy, Economy and Society
- Geography: PECO 6000 replaces GEOG 6003 or GEOG 6004 (0.5 credit), the field seminar The Geography of Societal Change, and students must register in GEOG 6906, the comprehensive The Geography of Societal Change.
- History: a relevant political economy course from the approved list (0.5 credit) or minor comprehensive field in political economy
- Political Science: a relevant political economy course from the approved list (0.5 credit).
- Public Policy and Administration: a relevant political economy course from the approved list (0.5 credit) .
- Sociology: a relevant political economy course from the approved list (0.5 credit) or part of comprehensive preparation in the sub-field of political economy.

3. Submission and successful defence of a doctoral thesis on a political economy topic in the participating unit.

The proposed topic must be approved by the student's home unit and by the Program Committee. At least one of the student's advisors or members of the examining committee will be selected from among the core faculty for the Collaborative Program.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at **central.carleton.ca**

The Institute's courses are not normally open to undergraduate students.

PECO 5000 [0.5 credit]
Theories of Political Economy
A survey of the core concepts and ideas proposed by both the founders and modern practitioners of political economy. Particular attention will be paid to contemporary theorists and classical theorists such as Smith, Ricardo, Marx, Mill, Schumpeter, Keynes, Veblen, and Innis.

PECO 5001 [0.5 credit]
The Methodology of Political Economy
An examination of the methods, procedures, and rules for developing theory and guiding inquiry in political economy research, including topics such as logic of inquiry, conceptualization, research design, dialectics, level of analysis, comparison, evidence and statistics.

PECO 5501 [0.5 credit]
Selected Problems in Political Economy I
(Also listed as SOCI 5504 and PSCI 5501.)

PECO 5502 [0.5 credit]
Selected Problems in Political Economy II
(Also listed as SOCI 5505 and PSCI 5502.)

PECO 5900 [0.5 credit]

Tutorial in Political Economy
Directed readings on selected aspects of political economy, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.
Prerequisite: permission of the Director.

PECO 5908 [1.0 credit]

Research Essay
Directly linked to the student's course work, the research essay must be interdisciplinary in approach.

PECO 5909 [2.0 credits]

M.A. Thesis
The thesis is an alternative to the research essay. It must also be interdisciplinary in approach, and requires greater substance and originality than the Research Essay. Normally, a student's thesis committee will be composed of members from more than one discipline.

PECO 6000 [0.5 credit]

Political Economy: Core Concepts
Core concepts in political economy, drawn from classical and contemporary writings. Topics will be selected in consultation with participating units, taking into account the potential number of students, their research interests and those of the participating units.

Selection of Courses

In addition to the graduate courses offered by, or associated with, the Institute, the courses listed below are relevant to students of political economy and would, with the prior approval of the Institute, be used to design a coherent and internally complementary set of courses to fulfil degree requirements. The list is not exclusive and is subject to change. Moreover, students in the Master's program may select 1.0 credit in political economy that is offered at the 4000-level.

Note: the number of spaces in graduate courses offered by other departments may be limited, and registration may be conditional upon obtaining the prior approval of the department concerned. It is the student's responsibility to ensure that permission is obtained from the appropriate department prior to registering in any of the following courses.

The Institute expects to attract high quality graduate students who will be likely to continue to a second post-graduate degree. Master's students will be directed to consult with the department where they might wish to pursue doctoral studies so that they may select courses that will prepare them for this next stage.

Business
BUSI 5300, BUSI 5301

Canadian Studies
CDNS 5101, CDNS 5102, CDNS 5201, CDNS 5202, CDNS 5501, CDNS 5601

Economics
ECON 5101, ECON 5201, ECON 5202, ECON 5403, ECON 5500, ECON 5504, ECON 5505, ECON 5507, ECON 5806, ECON 5807

Geography

- GEOG 4207 Urban Development and Analysis

- GEOG 4300 Comparative Environmental Movements
- GEOG 4400 Environmental Geopolitics
- GEOG 4401 Geographies of Globalization
- GEOG 5005, GEOG 5200, GEOG 5400, GEOG 5401, GEOG 5404, GEOG 5500

History
HIST 5506, HIST 5508, HIST 5509, HIST 5602, HIST 5800

International Affairs
INAF 5007, INAF 5101, INAF 5300, INAF 5302, INAF 5303, INAF 5501, INAF 5502, INAF 5401, INAF 5601

Law

- LAWS 4001 Law, Family and Gender
- LAWS 4002 Feminist Theories of Law
- LAWS 4003 Historical Perspectives on Law, Economy and Society
- LAWS 5002, LAWS 5003, LAWS 5004, LAWS 5005, LAWS 5006, LAWS 5007, LAWS 5200, LAWS 5302

Political Science

- PSCI 4000 Topics in Canadian Government and Politics
- PSCI 4002 Policy Seminar
- PSCI 4009 Quebec Politics
- PSCI 4102 Politics of Western Liberal Democracies
- PSCI 4103 The State in Advanced Capitalist Societies
- PSCI 4104 Theory and Practice in Third World Development
- PSCI 4105 Selected Problems in Third World Development
- PSCI 4401 Business-Government Relations in Canada
- PSCI 4500 Feminist Analysis in Comparative Perspective
- PSCI 4505 Transitions to Democracy
- PSCI 4603 Analysis of International Political Economy
- PSCI 4604 Selected Problems in International Political Economy
- PSCI 5003, PSCI 5008, PSCI 5101, PSCI 5105, PSCI 5107, PSCI 5202, PSCI 5501, PSCI 5502, PSCI 5504, PSCI 5507, PSCI 5509, PSCI 5607

Public Administration
PADM 5001, PADM 5002, PADM 5107, PADM 5401, PADM 5604, PADM 5607, PADM 5701, PADM 5703, PADM 5806, PADM 5808

Social Work

- SOWK 4102 Aboriginal Peoples and Social Policy
- SOWK 4103 Practice and Policy in Immigration
  SOWK 5102, SOWK 5105, SOWK 5106, SOWK 5301, SOWK 5805

Sociology and Anthropology
SOCI 5000, SOCI 5002, SOCI 5007, SOCI 5109, SOCI 5202, SOCI 5204, SOCI 5205, SOCI 5209, SOCI 5300, SOCI 5301, SOCI 5302, SOCI 5308, SOCI 5400, SOCI 5404, SOCI 5405, SOCI 5408, SOCI 5409, SOCI 5500, SOCI 5504, SOCI 5607, SOCI 5608, SOCI 5804, SOCI 5806

Political Science

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The Department

Chair of the Department: L. Macdonald
Associate Chair: V. Bhatia
Departmental Supervisor of Graduate Studies: W. Cross
Assistant Supervisor of Graduate Studie: E. Sloan
Faculty Co-op Advisor: E. Sloan

Carleton University is home to one of the largest concentrations of political scientists in Canada. It provides a challenging intellectual environment for students interested in developing the skills necessary to understand, analyse or participate in politics at the local, national and international levels. Its location in Canada's capital city, close to governmental institutions, embassies and non-governmental organizations, makes it an ideal location from which to learn about and study politics.

The Department offers graduate programs leading to the M.A. and Ph.D degrees in Political Science. The Department's strengths enable it to provide students with high quality advanced training across the entire spectrum of political science, including political theory, Canadian government and politics, comparative government and politics, international relations and public affairs and policy analysis. Graduate studies at Carleton will both acquaint students with the history and traditions of political thought and afford them an opportunity to study and research contemporary issues, problems and institutions. We encourage students to cross scholarly boundaries in pursuit of knowledge, and to frame their studies in terms of local, comparative and global perspectives. As a result of their training, many of the Department's graduate students have gone on to work in governmental and non-governmental organizations, and to teach and conduct research at leading universities in Canada and around the world.

Qualifying-Year Program

Applicants with a general (three-year) B.A. in Political Science, with second-class standing, may be considered for admission to a qualifying-year program. Candidates who complete the qualifying year with high honours standing may be considered for admission to the master's program the following year.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is B.A.(Honours) (or the equivalent) in Political Science, with at least high honours standing.

The Faculty of Graduate Studies and Research requires applicants whose native language is not English to be tested for proficiency in English. Applicants to the Political Science graduate program

must submit a CAEL Assessment score of a minimum of 70 or a TOEFL score of a minimum of 237 (computer-based) or 580 (regular).

Honours graduates in fields other than political science will be considered on the basis of their academic background and standing, and will be judged on a case-by-case basis. Those with only minor deficiencies may be required to take certain specified courses, while others whose degrees are less closely related to political science may be required to register in the qualifying year, at the discretion of the Department. Graduates of three-year programs in political science will be required either to complete the fourth year of an honours degree and reapply, or register in the qualifying year (see above), depending on work completed to date and academic standing.

Program Requirements

Details on all program requirements are provided in the departmental Guidelines for M.A. Candidates.

All master's candidates will fulfil a 5.0-credit program requiring departmental approval. A maximum of 1.0 credit may be taken at the 4000-level. The student may choose to take a maximum of 1.0 credit outside the Department of Political Science.

All candidates, in consultation with the Department, will pursue their degree by following one of three program patterns:

- 5.0 credits in approved courses
- Research Essay (1.0 credit) and 4.0 credits in approved courses
- Thesis (2.0 credits) and 3.0 credits in approved courses

All M.A. students must complete a language requirement prior to graduation. This language will normally be French, except where a degree of proficiency in another language is deemed appropriate in relation to the student's program of studies. The language requirement may be satisfied by passing a Departmental French language test. Departmental language tests are administered twice a year. The language requirement may also be satisfied by passing an approved language course with a grade of B- or better. This course will normally be FINS 2105. Students whose research interests require research skills skill beyond the basic methods requirement may obtain permission from the Department to substitute this advanced research skill for the language requirement.

It is anticipated that candidates will enter having taken some political theory at the undergraduate level. Those who have not will be required to take PSCI 2300, a 1.0-credit course over and above the normal M.A. program requirements.

It is anticipated that candidates will enter having taken a methods course at the undergraduate level. Those who have not may be required, depending on the course pattern chosen, to take PSCI 5700, a 0.5-credit course which can be included as part of the 5.0-credit requirement. When appropriate and related significantly to the program of study, another methods course, such as PSCI 5304, PSCI 5701 or PSCI 5702 may be substituted for PSCI 5700.

Defences

In the case of the student choosing a thesis, the thesis will be evaluated by three people: the student's thesis supervisor from the Department, a second reader from the Department, and an external third reader who is generally from another Carleton Department but may sometimes come from outside the University. A thesis must be defended orally before the three evaluators. No letter grade is assigned, but notations of Pass with Distinction, Satisfactory, and Unsatisfactory are assigned.

In the case of the student choosing a research essay, that essay will be evaluated by two of the Department's faculty members including the supervisor and a second reader, and a letter grade will be assigned. An oral defence of the essay is not required but may be requested by the supervisor or second reader.

Academic Standing

All master's candidates must obtain a B standing or better (GPA 8.0). One grade of C+ may be allowed.

Co-op Option

A co-op option is available to full-time students in the M.A. program. Students admitted to this option must satisfactorily complete at least two work terms in order to graduate with a co-op designation on their transcripts. These work terms are four months in duration and locate students in government departments or other organizations in order to work at a junior officer level. Students register in one of PSCI 5911, PSCI 5912 or PSCI 5913 Co-operative Work Term; however the coordination of the work terms is done by the University's Co-op office.

Washington Center Internship Program

The Washington Center Internship Program is open to full time master's students who have completed at least two terms of study at Carleton. Admission is open to students with at least a 9.5 GPA in Political Science graduate courses. Successful completion of the program satisfies the requirements for one term of full-time study (1.5 credits). Students spend one term (fall, winter or summer) in Washington, D.C. They serve four days a week as an intern in Washington, D.C. and also take two seminar courses offered by faculty of The Washington Center. The normal 1.5 credit course load for participants in the program is:

- PSCI 5904 (0.5 credit), Washington Center Internship
- PSCI 5905 (0.5 credit), Washington Center Seminar I
- PSCI 5906 (0.5 credit), Washington Center Seminar II

Full information on the program and application forms can be obtained from the Department of Political Science.

Doctor of Philosophy

The Ph.D. program in political science normally will be undertaken on a full-time basis. However, in cases of exceptional merit, the Department may accept a few candidates for the degree on a part-time basis.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or its equivalent) in political science with high honours standing or better.

The Faculty of Graduate Studies and Research requires applicants whose native language is not English to be tested for proficiency in English. Applicants to the Political Science graduate program must submit a CAEL Assessment score of a minimum of 70 or a TOEFL score of a minimum of 237 (computer-based) or 580 (regular).

Applicants should note, however, that meeting the admission requirement does not guarantee admission to the program. Review of the department's competitive selection process indicates that students with a GPA below 10.0 (A-) in the master's program are generally not recommended for admission to the doctoral program. Students applying on the basis of a master's degree from other disciplines will be considered on a case-by-case basis, and may be required to take additional courses as part of the program.

Program Requirements

Details on all program requirements are provided in the departmental **Guidelines for Ph.D. Candidates.**

The normal program requirements for Ph.D. candidates are outlined in the General Regulations section of this Calendar.

It is anticipated that Ph.D. candidates will enter having taken some political theory at the undergraduate level, regardless of their desired field of specialization. Those who have not will be required to take PSCI 2300, a 1.0-credit course in addition to the normal Ph.D. requirements. If statistical proficiency is needed for the preparation of the thesis, students will also be expected to take a course in research methods which can be included as part of the 10.0-credit requirement (see section titled Research Skill Requirement).

All Ph.D. candidates will fulfil a 10.0-credit program requiring departmental approval. A maximum of 1.0 credit may be taken at the 4000-level. The student may choose to take a maximum of 1.0 credit outside the Department of Political Science.

- At least 1.0 credit at the graduate level in each of the candidate's two major fields of study; a GPA of 9.0 or better must be obtained in these courses for students to be allowed to proceed to the comprehensive examinations.
- Satisfactory completion of PSCI 6900 (0.5 credit), Ph.D. Field Examination I and PSCI 6905 (0.5 credit), Ph.D. Field Examination II. Field examinations are normally written on two occasions each year, in April and August.
- Proficiency in a research skill, as outlined under research skill requirement
- At least 1.0 credit will normally be taken during the second year of the program in fields allied to the major topics of the thesis. This credit will normally be fulfilled through regular course work rather than tutorials.
- Successful completion of PSCI 6906 (1.0 credit)
- A public defence, in English, of a written thesis proposal
- A 5.0-credit thesis, written in English or French, which will be defended publicly in English at an oral examination.

Full-time students are normally required to complete the comprehensive examinations within 12 months of entering the program, and must normally complete the public defence of the thesis proposal, preceded by its formal acceptance by the supervisory committee, within 24 months of entering the doctoral program.

Upon entry to the program, each Ph.D. candidate will be assigned a faculty member to advise them on their studies. Students' programs, including the choice of supervisor and the thesis committee, must be approved by the Department. The thesis supervisor will normally be chosen from among faculty members in the Department of Political Science. Upon approval of the thesis supervisor and the Department, committee members may be chosen from elsewhere within the University.

Research Skill Requirement

Ph.D. candidates must demonstrate the ability to use a research skill appropriate to their program. The research skill requirement will normally be satisfied before the defence of the thesis proposal, and will take one of the following forms:

- An ability to read and translate French or another language appropriate to their course of study; or the ability to speak a language other than English sufficient to conduct interviews in that language
- An approved political science methods course, workshop, or colloquium, equivalent to 0.5 credit; or any one of the following courses (or an approved alternative): PSCI 5700, PSCI 5701, or PSCI 5702.

Comprehensive Examinations

All Ph.D. candidates must successfully complete a written comprehensive examination in each of their two major fields. Field examinations normally take place twice yearly, in April and August. At the discretion of the Department, candidates may be required to take an oral examination following the written examination.

The fields of study for the Ph.D. comprehensive examination are to be chosen from the following list:

Political Theory

- Democracy in the Age of Global Technology
- Politics, Statecraft and the Common Good
- Tradition, Interpretation and Civic Hermeneutics
- Ideology, Power and Political Morality
- Politics and Statecraft in Non-Western Traditions
- Religion, Civil Association and Individualism
- Collective Identities: Gender, Race and Nation

Public Affairs and Policy Analysis

- Canadian and Comparative Public Sector Reform
- Public Policy, Public Opinion and Public Belief Systems
- Methods for Quantitative Analysis and Evaluation
- Gender and Race in Public Policy and Administration
- Socio-Technical Change and Policy Design
- Political Communication, Political Persuasion and Social Marketing
- Domestic Security Policy and Management

Canadian Government and Politics

- Federalism and the Constitution
- Political Institutions and Processes
- Political Culture and Socialization
- Political Economy
- Provincial, Territorial and Local Government and Politics
- Administration and Public Policy Analysis
- Foreign Policy and Relations
- Canadian Political Thought and Ideology
- Gender and the State
- The Politics of Identity, Difference and Movements for Change

- Communications and Media

International Relations

- Foreign Policy Analysis
- Gender and International Relations
- Global Governance and International Organization
- Global Political Economy
- International Development
- International Political Sociology
- International Relations Theory
- International Security

Comparative Government and Politics

a) Countries and Areas

- Europe and the European Union
- Russia and Soviet Successor States
- North America
- Latin America
- Africa
- Asia
- Middle East

b) Topics or Themes

- State and Civil Society
- Political Governance and Institutions
- Development
- Social Movements
- Nationalism, Citizenship, Race and Ethnicity
- Political Behavior
- Gender and Politics
- Political Economy

Thesis Proposal

All students must publicly defend a thesis proposal after completing their comprehensive examinations. Full-time students must complete this requirement within the first two years of registration in the program.

Collaborative Ph.D. with a Specialization in Political Economy

The Department of Political Science and the Institute of Political Economy offer a Collaborative Program in Political Economy at the Ph.D. level. For further details, see the Institute of Political Economy's Collaborative Ph.D. with a Specialization in Political Economy section of this Calendar.

Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the Undergraduate Calendar) may be taken by graduate students.

Please note that not all of these courses are offered every year. Students should consult the timetable published each year in early June.

Political Science

PSCI 4000 Topics in Canadian Government and Politics
PSCI 4002 Policy Seminar: Problems of Northern Development
PSCI 4003 Politics and the Media
PSCI 4005 Stability, Justice and Federalism
PSCI 4008 National Security and Intelligence in the Modern State
PSCI 4009 Quebec Politics
PSCI 4103 The Modern State
PSCI 4104 Theory and Practice in Third World Development
PSCI 4105 Selected Problems in Third World Development
PSCI 4107 Political Participation in Canada
PSCI 4108 Canadian Provincial Government and Politics
PSCI 4109 The Politics of the Canadian Charter of Rights and Freedoms
PSCI 4204 Elections
PSCI 4205 Identity Politics
PSCI 4207 Globalization, Adjustment and Democracy in Africa
PSCI 4208 Queer Politics
PSCI 4304 Political Inquiry
PSCI 4305 Contemporary Political Theory
PSCI 4308 History of Political Inquiry
PSCI 4309 Contemporary Approaches to Political Enquiry
PSCI 4400 Socio-Technical Change and Public Policy Design
PSCI 4402 Gender, State, and Public Policy
PSCI 4403 Reproductive Rights Policy in North America
PSCI 4407 Public Policy: Content and Creation
PSCI 4408 Public Affairs Management and Analysis
PSCI 4409 Issues in Development Management
PSCI 4500 Gender and Globalization
PSCI 4501 Gender and Politics in Post-Communist Societies
PSCI 4502 Post-Soviet States and Societies
PSCI 4503 Politcs of Central Eurasia
PSCI 4505 Transitions to Democracy
PSCI 4506 Women and Politics in North America
PSCI 4601 Foreign Policies of Soviet Successor States
PSCI 4602 Bargaining and Negotiation
PSCI 4603 Analysis of International Political Economy
PSCI 4604 Selected Problems in International Political Economy
PSCI 4605 Gender in International Relations
PSCI 4606 American Foreign Policy
PSCI 4607 Politics of North America
PSCI 4609 European Integration and European Security
PSCI 4800 Advanced International Relations Theory
PSCI 4801 Selected Problems in Global Politics
PSCI 4802 International Politics of Africa
PSCI 4803 Foreign Policies of Major East Asian Powers

PSCI 4806 Translatlantic Security Issues
PSCI 4807 Migration and Mobility: Politics of Citizenship and Identity

Students are encouraged to look for courses within Carleton in the Departments of Economics, Geography, History, Law, Philosophy, and Sociology and Anthropology; the Schools of Business, Journalism and Communication, Public Administration, and the Norman Paterson School of International Affairs; and in the Institutes of European and Russian Studies, and Political Economy. They are equally strongly encouraged to look for courses in the Departments of Political Science and Philosophy at the University of Ottawa.

All courses selected will be subject to the approval of the Department, on grounds of appropriateness to the program of study and the avoidance of excessive overlap between courses.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Enrolment in graduate courses requires the permission of the Department, through the supervisor of graduate studies.

PSCI 5003 [0.5 credit]
Political Parties in Canada
A seminar on political parties and party systems in Canadian federal politics, including an examination of patterns of historical development, party organization and finance, relationships with social movements, and the impact of Canadian federalism.

PSCI 5006 [0.5 credit]
Legislatures and Representation in Canada
The role of Parliament and of the individual M.P. in terms of policy making, party discipline, and differing conceptions of representation. Also offered at the undergraduate level, with different requirements, as PSCI 4006, for which additional credit is precluded.

PSCI 5008 [0.5 credit]
The Politics of Climate Change
The politics and policy of climate change. Development of the climate change issues, international negotiations and agreements, national response strategies, perspectives on social and technological change, and the Canadian policy approach.

PSCI 5009 [0.5 credit]
Canadian Political Economy
A seminar on political economy as a traditional and contemporary approach to the study of Canadian politics and the Canadian state. Canada's economic development, social relations (including gender and race relations), and position in the international political economy is explored.

PSCI 5100 [0.5 credit]
Indigenous Politics of North America
Issues of governance regarding the original peoples of Canada, Mexico and the United States before and since the European invasion, including: movement for restoration of cultural, socio-economic, political, land and self-government rights. Also offered at the undergraduate level, with different requirements, as PSCI 4206, for which additional credit is precluded.

PSCI 5101 [0.5 credit]

Canadian Federalism

A study of the evolution and contemporary operation of the Canadian federal system, noting particularly the specific social, political, economic, and structural features which underlie its operational performance, its resilience in crisis, and its potential for adaptation.

PSCI 5103 [0.5 credit]

Canada-EU Relations

Relations between Canada and Europe in the context of European integration, with attention to policy issues affecting the relationship and/or areas of common policy challenges. Precludes additional credit for PSCI 5609 and EURR 5106 if taken in the summer of 2004-05 or 2005-06. (Also listed as EURR 5108.)
Prerequisite: previous course in European integration or permission of the instructor. Intensive two week summer module.

PSCI 5105 [0.5 credit]

Post-Communist Politics in East Central Europe

A comparative examination of the emergence of post-communist political systems in East Central Europe.

PSCI 5106 [0.5 credit]

The Politics of Post-Soviet Successor States

A seminar on selected problems of nation-building in Russia, Ukraine, and other Soviet successor states.

PSCI 5107 [0.5 credit]

Globalization, Adjustment and Democracy in Africa

The nature of global pressures in Africa as states go through a "second wind" of political and economic change.
Also offered at the undergraduate level, with different requirements, as PSCI 4207, for which additional credit is precluded.

PSCI 5109 [0.5 credit]

Comparative Public Policy

A review of approaches to the study of policy, of the impact of political factors on policy, and of the substance of policy choices in such domestic fields as communications, social security, health, industrial and rural development policies in selected countries.

PSCI 5110 [0.5 credit]

Post-Soviet States and Societies

The relationship between social forces and state structures at both the national and local levels in the USSA and the post-soviet states. Precludes additional credit for EURR 4002. (Also listed as EURR 5002).

PSCI 5200 [0.5 credit]

Nationalism

A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.

PSCI 5201 [0.5 credit]

Politics in Plural Societies

A seminar on politics in multicultural societies and multi-national states, including settler and post-colonial societies. Topics may include: conflict relating to race, religion, language, regionalism, intra-state nationalism, multicultural policies and theories of pluralism.

PSCI 5202 [0.5 credit]

Politics of Third World Development

A seminar examining the politics of development and underdevelopment in the Third World. Topics covered include theory, selected issues, and case studies from Africa, Asia, and Latin America.

PSCI 5203 [0.5 credit]

Southern Africa After Apartheid

An exploration of he pathology of apartheid, the reasons for its end, and prospects for democratization and development in southern Africa in the era of globalization. Also offered at the undergraduate level, with different requirements, as PSCI 4203, for which additional credit is precluded.

PSCI 5204 [0.5 credit]

Elections

The conduct and meaning of elections in contemporary states. Attention to the connection of elections to concepts of representation, policy mandates, and political parties, and to electoral systems and referenda.
Precludes additional credit for PSCI 4204 if taken before 2006-07.

PSCI 5205 [0.5 credit]

Problems in American Government I

A research seminar on topics such as the distribution of power, decision-making processes, the impact of technology, strains in intergovernmental relations, civil-military relations, governmental news management and secrecy; executive accountability, and impediments to reform of Congress and the presidency.

PSCI 5300 [0.5 credit]

The Political in Non-Western Texts

'The political' in the works of both pre-modern and modern masters in non-western traditions, including the Persian, Indian, Chinese, and Arab.

PSCI 5302 [0.5 credit]

Democratic Theories

Analysis of various theories of democracy and community, from classical to modern.

PSCI 5303 [0.5 credit]

Governance, Power, and Politics

Critical theories and concepts of governance, and recent developments in political sociology. Topics may include forms of capitalism, governmentality, sovereign power, biopolitics, and citizenship. Also listed as SOCI 5407. Also offered at the undergraduate level, with different requirements, as PSCI 4303, for which additional credit is precluded.

PSCI 5304 [0.5 credit]

Political Inquiry

This seminar focuses on the major approaches to research in political areas as discussed in contemporary philosophy of the social sciences, exploring the variety of explanatory strategies in use in the contemporary study of politics.
Precludes additional credit for PSCI 5700.

PSCI 5305 [0.5 credit]

Political Thought in the Modern Muslim Middle East

Contemporary political thought in the Muslim Middle East. Secular and religious responses to the challenges of modernity. Readings may include writings of Arab, Turkish, and Iranian intellectuals.
Also offered at the undergraduate level, with different requirements, as PSCI 4302, for which additional credit is precluded.

PSCI 5306 [0.5 credit]

North American Political Traditions

A seminar on the interpretations that may include American, Mexican, anglo-Canadian and franco-Canadian political traditions.
Precludes additional credit for PSCI 5305.

PSCI 5308 [0.5 credit]

Concepts of Political Community I

A critical survey of concepts of political community, including the common good, justice, citizenship, statesmanship, democracy, and legitimacy, from ancient, modern, and contemporary political theory.
Precludes additional credit for PSCI 4306.

PSCI 5309 [0.5 credit]

Concepts of Political Community II

A continued critical survey of concepts of political community, including the common good, justice, citizenship, statesmanship, democracy, and legitimacy, from ancient, modern, and contemporary political theory.
Precludes additional credit for PSCI 4307.
Prerequisite: PSCI 5308 or permission of the Department.

PSCI 5402 [0.5 credit]

Politics of Diversity in Public Affairs

An examination of the implications of diversity in public affairs including gender, race, sexual orientation and disability. Their impact on public policy creation and its implementation in public administration.

PSCI 5405 [0.5 credit]

Public Administration in Developing Countries

A seminar on the literature and characteristics of development administration; comparison by region, country, and topic.

PSCI 5409 [0.5 credit]

Research Seminar in Public Administration

The content of this seminar will vary from year to year according to faculty research interests and student demand.

PSCI 5501 [0.5 credit]

Selected Issues in Political Economy I

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process. (Also listed as PECO 5501 and SOCI 5404.)

PSCI 5502 [0.5 credit]

Selected Issues in Political Economy II

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process. (Also listed as PECO 5502 and SOCI 5505.)

PSCI 5503 [0.5 credit]

Topics in European Politics

A research seminar dealing with a central theme of current research in European politics.
Precludes additional credit for PSCI 5500.

PSCI 5506 [0.5 credit]

Gender and Politics

Selected gender dimensions of politics in comparative perspective. Topics may include: gendered nature of authority, gender regimes and state forms, feminist accounts of citizenship, representation, power and democracy, women's movements and anti-feminist movements, identity politics, gendered accounts of nationalism and multiculturalism.

PSCI 5507 [0.5 credit]

Social Movements and Civil Society in Comparative Perspective

Major theoretical approaches to social movements and civil societies in different countries. Specific movements to be examined may include the women's movement, the environmental movement, and the anti-globalization movement.

PSCI 5509 [0.5 credit]

Governing in the Global Economy

The course examines how national states respond to challenges of governing in an increasingly interdependent global economy. The course will be comparative in its focus, emphasizing advanced industrial societies primarily in western Europe and Canada.

PSCI 5600 [0.5 credit]

Origins and Evolution of the Discipline of International Relations

The disciplinary development of the academic field of International Relations. A critical examination of the historiography of the field, focusing on its great debates, institutional and national boundaries, and contemporary identity. Also offered at the undergraduate level, with different requirements, as PSCI 4600, for which additional credit is precluded.

PSCI 5601 [0.5 credit]

Analysis of Canadian Foreign Policy

A research seminar on contemporary Canadian external policies, with emphasis on the analysis of cases and issues, and comparisons with other national actors.

PSCI 5602 [0.5 credit]

Ethics in International Relations

Historical and contemporary approaches to normative theory and ethics in international relations, including Kantian, Hegelian, Marxist, postmodern and feminist ethics. Issues may include poverty and justice, human rights and humanitarian intervention.

PSCI 5607 [0.5 credit]

Politics of North America

Continentalism in Canadian foreign policy during the twentieth century, charting regional, economic, political, and defence relations in North America.
Precludes additional credit for PSCI 4607 if taken before 2006-07.

PSCI 5608 [0.5 credit]

European Integration and European Security

A seminar focusing on issues related to the formation of supra-national decision-making structures in Europe. Also offered at the undergraduate level, with different requirements, as PSCI 4608, for which additional credit is precluded. (Also listed as EURR 4104/5104).

PSCI 5609 [0.5 credit]

Selected topics in European Integration Studies

A seminar focusing on selected topics related to European integration in the post-World War II period. (Also listed as EURR 5106).

PSCI 5700 [0.5 credit]

Basic Research Methods

A course in applied research design and methodology, with emphasis on empirical research strategies that are amenable to quantification. Master's students who have not completed PSCI 2700 (or its equivalent) with high honours or better standing may be required to take this course.

PSCI 5701 [0.5 credit]

Intermediate Polimetrics for Micro Data

Intermediate research designs and statistical techniques primarily used in analyzing survey data. Selected topics may vary from year to year. Students intending to do research based on micro data are advised to take this course. Also offered at the undergraduate level, with different requirements, as PSCI 4701, for which additional credit is precluded.

Prerequisite: PSCI 5700 or permission of the Department.

PSCI 5702 [0.5 credit]

Intermediate Research Methods for Applied Political Science

Applied methods for policy, politics and public affairs. Primarily quantitative but may have qualitative elements. Also offered at the undergraduate level, with additional or different requirements, as PSCI 4702 for which additional credit is precluded.
Prerequisite: PSCI 5700 or permission of the Department.

PSCI 5801 [0.5 credit]

Foreign Policies of African States

The foreign policy determinants and international behaviour of African states. Each year, the seminar focuses on a particular issue area.
Precludes additional credit for PSCI 5802.
Prerequisite: permission of the Department.

PSCI 5802 [0.5 credit]

Political Economy of Global Finance

An exploration of the organization of the global financial system. Issues include the relationship between global finance and the state and problems associated with governing global finance. Also offered at the undergraduate level, with different requirements, as PSCI 4805, for which additional credit is precluded.

PSCI 5803 [0.5 credit]

Transatlantic Security Issues

NATO as a political and military alliance. NATO and 21st-century threats. Security roles for the European Union. Broader transatlantic security issues.
Precludes additional credit for PSCI 4806 if taken before 2006-07.

PSCI 5805 [0.5 credit]

Foreign Policy Analysis

A research seminar dealing with selected problems in the study of foreign policy formulations and outcomes.

PSCI 5806 [0.5 credit]

Strategic Thought and Issues in International Security

A research seminar on the evolution of classical and contemporary strategic thought, and on current issues in international security.

PSCI 5807 [0.5 credit]

Analysis of International Organizations

A research seminar on process and change in contemporary forms of international organization.

PSCI 5808 [0.5 credit]

International Political Economy

A seminar on the changing international division of labour, and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy. (Also listed as INAF 5808.)
Prerequisite: Work at a senior undergraduate level in at least two of the following: international relations, development studies, international trade, or political economy; or permission of the Department.

PSCI 5810 [0.5 credit]

Approaches to Environmental Politics

Theoretical and methodological approaches to research in the field of environmental politics, including but not limited to public policy research. A variety of institutionalist, political economy, political ecology, and post-modern approaches will be examined.

PSCI 5900 [1.0 credit]
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the Department.

PSCI 5901 [0.5 credit]
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the Department.

PSCI 5904 [0.5 credit]
Washington Center Internship
A one-term internship in the NAFTA Leaders Program of The Washington Center, offered in Washington D.C.
Prerequisite: permission of the Department.

PSCI 5905 [0.5 credit]
Washington Center Seminar I
A seminar offered by The Washington Center.
Prerequisite: permission of the Department.

PSCI 5906 [0.5 credit]
Washington Center Seminar II
A seminar offered by The Washington Center.
Prerequisite: permission of the Department.

PSCI 5908 [1.0 credit]
M.A. Research Essay
Tutorial for students who write a research essay rather than a thesis.

PSCI 5909 [2.0 credits]
M.A. Thesis

PSCI 5911 [0.0 credit]
Co-operative Work Term
Students may register in the co-op option according to the guidelines listed under Co-op Option in the Calendar of Graduate Studies.
Prerequisite: permission of the Department.

PSCI 5912 [0.0 credit]
Co-operative Work Term
Students may register in the co-op option according to the guidelines listed under Co-op Option in the Calendar of Graduate Studies.
Prerequisite: permission of the Department.

PSCI 5913 [0.0 credit]
Co-operative Work Term
Student may register in the co-op option according to the guidelines listed under Co-op Option in the Calendar of Graduate Studies.
Prerequisite: permission of the Department.

PSCI 5915 [0.5 credit]
Special Topics in Political Science
A seminar on a selected topic in political science, to be determined by faculty research and teaching interests.

Please note that courses numbered PSCI 6000 through PSCI 6601 are open to both M.A. and Ph.D. students.

PSCI 6000 [0.5 credit]
The Political Process in Canada I
An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada.
Precludes additional credit for PSCI 5100.

PSCI 6001 [0.5 credit]
The Political Process in Canada II
An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada.
Precludes additional credit for PSCI 5100.

PSCI 6105 [0.5 credit]
Comparative Politics I
A research seminar dealing with theories, methods, and problems of comparison.
Precludes additional credit for PSCI 5005.

PSCI 6106 [0.5 credit]
Comparative Politics II
A research seminar dealing with particular themes.
Precludes additional credit for PSCI 5005.

PSCI 6300 [0.5 credit]
Political Theory I
An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This course is historically comprehensive in scope and thematically oriented in depth.
Precludes additional credit for PSCI 5300.

PSCI 6301 [0.5 credit]
Political Theory II
An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This course is historically comprehensive in scope and thematically oriented in depth.
Precludes additional credit for PSCI 5300.

PSCI 6407 [0.5 credit]
Public Policy: Theory and Analysis
Introduction to major theoretical approaches in the study and analysis of public policy and to current topics and debates in the field.

PSCI 6408 [0.5 credit]
Public Affairs Management and Analysis
A seminar on theories and practice in the management of public affairs, including the environment and administration of the public sector, public opinion, and public communications.

PSCI 6600 [0.5 credit]
Theory and Research in International Politics I
An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.
Precludes additional credit for PSCI 5600.

PSCI 6601 [0.5 credit]
Theory and Research in International Politics II
An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.
Precludes additional credit for PSCI 5600.

PSCI 6900 [0.5 credit]

Ph.D. Field Examination I

Ph.D. preparation for the major field examination I. The grade to be awarded will be that obtained on the field examination.

PSCI 6905 [0.5 credit]

Ph.D. Field Examination II

Ph.D. preparation for the major field examination II. The grade to be awarded will be that obtained on the field examination.

PSCI 6906 [1.0 credit]

Thesis Proposal Workshop

Following a survey of general issues and problems in developing research proposals, students will prepare their own thesis proposal. Coordinated by one instructor, but faculty from other fields will also participate. The grade for this course will be Satisfactory or Unsatisfactory. Prerequisite: successful completion of comprehensive examinations or permission of the Department.

PSCI 6909 [5.0 credits]

Ph.D. Thesis

Psychology

Loeb Building B555
Telephone: 613-520-4017
Fax: 613-520-3667
carleton.ca/psychology

The Department

Chair of the Department: Janet Mantler
Supervisor of Graduate Studies: Craig Bennell

The Department of Psychology offers programs of study and research on a full-time and part-time basis, leading to the degrees of M.A., M.Sc. and Ph.D. Financial support is available, but is limited to full-time students.

There is a very close link in the Department of Psychology between graduate studies and research. Research in the Department is distributed across the life sciences areas of behavioural neuroscience, animal learning, perception, and cognition, and across the social sciences areas of social and developmental psychology. Its research and graduate program in behavioural neuroscience is one of the strongest in Canada, with current research focusing on problems of the neurochemistry of stress and learning; developmental psychopharmacology; experimental models of epilepsy; neurodegeneration; dementia; neural mechanisms of audition; drug dependence; and the effects in animals and humans of prenatal alcohol and drug exposure on postnatal behaviour. The Department has related human neuropsychological research activities dealing with alterations to visual and auditory psychophysical functions associated with neuropathological conditions. In recent years, there has been a growth of activity in aspects of applied psychology, including evaluation research; corrections; education; impact of computer and telecommunications technology; behavioural medicine; and psychological assessment. This has fostered close collaborative contacts between the Department and public service and applied settings in Ottawa, such as the Children's Hospital of Eastern Ontario, the Royal Ottawa Hospital, the National Research Council, Department of Communications (Canada), Ontario Ministry of Correctional Services, and the Ottawa-Carleton Board of Education. Practica and internships are available in many of these settings to students at the doctoral level.

Because of the breadth of interests in the Department, there is an emphasis in graduate courses on methodological and conceptual issues that are applicable across research specializations. Consequently, most substantive courses, regardless of title, are relevant to most students' programs. Students typically work closely with their advisers who, through informal tutorials and directed studies and independent research courses, provide much of the opportunity for specialized study. Applicants are strongly encouraged to write directly to faculty members for more specific details on research interests and programs underway.

As part of its general experimental program, the Department provides the opportunity to pursue a concentration at the master's and doctoral level in behavioural neuroscience (a collaborative specialization with the University of Ottawa), human neuropsychology, or human information systems. Applicants should consult with the supervisor of graduate studies for information on structuring a doctoral program of studies within a concentration.

Through a quantitative methods requirement, completion of a demanding empirical thesis presented and defended orally, participation in small seminars, and a close relationship with faculty advisers and students, the master's programs provide the opportunity for a refinement of critical, logical, and analytical skills; skills of written and oral expression; understanding of the strengths and limitations of

the scientific method as a means of problem solving, demonstrated through psychology but applicable to issues in society at large; an understanding of quantification and scaling; the use of statistical methods and inference; and the use of evidence to support argument. For some students this is a satisfactory and satisfying end in itself. For others, it provides a solid preparation for the doctoral program in which original independent study and research is stressed. The Department does not distinguish between an applied and an experimental program; instead, the basic orientation is experimental and theoretical, but with opportunities, where appropriate, to provide complementary experience necessary to work successfully as a psychologist in applied research/service settings.

Augmenting the well-equipped laboratories expected in an active research environment, the Department of Psychology receives excellent technical support from the Carleton University Science Technology Centre, where design and manufacture of special-purpose apparatus is carried out. In addition, the workshops provide technical support for the numerous computer systems in use throughout the Department's laboratories.

In fulfilling degree credit requirements, all graduate students are required to demonstrate competence in statistical and quantitative methods through successful completion of PSYC 5410 and PSYC 5411 (with a grade of B- or better) .

In addition to fulfilling the remaining credit requirements as described in subsequent sections, all graduate students in psychology are expected to conduct research of interest to them during each year of graduate study. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each year, the candidate's adviser submits a written critique of research progress, which becomes part of the candidate's permanent record. Qualifying-year students are evaluated at the end of the first twelve months.

Depending on his/her field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

The Department may recommend that a graduate student be asked to withdraw from the program at any time if his or her progress in course work or research proves unsatisfactory.

Within the Department exist subgroups of faculty members with common interests and subgroups of courses associated with particular areas of psychology. Below are listed seven formally identified fields of concentration, with the work that would be expected from any student who decided to pursue interests in one of these fields.

Concentrations

Concentration in Social and Organizational Psychology

The objective of the Social and Organizational Psychology concentration is to provide advanced education for students in the related areas of social psychology that reflect both basic and applied issues pertaining to Psychology. In both the Social (basic) and Organizational (applied) streams, special emphasis is given to developing skills in intellectual and empirical inquiry that will prepare students for research and educational careers in government, the private sector or academia. Students pursuing an M.A. degree in social/organizational psychology are encouraged to undertake studies of the historical and recent developments in the field, and of the multiplicity of research methods used to study social phenomena, in preparation for the production of a research thesis. While

not all of the students in this field are interested in an applied orientation, those who are will be encouraged to complete a practicum in an organizational setting in order to develop greater knowledge of the conduct of organizational research in a practical context. Students interested in this area are encouraged to take courses such as PSYC 5010, PSYC 5011, and PSYC 5109, and to generate theses in this area.

Concentration in Cognitive Psychology

The Concentration in Cognitive Psychology is intended to provide the graduate student with an advanced knowledge of methodological and theoretical issues in the domain of cognitive psychology. Research interests of regular and adjunct faculty in cognition include perception and psychophysics, attention, pattern recognition, reading and language processing, cognitive development, learning and memory, problem solving, neuropsychology, and human-computer interactions. Students interested in this area are encouraged to take courses such as PSYC 5700, PSYC 5703, PSYC 5704 and PSYC 6700 and generate theses in the area of cognition.

Concentration in Developmental Psychology

The concentration in developmental psychology is intended to provide graduate students with an in-depth knowledge of the theoretical and methodological issues associated with the study of child development from birth to adolescence. Faculty interests span the areas of language, cognitive, and social development. Current research in the Department includes topics related to literacy acquisition; numeracy and mathematics; mental imagery; bilingualism; peer relationships, aggression and shyness; learning disabilities; and stress, coping, and social determinants of adolescent adjustment and health behaviours. Students interested in this area are encouraged to take courses such as PSYC 5500, PSYC 5503, and PSYC 5504. Also, it is expected that students in this field will generate a thesis in the area of developmental psychology.

Concentration in Forensic Psychology

The Concentration in Forensic Psychology is intended to provide graduate students with a broad knowledge of the key theoretical and methodological approaches to forensic issues. Faculty interests include forensic assessment, treatment of offenders, assessment and treatment of special offender populations (e.g., psychopaths, female offenders, sex offenders), police psychology, and eyewitness/jury decision making. Students interested in this area are encouraged to take courses such as PSYC 5021, PSYC 5022, PSYC 5023, and PSYC 5024. Also, doctoral students in this area are required to take PSYC 6400, Forensic Psychology Reading Course, and are expected to generate a thesis in the area of forensic psychology.

Concentration in Health Psychology

Health psychology is concerned with the reciprocal interactions among physical health and illness, and psychological factors, including emotional well-being. The graduate concentration in health psychology, which offers M.A., M.Sc., and Ph.D. degrees, provides courses and research opportunities designed to facilitate students' understanding of the theoretical and methodological issues relevant to health psychology. Guided by a biopsychosocial perspective, faculty members affiliated with the concentration adopt a range of approaches to the study of health, including neuroscientific, psychoimmunological, social, personality, cognitive-behavioral and life span developmental approaches. Specific areas of research include posttraumatic stress and its neurochemical underpinnings; stress and coping; stress in the workplace; personality, including positive psychological factors, health and illness; psychological factors in seeking treatment for medical problems; adjustment to trauma and loss; consequences of prenatal exposure to marijuana; HIV/AIDS; aging; Parkinson's disease; poverty and health; addictions, including gambling; women and minority health; and the psychological and physical aftereffects of violence toward women and

children. Methodological approaches include both quantitative and qualitative analyses. Graduate students are encouraged to take graduate courses in health psychology and psychobiology, as well as generate theses in health psychology.

Concentration in Human-Computer Interaction

The Concentration in Human-Computer Interaction is designed to provide students with skills to conceive, conduct and report research that improves the usefulness and usability of computer and communication technologies. Examples include the creation and evaluation of human-computer interfaces, the use of psychological principles in the design of interactive technologies, and studies of the social effects of computer-mediated communication. To pursue the Concentration, students are encouraged to take at least three of PSYC 5105, PSYC 5106, PSYC 6105 and PSYC 6106, take additional courses in related areas (e.g., cognition, social psychology, design) and complete a thesis in the area.

Specialization in Behavioural Neuroscience

Behavioural Neuroscience is the study of the relation between behaviour and the nervous system. This specialty is cross-disciplinary, incorporating neuroanatomy, neurobiology, neuropharmacology, neurophysiology, psychiatry, psychology and cognitive studies. While individual researchers usually specialize in a particular area, behavioural neuroscientists must also be able to appreciate significant research in other fields of neuroscience.

Training in Behavioural Neuroscience extends beyond the boundaries of traditional departments. This area of concentration is offered as a collaborative Specialization in Behavioural Neuroscience by the Institute of Neuroscience at Carleton University and the School of Psychology at the University of Ottawa. Faculty members of the Institute of Neuroscience are from the Psychology and Biology departments and also include adjuncts from the large and diverse Ottawa Neuroscience community. To augment the scope of training provided, faculty members from the Department of Psychiatry (Institute of Mental Health Research, Royal Ottawa Hospital) also participate in the teaching, research training and student supervision. Further details on the Specialization, including faculty members of the Institute of Neuroscience and program requirements of the Specialization are listed in the Neuroscience section of this Calendar. Prospective students are encouraged to contact the Director of the Institute of Neuroscience for current research activities of the participating faculty.

Qualifying-Year Program

Occasionally, candidates with exceptional promise who offer less than Honours B.A. status may be admitted to a qualifying-year program approved by the graduate studies committee and designed to prepare them for master's study. A grade of B- or better must be obtained in each qualifying-year course, and candidates may be required to complete satisfactorily the equivalent of a B.A.(Honours) thesis.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is a B.A. Honours Psychology (or equivalent) with high honours standing, completion of a research thesis, and credit in a breadth of courses in line with the psychology major.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

Application deadlines can be found at https://gsapplications.carleton.ca . Financial assistance is not available for those seeking January admission.

Program Requirements

The master's program consists of 5.0 credits, of which at least two must be at the graduate level (numbered 5000 or higher), and a thesis (equivalent to 2.5 credits) which must be defended at an oral examination. Specific requirements include:

- PSYC 5410 (Advanced Analysis of Variance, 0.5 credit) and PSYC 5411 (Advanced Regression, 0.5 credit). With permission of the adviser and the graduate committee, master's students may have one of PSYC 5410 or PSYC 5411 waived from their requirements, and another course must be substituted for this 0.5 credit. Normally, requests for this requirement waiver must be made in the first term of the master's program. Equivalencies will be determined on a case-by-case basis through application to the graduate committee.
- PSYC 5906 (Pro-Seminar in Psychology, 0.0 credit)

Master of Science

The Department of Psychology offers the M.Sc. degree for those students in the behavioural neuroscience specialization. For the neuroscience specialization, the candidate must fulfil the normal program requirements together with the requirements of the specialization. For further details, see the Neuroscience section of this Calendar.

Academic Standing

A grade of B- or better is normally required in each of the credits counted towards the M.A. or M.Sc. degree. The Department is prepared on occasion to recommend to the Dean of the Faculty of Graduate Studies and Research that a candidate be allowed a grade of C+ in 1.0 credit or each of two 0.5 credits.

Doctor of Philosophy

Admission Requirements

The requirements for admission to the Ph.D. program are outlined in the General Regulations section of this Calendar. Scores on the Graduate Record Examination are optional.

The Ph.D. program in psychology normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the Department will accept a few candidates for the degree on a part-time basis. The time limit for completion of Ph.D. degree requirements for those who enter the program on a part-time basis will be the same as for those who enter on a full-time basis and subsequently register for part-time study: that is, eight calendar years. (See General Regulations, Section 13, Time Limits.)

Applicants should note that of the B.A., M.A., M.Sc., and Ph.D. degrees in Psychology, ordinarily only two may be taken at Carleton University.

Program Requirements

The minimum program requirements for the Ph.D. degree in Psychology include 10.0 credits with a grade of B- or better in each course. Specific requirements are:

- PSYC 5410 (Advanced Analysis of Variance), PSYC 5411 (Advanced Regression) and 0.5 credit from: PSYC 5401 (Multivariate Techniques), PSYC 5412 (Topics in Advanced Statistics and Methods), PSYC 5413 (Workshops in Advanced Statistics and Methods), or other as approved by the graduate committee (e.g., PSYC 5010). Equivalencies will be determined on a case-by-case basis through application to the graduate committee;
- Any additional concentration requirement;
- PSYC 6906 (Pro-Seminar in Psychology I) and PSYC 6907 (Pro-Seminar in Psychology II); and
- A thesis equivalent to 7.0 of the required 10.0 credits which must be defended at an oral examination.

All Ph.D. candidates are required to submit a thesis prospectus. The prospectus examination will normally be successfully completed within seven calendar terms of the student's initial registration for full-time students and ten terms for part-time students.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

PSYC 5001 [0.5 credit]
Qualitative Research Methods in Psychology
Introduction to various non-numerical, interpretive research methods. Attention will be devoted to the philosophical underpinnings of qualitative research, methods collecting and analyzing qualitative data, and issues regarding sampling, reliability, and validity.
Prerequisite: PSYC 5410 and PSYC 5411 or permission from the instructor.

PSYC 5002 [0.5 credit]
Ethics in Psychology
Ethical concepts and controversies related to research and practice in psychology. Topics may include ethical dilemmas and debates, professional codes of ethics, confidentiality, informed consent, legal rights and responsibilities, use of deception, or guidelines for research with special populations.

PSYC 5010 [0.5 credit]
Social Psychology Methodology
An overview of research methods for the study of social and organizational psychology. Topics may include observational and interview techniques, archival methods, questionnaire design, focus groups, qualitative analyses, and computer simulation. A research project will be required.

PSYC 5011 [0.5 credit]
Social Psychology I
Recent developments in social psychology theory and research. Topics may include social cognition, social influence, group processes, conflict resolution and social change.

PSYC 5012 [0.5 credit]
Organizational Psychology I
Recent developments in organizational psychology and research. Topics may include personnel selection, work motivation, morale and productivity, organizational decision making, leadership and social action.

PSYC 5021 [0.5 credit]
Forensic Assessment
Theoretical and empirical issues of the biopsychosocial antecedents of criminal behaviour. Classification and assessment of offenders for courts, probation and parole services. Risk

assessment, management and service planning are addressed in both correctional and mental health contexts.

PSYC 5022 [0.5 credit]
Adult Offenders
Theoretical and empirical issues on the use of different types of interventions in modifying adult criminal behaviour. Institutional treatment and community-based approaches are discussed.

PSYC 5023 [0.5 credit]
Witnesses, Victims and Juries
A review of research and theory concerning eyewitnesses, victims of crime, and jury decision-making. Topics such as police interviewing techniques and practices, eyewitness identification and testimony, victim rights, effects and outcomes, and influences on jury verdicts are discussed.

PSYC 5024 [0.5 credit]
Youthful Offenders
An examination of the development of delinquency with a focus on etiology, risk factors, assessment, prediction, and developmental trajectories. Individual, group, and family institutional and community treatment approaches are examined.

PSYC 5104 [0.5 credit]
Psychology of Women
This seminar will consider and evaluate research concerning the psychology of women, including research methods, gender roles and gender differences.

PSYC 5105 [0.5 credit]
Fundamentals of Computing for Psychologists
A survey of computer and communication hardware and software. The course is designed to make psychologists aware of concepts and terminology used by engineers and programmers in planning computer applications. The course will have a weekly laboratory.
Prerequisite: one course in computer programming or equivalent.

PSYC 5106 [0.5 credit]
Computers and Cognition
A survey of literature in such fields as artificial intelligence, database management, computer-aided instruction, simulation and forecasting, and computer-mediated communication. Psychological principles in the design, use, and evaluation of these cognitive aids are stressed.

PSYC 5107 [0.5 credit]
Psychology of Family Violence
Biopsychosocial antecedents and consequences of the abuse and neglect of children, partners and elders within the family. The efficacy of preventive and treatment strategies is also assessed, as are current controversies and research methods in the area.

PSYC 5109 [0.5 credit]
Historical and Social Foundations of Social Psychology
History of psychological social psychology (1890s to 1960s), with emphasis on the development of social psychology as both an experimental and an interpretive science. Some attention is given to historiographic issues and the history of the human sciences generally.

PSYC 5200 [1.0 credit] (BIOL 5304)
Basics of Neuroscience
A comprehensive neuroscience course from cellular levels to neural systems and behavior. Topics covered include aspects of neuroanatomy, neurophysiology, neuropharmacology and behavioural and cognitive neuroscience. (Also listed as PSY 6201 at the University of Ottawa.)

PSYC 5209 [0.5 credit]

Psychology of Health and Illness

A critical examination of scientific theory and research on the role of psychological factors in health and illness, and the use of psychological interventions in treating illness and maintaining health. Topics include the biopsychological model of illness, stress and coping, psychoneuroimmunology, personality, and stress management.

PSYC 5300 [0.5 credit]

Perceptual Processes

Theoretical and empirical issues of the area of perception. Topics may include: psychophysics, constancies, depth perception, pattern recognition, iconic memory, attention, hemispheric specialization.

PSYC 5301 [0.5 credit]

Psychophysics

A study of classic and contemporary psychophysical methods. Applications to cognition will be included.

PSYC 5401 [0.5 credit]

Multivariate Techniques

Applications of multivariate statistical techniques with psychological data including multivariate analysis of variance, canonical correlation, discriminant function analysis, and factor analysis. Extensive use is made of statistical software.
Prerequisite: PSYC 5410 and PSYC 5411.

PSYC 5407 [0.5 credit]

Tests and Measurements I: Intellectual/Cognitive

This course is designed to assist students learning of basic cognitive/intellectual assessment procedures. Students will be required to administer and interpret a variety of tests such as the WAIS-R, Weschler Memory Scale, Rey Auditory Verbal Learning Test, and Buschke's Cued Recall Test.
Prerequisite: Undergraduate course in testing or psychometrics.

PSYC 5410 [0.5 credit]

Advanced Analysis of Variance

Concepts and applications of advanced analysis of variance designs, including factorial, within groups, and hierarchical designs, and analysis of covariance. Extensive use is made of statistical software.

PSYC 5411 [0.5 credit]

Advanced Regression

Concepts and applications of advanced regression analyses, including multiple regression, hierarchical and polynomial techniques. Extensive use is made of statistical software.

PSYC 5412 [0.5 credit]

Topics in Advanced Statistics and Methods

Selected topics in advanced statistics and research methods relevant to broad areas of psychology, varying from year to year. Topics might include broad analytic approaches, such as, program evaluation, qualitative methods, nonparametric statistics, among others.
Prerequisite: PSYC 5410 and PSYC 5411 and permission of the Department.

PSYC 5413 [0.25 credit]

Workshops in Advanced Statistics and Methods

Intensive focus on specific statistical or methodological approaches relevant to psychological research (e.g., structural equation modeling, advanced factor analysis, meta-analysis, observational methods).
Prerequisite: PSYC 5410 and PSYC 5411 and permission of the Department.

PSYC 5500 [0.5 credit]

Developmental Psychology Methodology

An overview of research methods in the study of developmental psychology. Topics may include: observational and interview techniques, use of archival data, longitudinal designs, questionnaire development, and basic assessment methods. A research project will be required.

PSYC 5503 [0.5 credit]

Advanced Topics in Developmental Psychology: Social & Emotional Development

Recent developments in developmental psychology theory and research related to the study of cognitive development. Topics may include: Child temperament, parenting and the family, peer relationships, self-system, and developmental psychopathology.

PSYC 5504 [0.5 credit]

Advanced Topics in Developmental Psychology: Cognitive Development

Recent developments in developmental psychology theory and research related to the study of cognitive development. Topics may include: language, literacy, numeracy, and theory of mind.

PSYC 5601 [0.5 credit]

Contemporary Research in Personality

Current controversial issues in personality research, and selected theoretical and research studies in personality.

PSYC 5700 [0.5 credit]

Advanced Topics in Cognition I

An in-depth study of a specific topic in the area of basic cognitive processes. Topics will vary from year to year and may include judgmental processes, object identification, selective attention and spatial cognition.

PSYC 5703 [0.5 credit]

Cognition I

A survey of issues and research methodologies in basic cognitive processes. Topics may include detection and processing of sensory signals, pattern recognition, attention, mental imagery and automaticity.

PSYC 5704 [0.5 credit]

Cognition II

A survey of issues and research methodologies in higher-level cognitive processes. Topics may include memory, representation of knowledge, decision processes, and the procedural/declarative controversy. The course may be focused on a particular area (e.g. reading, transfer in problem solving).

PSYC 5800 [0.5 credit]

Special Topics in Psychology

The topics of this course will vary from year to year, and will be announced in advance of the registration period.

PSYC 5900 [0.5 credit]

Directed Studies

In-depth investigation of selected problems in psychology by means of directed library research. Registration is restricted, permission to register being granted only by the graduate committee. A final report must be filed in the departmental office prior to submission of course grade.

PSYC 5901 [0.5 credit]

Independent Research

Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

PSYC 5903 [0.5 credit]

Practicum in Psychology

The practicum offers master's level students the opportunity to gain experience in a range of applied psychology settings with the goal of integrating academic and practical aspects of psychology. This course cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory. Details are available from the Department.

PSYC 5906 [0.0 credit]

Pro-Seminar in Psychology

The pro-seminar is based on the departmental invited colloquia series. This course provides breadth in terms of exposure to research. Colloquia are offered from September to April.

PSYC 5909

M.A. Thesis

PSYC 6101 [0.5 credit]

Social Psychology II

A seminar covering a selection of advanced topics in social psychology theory and research taken from recent publications and debates in the discipline.

PSYC 6102 [0.5 credit]

Organizational Psychology II

A seminar covering advanced topics in organizational psychology theory and research taken from recent publications and debates in the discipline.

PSYC 6104 [0.5 credit]

Seminar in University Teaching

Theoretical and empirical work related to teaching in higher education. Analysis of instructional discourse, use of language in classroom decision-making, bases of effective practice and methods of instruction. Constructivist principles of teaching and learning. Role of teaching in university scholarship. Also listed as LALS 5204.
Precludes additional credit for LALS 5905 (Section T, 1997-98), LALS 5905 (Section X, 1998-99), LALS 5905 (Section W, 1999-2000), LALS 5905 (Section W, 2000-01), LALS 5905 (Section X, 2001-02), LALS 5905 (Section W, 2002-03) and LALS 5204.

PSYC 6105 [0.5 credit]

Psychological Aspects of Computer Use

An investigation of human factors related to the effective design of computer hardware and software. Topics may include the design and evaluation of information search procedures, graphic displays, and operation manuals on the assessment of usability. A research project will be required.

PSYC 6106 [0.5 credit]

Social Aspects of Computer Use

An investigation of the social psychological factors affecting the use of computers and the social consequences of their use Topics may include the use of computers in higher education and the social consequences of the Internet for the Third World.

PSYC 6202 [0.5 credit] (BIOL 6305)

Advanced Seminar in Neuroscience I

A comprehensive pro-seminar series, covering issues ranging from cellular and molecular processes through to neural systems and behaviours as well as psychopathology.
Precludes additional credit for PSYC 6200 [1.0].
Prerequisite: PSYC 5200.

PSYC 6203 [0.5 credit] (BIOL6306)

Advanced Seminar in Neuroscience II

A comprehensive proseminar series, covering issues ranging from cellular and molecular processes through to neural systems and behaviours as well as psychopathology.
Precludes additional credit for PSYC 6200 [1.0].

Prerequisite: PSYC 5200.

PSYC 6204 [0.5 credit] (BIOL 6204)

Neuroscience Techniques I

Completion of a research project carried out under the supervision of a neuroscience faculty member, normally not the current supervisor. The student will learn a new neuroscience technique and apply it to a research objective. The course can be repeated for different projects. Students must obtain approval from the Director of the Neuroscience.

PSYC 6300 [0.5 credit]

Special Topics in Neuroscience

An in depth study of current topics in neuroscience. Course content varies yearly and has recently included cognitive neuroscience, neuropharmacology, neurodegeneration, behavioural medicine and molecular neuroscience.

PSYC 6400 [0.5 credit]

Forensic Psychology Reading Course

A foundational course in Forensic psychology with a list of core readings. Topics may include: forensic assessment, treatment of offenders, assessment and treatment of special offender populations (e.g., young offenders, sex offenders), police psychology and eyewitness/jury decision making.

PSYC 6700 [0.5 credit]

Advanced Topics in Cognition II

An in-depth study of a specific topic in higher-level cognitive processes. Topics will vary from year to year and may include mathematical knowledge and processes, problem solving, or models of reading.

PSYC 6800 [0.5 credit]

Special Topics in Psychology

The topics of this course will vary from year to year, and will be announced in advance of the registration period.

PSYC 6900 [0.5 credit]

Directed Studies

Same description as PSYC 5900.

PSYC 6901 [0.5 credit]

Independent Research

Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

PSYC 6903 [0.5 credit]

Practicum in Psychology

The practicum offers Ph.D. students the opportunity to gain experience in a range of applied psychology settings with the goal of integrating academic and practical aspects of psychology. This course cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory. Details are available from the Department.

PSYC 6906 [0.0 credit]

Pro-Seminar in Psychology I

The pro-seminar is based on the departmental invited colloquia series. This course provides breadth in terms of exposure to research. Colloquia are offered from September to April.

PSYC 6907 [0.0 credit]

Pro-Seminar in Psychology II

The pro-seminar is based on the departmental invited colloquia series. This course provides breadth in terms of exposure to research. Colloquia are offered from September to April.

PSYC 6909
Ph.D. Thesis

Public Policy and Administration

Dunton Tower 1001
Telephone: 613-520-2547
Fax: 613-520-2551
carleton.ca/sppa

The School

Director of the School: S.D. Phillips
Supervisor, Master's Program: C. Carmichael
Supervisor, Doctoral Program: L.A. Pal
Supervisor, Co-op: P. Ryan

The School of Public Policy and Administration at Carleton University is a leading national and international centre for teaching and research in public administration and public policy. Since being established in 1953, the School has prepared its students for professional careers in the public, private and third sectors, both in Canada and abroad. The nature of the public sector has always been subject to change, but perhaps never more than in recent years. The graduate programs of the School treat the public sector in this dynamic context.

The School offers graduate programs of study and research in the fields of public administration and public policy leading to the Master of Arts (M.A.) in Public Administration, four diplomas in areas of public policy and administration, and the Doctor of Philosophy (Ph.D.) in Public Policy. These programs are designed both for individuals who wish to work in the public sector or in public policy related careers, and for those who are already doing so but who wish to broaden or strengthen their conceptual and technical skills.

The M.A. program provides an advanced understanding of public policy development, public management and policy implementation. The program offers a choice of four areas of concentration: Policy Analysis; Public Management; Innovation, Science and Environment; and International and Development. The International and Development Concentration is offered in co-operation with the Norman Paterson School of International Affairs. The graduate diplomas enable students, particularly professionals with work experience in the public sector, to develop knowledge and skills in several specialized areas of public policy, administration and management. The D.P.A. program offers specializations in: Policy and Program Evaluation, Public Management, Sustainable Development, and Health Policy. The Ph.D. program involves the intensive study of the formation and evolution of public policy in Canada and, from a comparative perspective, in countries of the OECD.

Each of these graduate programs is described in detail below. Further information and application packages can be obtained from the School's Web site (carleton.ca/sppa) or by contacting the School of Public Policy and Administration.

Master of Arts

The overall objective of the M.A. program is to provide individuals with a balanced conceptual and technical ability to understand and contribute to policy development, public management, and policy implementation, through study and through co-operative education in the public sector.

Under this objective, the Policy Analysis Concentration provides an advanced understanding of approaches to policy analysis in a variety of disciplines, with insights drawn from economics, political science and the policy sciences broadly understood, from Canadian and comparative perspectives.

The Public Management Concentration provides an advanced understanding of the institutions and practices of modern states. This includes theoretical and technical approaches to accountability, leadership, implementation and evaluation, fiscal control, ethics, and organizational development and analysis.

The Innovation, Science and Environment Concentration provides an advanced understanding of the problems and opportunities that confront governments, firms and society in making and implementing innovation, science and environment policies in an increasingly knowledge and information-based economy and society.

The International and Development Concentration provides an advanced understanding of the problems and opportunities confronting citizens, national administrative systems and policy makers in different types of economies in an increasingly integrated and competitive world.

These overall and particular objectives are consistent with the School's view of what is fundamental to education in the field of public administration. This view is:

- that democratic ideals and practices are central to government and to the public sector broadly defined;
- that a balance of conceptual and technical skills is needed to understand the linked activities of policy development (how and why policy is made), public management (how the public sector is structured, staffed and resourced) and policy implementation (how policy intentions are carried out, including the grievances and appeals of citizens and clients);
- that these advanced conceptual and technical skills come from exposure to a variety of academic disciplines; and
- that professional education in public administration and policy analysis requires a balance of theory and practice.

The relevance of this view has been borne out by the success of graduates of the School who now work in many areas of the public sector and in public policy related careers in Canada and internationally.

A co-operative education option is available to full-time students in the M.A. program. Students admitted to this option must satisfactorily complete at least two work terms in order to graduate with a co-op designation on their transcripts and diplomas. These work terms are four months in duration and locate students in government departments or other organizations in order to work at a junior officer level. They provide students with opportunities to integrate the theoretical and practical aspects of public administration. During a work term, students will register in one of the co-op work term courses: PADM 5301, PADM 5302, or PADM 5303. While on a work term, students are limited to an additional 0.5 credit course. It should be noted that most co-op positions in the federal public service are restricted to Canadian citizens.

Program Schedules

The M.A. program may be taken under three schedules: full-time, part-time or a mixture of the two. The full-time schedule enables students to complete the program in two years (four or five academic terms). For students who wish to study part-time or a combination of full and part-time, courses are regularly scheduled in evening sections and during the summer.

Admission Requirements

The SPPA requires higher English language assessment test scores than the Faculty of Graduate Studies and Research. The Faculty of Graduate Studies and Research requirements may be found in Section 3.6 of the General Regulations of this Calendar.

Students whose first language is not English, or who have not completed a previous degree at an English speaking university, must demonstrate an adequate command of English by attaining, at least, a TOEFL score of 237 CBT (computer-based test) or 580 (written); or 86 IBT overall with a minimum score in each component of: writing: 22; speaking: 22; reading: 20; and listening: 20, or a CAEL score of 70, or an IELTS score of 7.0.

Applicants must have a bachelor's degree (or equivalent). Normally, an average of B+ or higher is required for admission. The level of academic performance and potential demonstrated within the degree is more important than the discipline. Indeed, students enter the program from a wide variety of academic backgrounds in the social sciences, humanities, sciences and engineering. The School also considers mid-career applicants who do not have a bachelor's degree, but who have demonstrated professional excellence over a number of years of work in the public sector.

All applicants must have completed a 1.0-credit university course covering micro- and macroeconomic theory (ECON 1000 or the equivalent) and a 0.5-credit university political science course at the 2000-level or higher, dealing with institutions and processes by which governments legitimize and exercise power, ideally in a Canadian setting (PSCI 2003 or equivalent). A working knowledge of algebra is also expected.

In some cases, applicants may be admitted to the program despite not having completed one of these pre-requisite courses in economics or political science, on the condition that the course be completed (with a grade of B- or higher) in the first year of the program. Nevertheless it is strongly recommended that students complete the prerequisites before starting the program, to ensure that their progress through the core courses is unimpeded.

Note that, because of the number of applications received, possession of these admission requirements does not, in itself, guarantee admission to the program.

Application to the M.A. program is through the Ontario Universities' Application Centre (OUAC). The OUAC web site can be accessed from carleton.ca/sppa or www.gs.carleton.ca. Application deadlines can be found at https://gsapplications.carleton.ca .

Program Requirements

The M.A. in Public Administration is a 7.5- credit program. Students must complete:

1. 3.5 credits of core courses;
2. 2.0 credits from courses in one of the four Concentrations offered by the School; and
3. 2.0 other approved credits.

The seven core courses are listed under A, below. Full-time students are normally expected to complete these core courses during their first two semesters of study. Part-time students are normally expected to complete the core courses before proceeding to the remainder of the program.

The courses for the four concentrations are listed below under B, below.

With respect to the remaining 2.0 credits, students may select: additional courses in their chosen concentration; and/or electives listed under other concentrations; and/or (with the approval of the M.A. Supervisor) graduate courses in other units. Credits may also be earned by completion of a research

essay (1.0 credit), a thesis (2.0 credits), or by taking courses from the School's Ph.D. program (with approval of the M.A. Supervisor).

All students will graduate with at least one area of concentration, but students may structure their program to satisfy the requirements (at least 2.0 credits) for a second concentration. In this case, each course may count towards only one concentration.

Advanced Standing

Upon admission, students may receive advanced standing with transfer of credit for up to 3.0 credits. Advanced standing will be considered only for core courses. Advanced standing will be determined on an individual basis in consultation with the M.A. Supervisor and the Faculty of Graduate Studies and Research and pursuant to Section 6.1 of the General Regulations section of this Calendar. In general, a grade of B+ or higher is necessary in the equivalent courses in order to receive advanced standing.

A. Core Courses

PADM 5111 Microeconomics for Policy Analysis
PADM 5112 Macroeconomics for Policy Analysis
PADM 5113 Research Methods and Design I
PADM 5114 Research Methods and Design II
PADM 5115 Introduction to State and Society
PADM 5116 Policy Analysis and Contemporary Governance
PADM 5117 Public Management

B. Concentrations

To complete a concentration, students must complete at least four of the courses (2.0 credits) listed as electives for that concentration. A course cross-listed between concentrations qualifies for either concentration but may count toward only one of them.

Policy Analysis Concentration

The Policy Analysis Concentration includes courses that focus on the theory, methods, or practice of policy analysis as well as courses that focus on specific policy fields. The courses are grouped into these two categories to give students guidance about the goals of the courses.

Students are required to take 2.0 credits selected from the courses listed below:

Theory, Methods and Policy Processes
PADM 5211 Intergovernmental Relations
PADM 5212 Civil Society and Public Policy
PADM 5213 Gender and Public Policy
PADM 5214 Budgetary Policy in the Public Sector
PADM 5215 Benefit-Cost Analysis
PADM 5216 Economic Models of Politics and Public Policy
PADM 5217 Applied Microeconomic Policy Analysis
PADM 5218 Analysis of Socio-economic Data
PADM 5219 Advanced Statistical Policy Analysis
PADM 5420 Policy and Program Evaluation

Field Courses
PADM 5220 Regulation and Public Policy

PADM 5221 Health Policy in Canada
PADM 5222 Economics and Health Policy
PADM 5223 Canadian Economic Policy
PADM 5224 Aboriginal Policy
PADM 5225 Trade Policy
PADM 5226 Tax Policy
PADM 5227 Education Policy
PADM 5228 Social Policy
PADM 5229 The Health of Populations
PADM 5272 Policy Seminar (Policy Analysis Concentration)
PADM 5291 Directed Studies (Policy Analysis Concentration)
PADM 5616 Environmental Policy
Other courses as approved by the M.A. Supervisor.

Public Management Concentration

Students are required to take 2.0 credits selected from:

PADM 5411 Organization Theory
PADM 5412 Ethics and Accountability in the Public Sector
PADM 5413 Law of Public Authorities I
PADM 5414 Law of Public Authorities II
PADM 5415 Strategic Management in the Public Sector
PADM 5416 Budgetary Management for the Public Sector
PADM 5417 Principles of Finance
PADM 5418 Human Resources Management
PADM 5419 Industrial Relations and Public Sector Collective Bargaining
PADM 5420 Policy and Program Evaluation
PADM 5421 Globalizing Public Management
PADM 5422 Urban and Local Government
PADM 5423 Third Sector Governance and Management
PADM 5424 Evaluation Cases and Applications
PADM 5472 Policy Seminar (Public Management Concentration)
PADM 5491 Directed Studies (Public Management Concentration)
PADM 5211 Intergovernmental Relations
PADM 5215 Benefit-Cost Analysis
PADM 5814 Program and Project Management
Other courses as approved by the M.A. Supervisor

Innovation, Science and Environment Concentration

Students are required to take 2.0 credits selected from:

PADM 5611 Science and Technology Policies
PADM 5612 Industrial Policy, Innovation and Sustainable Production
PADM 5613 Science, Risk and Evaluation
PADM 5614 Natural Resource Management
PADM 5615 Sustainable Energy Policy
PADM 5616 Environmental Policy
PADM 5617 Implementing Sustainable Development in Industrialized Countries
PADM 5618 Environmental and Ecological Economics
PADM 5619 Urban Sustainability
PADM 5620 The Science, Politics and Economics of Global Climate Change
PADM 5672 Policy Seminar (Innovation, Science and Environment Concentration)
PADM 5691 Directed Studies (Innovation, Science and Environment Concentration)

PADM 5220 Regulation and Public Policy
Other courses as approved by the M.A. Supervisor.

International and Development Concentration

Students are required to take 2.0 credits selected from:

PADM 5811 The International Policy Framework
PADM 5812 Governance in Developing Countries
PADM 5813 The Evolution of World Bank/IMF Policy Conditionality
PADM 5814 Program and Project Management
PADM 5815 Civil Society Organizations and Development
PADM 5816 Program Evaluation in Developing Countries
PADM 5817 Health Policy in Developing Countries
PADM 5872 Policy Seminar (International and Development Concentration)
PADM 5891 Directed Studies (International and Development Concentration)
PADM 5213 Gender and Public Policy
PADM 5225 Trade Policy
PADM 5421 Globalizing Public Management
INAF 5007 Theories of Development and Underdevelopment
INAF 5008 Economic Development Policy and Planning
Other courses as approved by the M.A. Supervisor.

French Language Proficiency

There is no formal second language requirement as part of the M.A. However, students planning careers in or with governments in Canada are strongly encouraged to develop facility with French. The School provides access to courses in French for the Public Service on a non-credit basis (these courses do not count towards the degree).

Academic Standing

A grade of B- or higher must normally be obtained in each course credited towards the M.A. degree. A candidate may, with the recommendation of the M.A. Supervisor and the approval of the Dean of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in courses totaling 1.0 credit.

Graduate Diplomas in Public Policy and Administration

The graduate diplomas are intended to serve the needs for continuous learning for public servants and other professionals who seek to strengthen or broaden their conceptual and technical skills in public administration and policy analysis. They can be completed within two years by students who are working full-time. Students enter the program with widely varying backgrounds, including those who already have advanced degrees in other fields but who wish to increase their knowledge and skills in particular areas of specialization relevant to the public sector.

The areas are: Policy and Program Evaluation; Public Management; Sustainable Development; and Health Policy.

The three-credit program is designed to be completed in two years while working full-time, although students may take the program on either a part-time or full-time basis.

Admission Requirements

Students whose first language is not English, or who have not completed a previous degree at an English speaking university, must demonstrate an adequate command of English by attaining, at least, a TOEFL score of 237 CBT (computer-based test) or 580 (written); or 86 IBT overall with a minimum score in each component of: writing: 22; speaking: 22; reading: 20; and listening: 20, or a CAEL score of 70, or an IELTS score of 7.0.

Applicants must have a bachelor's degree (or equivalent). Normally, an average of B+ or higher is required for admission. Students taking PADM 5111 or PADM 5112 must have completed a university course [1.0 credit] covering micro- and macroeconomic theory (ECON 1000 or the equivalent). Students taking PADM 5116 or PADM 5117 must have completed a relevant university political science course [0.5 credit] at the second-year level or higher dealing with the institutions and processes by which governments legitimize and exercise power, ideally in a Canadian setting (PSCI 2003 or equivalent). Several years of relevant professional experience in the public sector may be considered as equivalent to this prerequisite.

Note that students in the Diploma programs are not eligible to receive university funding.

Program Requirements

Each of the Diplomas comprises 3.0 credits. The composition of the required and elective courses varies by specialization, as outlined below.

Public Policy and Program Evaluation

Students must complete:

1. 2.0 credits of required courses:
    - PADM 5113 Research Methods and Design I
    - PADM 5114 Research Methods and Design II
    - PADM 5420 Policy and Program Evaluation
    - PADM 5424 Evaluation Cases and Applications
2. 1.0 credit in electives from the following list:
    - PADM 5116 Policy Analysis and Contemporary Governance
    - PADM 5117 Public Management
    - PADM 5213 Gender and Public Policy
    - PADM 5215 Benefit-Cost Analysis
    - PADM 5217 Applied Microeconomic Policy Analysis
    - PADM 5218 Analysis of Socio-economic Data
    - PADM 5219 Advanced Statistical Policy Analysis
    - PADM 5220 Regulation and Public Policy
    - PADM 5415 Strategic Management in the Public Sector
    - PADM 5416 Budgetary Management for the Public Sector
    - PADM 5613 Science, Risk and Evaluation
    - PADM 5812 Governance in Developing Countries
    - PADM 5814 Program and Project Management
    - PADM 5816 Program Evaluation in Developing Countries
    - PADM 5272 Policy Seminar (Policy Analysis)
    - PADM 5472 Policy Seminar (Public Management)
    - Other PADM courses as approved by the M.A. Supervisor.

Public Management

Students must complete:

1. 0.5 credit in required course PADM 5117 Public Management
2. 2.5 credits electives from the following list:
    - PADM 5411 Organization Theory
    - PADM 5412 Ethics and Accountability in the Public Sector
    - PADM 5413 Law of Public Authorities I
    - PADM 5414 Law of Public Authorities II
    - PADM 5415 Strategic Management in the Public Sector
    - PADM 5416 Budgetary Management for the Public Sector
    - PADM 5417 Principles of Finance
    - PADM 5418 Human Resources Management
    - PADM 5419 Industrial Relations and Public Sector Collective Bargaining
    - PADM 5420 Policy and Program Evaluation
    - PADM 5421 Globalizing Public Management
    - PADM 5422 Urban and Local Government
    - PADM 5423 Third Sector Governance and Management
    - PADM 5472 Policy Seminar (Public Management)
    - Other PADM courses as approved by the M.A. Supervisor.

Sustainable Development

Students must complete 3.0 credits in:

1. 0.5 credit in required course PADM 5112 Macroeconomics for Policy Analysis
2. 2.5 credits electives from the following list:
    - PADM 5611 Science and Technology Policies
    - PADM 5612 Industrial Policy, Innovation and Sustainable Production
    - PADM 5613 Science, Risk and Evaluation
    - PADM 5614 Natural Resource Management
    - PADM 5615 Sustainable Energy Policy
    - PADM 5616 Environmental Policy
    - PADM 5617 Implementing Sustainable Development in Industrialized Countries
    - PADM 5618 Environmental and Ecological Economics
    - PADM 5619 Urban Sustainability
    - PADM 5620 The Science, Politics and Economics of Global Climate Change
    - PADM 5220 Regulation and Public Policy
    - PADM 5672 Policy Seminar (Innovation, Science and Environment)
    - Other PADM courses as approved by the M.A. Supervisor

Health Policy

Students must complete 3.0 credits in:

1. 1.0 credit in required courses
    - PADM 5111 Microeconomics for Policy Analysis
    - PADM 5116 Policy Analysis and Contemporary Governance.
2. 1.5 credits electives from the following list:
    - PADM 5221 Health Policy in Canada
    - PADM 5222 Economics and Health Policy
    - PADM 5229 The Health of Populations
    - PADM 5817 Health Policy in Developing Countries

3. 0.5 credit in other PADM courses as approved by the M.A. Supervisor.

Academic Standing

All candidates are required to obtain a grade of B- or higher in each course in the program.

Doctor of Philosophy

The doctoral program in public policy has two primary objectives:

- to contribute to the advancement of research and teaching of public policy by drawing on various theoretical frameworks, multi-disciplinary perspectives, and applied methodologies
- to develop scholars and researchers for positions in universities, private research institutions, and various other public and private organizations

The Ph.D. focuses on the study of public policy, including its formation, evolution and implementation. The primary focus is on Canada in an international or comparative context. Canadian, European, and other international students interested in research with an explicitly international and comparative perspective will also find the program conducive to their work, depending on the field of specialization chosen.

A distinguishing feature of the School of Public Policy and Administration is the presence of faculty who strive to integrate political science and economics in their research and teaching. The Ph.D. program is to a considerable extent based on the view that political economy is essential to an understanding of the public sector. It is also based on the view that such multi-disciplinary perspectives are essential to an understanding of the public sector.

Degree Schedule

The program consists of three academic terms of course work plus preparation and completion of one comprehensive examination, and a doctoral thesis. The Ph.D. program in Public Policy normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the School may accept a few candidates for the degree on a part-time basis.

Admission Requirements

Admission will be judged primarily on the applicant's ability to conduct advanced research and to complete the program successfully. Applications should contain at least one essay or paper at the M.A. level written by the applicant, as well as a statement of research interests and potential thesis topics. Enrolment is limited and possession of the minimum requirements does not, in itself, guarantee acceptance. Application deadlines can be found at https://gsapplications.carleton.ca .

Admission requires completion of an M.A. degree in any of public administration, political science, economics, political economy, business administration, law, or similar degree with first class standing (A- average or higher in their M.A. work).

Students are advised that a working knowledge of basic calculus is required for completion of the program. Assistance in acquiring these skills is provided by the program. Students requiring additional assistance should consult the Ph.D. Co-ordinator.

Applicants must also successfully complete prerequisites in statistics, political science, and economics as described in detail below. These prerequisites may be satisfied by the completion of appropriate course work at the intermediate undergraduate level or higher in each of the subjects listed.

Prerequisites in political science, economics and statistics must be completed prior to entry. Completed courses in political science should be approximately equivalent to PADM 5115 or PADM 5116. With permission of the Ph.D. Supervisor, this requirement may be done, as a directed study in the summer, prior to registration in the program, under the supervision of faculty in the School. Completed courses in economics should be approximately equivalent to PADM 5111. Equivalent courses may be taken at most universities throughout the academic year. Completed course in statistics should be approximately equivalent to PADM 5114. Applicants should seek advice from the Supervisor of the Ph.D. program about whether particular courses are acceptable as prerequisites.

Students whose first language is not English, or who have not completed a previous degree at an English speaking university, must demonstrate an adequate command of English by attaining, at least, a TOEFL score of 237 CBT (computer-based test) or 580 (written); or 86 IBT overall with a minimum score in each component of: writing: 22; speaking: 22; reading: 20; and listening: 20, or a CAEL score of 70, or an IELTS score of 7.0.

Advanced Standing

Advanced standing will not normally be granted for any of the required courses described below. If granted, advanced standing will be limited to 1.0 credit.

Program Requirements

The program consists of the following elements:

- 3.5 credits of course work;
- Preparation for and writing of one comprehensive examination, normally written in the summer term of the first year equivalent to 0.5 credit;
- Public defence of a written thesis proposal;
- A thesis equivalent to 6.5 credits;
- A language requirement.

Course Components

Courses will normally be taken in the first year. Students in the doctoral program are required to complete the following:

- 2.0 credits in: PADM 6111, PADM 6112, PADM 6113, PADM 6114. A GPA of 9.0 (B+) or better overall must be obtained in these courses before proceeding to the comprehensive examination.
- 0.5 credit Doctoral Seminar: PADM 6200;
- 1.0 credit that constitutes one area of specialization beyond the public policy foundations covered in the core courses. These courses will be chosen by the student after consultation with, and approval by, the student's academic supervisor and the Ph.D. Co-ordinator. The fields of specialization are: Public Management; Political Economy; Innovation, Science, and Environment; Health and Social Policy; and International and Development Policy.

These courses will normally be graduate courses offered by the School or by the Departments of Political Science and Economics, or directed studies (PADM 6901 and PADM 6902). However, other courses may be approved. Doctoral students taking courses at the master's level will be subject to

enhanced course requirements. When necessary, students must arrange formal approval from the relevant department for admission to courses.

Comprehensive Examinations

Students will write a general comprehensive examination, normally in the summer term of the first year. This examination will focus on the area of specialization they chose in conjunction with the two elective courses. In addition to those courses, each comprehensive examination will have a supplementary reading list. At the discretion of the examining board, a candidate whose performance is not fully satisfactory may be asked to take an oral examination or a second written examination.

Thesis

Following the successful completion of the comprehensive examinations, students will prepare a formal thesis proposal under a committee composed of the supervisor and two other faculty members. The thesis supervisor will normally be a faculty member from the School of Public Policy and Administration. Under normal circumstances, the proposal must be defended by the end of the fall term of the second year of full-time registration. The thesis must demonstrate an advanced ability to integrate the politics and economics of public policy. The thesis must be defended at an oral examination.

Language Requirement

Students will be required to demonstrate a reading knowledge of French. Another language may be substituted for French, if it is essential for the thesis.

Collaborative Ph.D. with a Specialization in Political Economy

The School of Public Policy and Administration and the Institute of Political Economy offer a Collaborative Program in Political Economy at the Ph.D. level. For further details, see the Institute of Political Economy's Collaborative Ph.D. with a Specialization in Political Economy section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

PADM 5111 [0.5 credit]
Microeconomics for Policy Analysis
Key concepts in microeconomic theory and their application to public policy. Topics may include incentives, rational choice theory, market structure, welfare economics, and strategic behaviour.
Precludes additional credit for PADM 5203
Prerequisite: ECON 1000 or equivalent.

PADM 5112 [0.5 credit]
Macroeconomics for Policy Analysis
Macroeconomic policy analysis. Theoretical foundations and current policy debates concerning economic growth and sustainable development, globalization and the open economy, stabilization policy, and fiscal and monetary policy are analyzed in the Canadian and international context.
Precludes additional credit for PADM 5202.

Prerequisite: ECON 1000 or equivalent.

PADM 5113 [0.5 credit]
Research Methods and Design I
Methods used in qualitative policy research. Topics may include the formulation of research problems, research design and techniques for collecting and managing evidence, and the role of qualitative research in the analysis of public policies and programs.
Precludes additional credit for PADM 5603.

PADM 5114 [0.5 credit]
Research Methods and Design II
Descriptive statistics, probability theory and sampling distributions, hypothesis testing of quantitative and qualitative population parameters, and regression analysis.
Precludes additional credit for PADM 5501.

PADM 5115 [0.5 credit]
Introduction to State and Society
Classic and contemporary debates about the relationship between the state, society, and economy. The development of the state, and changing conceptions of citizenship, democracy, and nationalism as well as the state's role in the post-WWII international order and the challenges of globalization.
Precludes additional credit for PADM 5607.

PADM 5116 [0.5 credit]
Policy Analysis and Contemporary Governance
Policy analysis and policy processes, emphasizing the contemporary context and challenges facing decision makers. Selected policy issues.
Precludes additional credit for PADM 5608.
Prerequisite: PSCI 2003 or equivalent.

PADM 5117 [0.5 credit]
Public Management
Principles and processes of public-sector management as they function through cabinet-parliamentary government, federalism, the public service bureaucracy and the judiciary. Institutional reforms and changes in the philosophy of public sector management.
Precludes additional credit for PADM 5000.
Prerequisite: PSCI 2003 or equivalent.

PADM 5211 [0.5 credit]
Intergovernmental Relations
Major cost-sharing and fiscal transfer agreements. The intergovernmental mechanisms for policy and administrative coordination in selected policy fields.
Precludes additional credit for PADM 5003.

PADM 5212 [0.5 credit]
Civil Society and Public Policy
The influence of various interests, social movements, voluntary organizations and citizens in the policy process in a Canadian and comparative context.

PADM 5213 [0.5 credit]
Gender and Public Policy
The impact of public policy on gender relations and how gender relations shape policy. Topics covered may include gender inequalities in earnings and employment, macroeconomic policy, gender and development, and gender-based analysis.
Also offered at the undergraduate level, with different requirements, as PADM 4213, for which additional credit is precluded.
Precludes additional credit for PADM 4701 and PADM 5701.

PADM 5214 [0.5 credit]

Budgetary Policy in the Public Sector

Selected aspects of the expenditure and revenue budget and budgetary process at all levels of government. Critical review of actual budgets and budgetary processes. Also offered at the undergraduate level, with different requirements, as PADM 4214, for which additional credit is precluded.

Precludes additional credit for PADM 5103.

PADM 5215 [0.5 credit]

Benefit-Cost Analysis

Benefit-cost analysis and its application to public-sector investment, pricing policy, discount rates, marginal cost and shadow pricing, and the handling of risk and uncertainty.

Precludes additional credit for PADM 5200.

PADM 5216 [0.5 credit]

Economic Models of Politics and Public Policy

Microfoundations of collective action, majority rule, political institutions and bureaucracy. Applications to various issues in Canadian and international public policy.

Precludes additional credit for PADM 5609.

PADM 5217 [0.5 credit]

Applied Microeconomic Policy Analysis

Microeconomic theory applied to public policy problems and issues.

Precludes additional credit for PADM 5204.

PADM 5218 [0.5 credit]

Analysis of Socio-economic Data

Correlation and regression analyses to test hypotheses about the relationships between socio-economic variables.

Precludes additional credit for PADM 5502.

PADM 5219 [0.5 credit]

Advanced Statistical Policy Analysis

Econometric research on selected policy issues using selected econometric techniques.

Precludes additional credit for PADM 5705.

Prerequisite: PADM 5218 or equivalent.

PADM 5220 [0.5 credit]

Regulation and Public Policy

Political, economic, legal, and organizational theories of regulation in the Canadian and comparative context. Processes and consequences of regulatory practice in selected Canadian public policy fields. Also offered at the undergraduate level, with different requirements, as PADM 4220, for which additional credit is precluded.

Precludes additional credit for PADM 5002.

PADM 5221 [0.5 credit]

Health Policy in Canada

Canadian health policies and programs set in a comparative political-economic and institutional context.

Also offered at the undergraduate level, with different requirements, as PADM 4221, for which additional credit is precluded.

Precludes additional credit for PADM 4009 and PADM 5009.

PADM 5222 [0.5 credit]

Economics and Health Policy

This course applies microeconomic theory to a discussion of health policy. Focus on issues of particular interest to a student of Canadian health care policy.

PADM 5223 [0.5 credit]

Canadian Economic Policy

Overview of Canadian economic development and how it has been affected by governments. Topics may be drawn from monetary, fiscal, industrial, trade, labour market or competition policies, viewed in contemporary and historical contexts.
Precludes additional credit for PADM 5205.

PADM 5224 [0.5 credit]

Aboriginal Policy

Canadian policies and programs on aboriginal peoples and aboriginal peoples' own policies as nations set in a comparative political-economic and institutional context.
Also offered at the undergraduate level, with different requirements, as PADM 4224, for which additional credit is precluded.
Precludes additional credit for PADM 4806 and PADM 5806.

PADM 5225 [0.5 credit]

Trade Policy

Canadian multilateral and regional trade policies and programs set in a comparative political-economic and institutional context.
Precludes additional credit for PADM 4807 and PADM 5807.
Also offered at the undergraduate level, with different requirements, as PADM 4225, for which additional credit is precluded.

PADM 5226 [0.5 credit]

Tax Policy

Canadian tax policies set in a comparative political-economic and institutional context.
Also offered at the undergraduate level, with different requirements, as PADM 4226, for which additional credit is precluded.
Precludes additional credit for PADM 4509 and PADM 5509.

PADM 5227 [0.5 credit]

Education Policy

Canadian policies and programs on education set in a comparative political-economic and institutional context. Also offered at the undergraduate level, with different requirements, as PADM 4227, for which additional credit is precluded.
Precludes additional credit for PADM 4809 and PADM 5809.

PADM 5228 [0.5 credit]

Social Policy

The nature and historical development of social programs in capitalist countries, with particular focus on Canada. The course will concentrate on developing a critical understanding of the social forces shaping these programs.
Precludes additional credit for PADM 4604 and PADM 5604.
Also offered at the undergraduate level, with different requirements, as PADM 4228, for which additional credit is precluded.

PADM 5229 [0.5 credit]

The Health of Populations

Assessment of the medical model, and perspectives on the social and economic determinants of health, population health, and community health. The health of particular groups in Canada (e.g., women, Aboriginal peoples). International comparisons will be made.

PADM 5272 [0.5 credit]

Policy Seminar (Policy Analysis Concentration)

One or more selected policy areas or specialized aspects of policy analysis. The policy field or topic will change each year.

PADM 5291 [0.5 credit]

Directed Studies (Policy Analysis Concentration)

A tutorial or directed reading course on selected subjects related to policy analysis.

PADM 5301

Co-operative Work Term
Prerequisites: registration in the Co-operative Education Option of the M.A. program and permission of the Co-op Supervisor.

PADM 5302

Co-operative Work Term
Prerequisites: Registration in the Co-operative Education Option of the M.A. program and permission of the Co-op Supervisor.

PADM 5303

Co-operative Work Term
Prerequisites: Registration in the Co-operative Education Option of the M.A. program and permission of the Co-op Supervisor.

PADM 5411 [0.5 credit]

Organization Theory
Focusing on major theoretical approaches to organizations, the course develops practical insights into issues such as organizational design, leadership, technology, culture and diversity, motivation and power. It applies these insights to organizations in both the public and private sectors in a variety of national contexts.
Precludes additional credit for PADM 5300.

PADM 5412 [0.5 credit]

Ethics and Accountability in the Public Sector
Philosophy, principles and values that have shaped Canada's framework of public sector ethics and accountability. The relationship between ethics, accountability and good governance and the reforms designed to limit unethical behaviour and strengthen accountability.
Precludes additional credit for PADM 4703.

PADM 5413 [0.5 credit]

Law of Public Authorities I
The legal environment of Canadian public administration, Canadian law, institutions and processes. Canadian legal history, adversarial adjudicative procedures, delegation of powers to public authorities, procedural justice in government decision making, and controls on public authorities and enforcement of ethics.
Precludes additional credit for PADM 5306.

PADM 5414 [0.5 credit]

Law of Public Authorities II
Characteristics and selected problems of control of administrative action. Topics may include: varieties of constitutional, legal and judicial control, impact of the Charter, reforms to administrative law control systems in Canada, and comparisons with developments outside Canada.
Precludes additional credit for LAWS 4507 and PADM 5307.
Prerequisite: PADM 5413.

PADM 5415 [0.5 credit]

Strategic Management in the Public Sector
Key concepts, principles and tools of strategic management, and their use in planning and policy implementation in the public sector. Reviews critical perspectives and cases in order to identify some of the limitations of strategic management.

PADM 5416 [0.5 credit]

Budgetary Management for the Public Sector
Theory and practice of budgeting in the public sector. From a management perspective, the course focuses on the objectives, methods and systems for the control and reporting of expenditures.

PADM 5417 [0.5 credit]

Principles of Finance

The use of financial assets to obtain funds, evaluative criteria to compare alternative uses of funds, and derivative contracts to manage risk. Public sector applications of these practices are emphasized.
Precludes additional credit for PADM 5101.

PADM 5418 [0.5 credit]

Human Resources Management

The field of human resources management including the roles of human resource departments, employee motivation, staffing, compensation, benefits, training and development and employee relations.
Precludes additional credit for PADM 5801.

PADM 5419 [0.5 credit]

Industrial Relations and Public Sector Collective Bargaining

The basic concepts of industrial relations, with respect to both public and private sector employees and organizations.
Precludes additional credit for PADM 5804.

PADM 5420 [0.5 credit]

Policy and Program Evaluation

Selected concepts, issues, and processes in applied governmental planning and evaluation, utilizing both Canadian and comparative experiences.
Precludes additional credit for PADM 5602.

PADM 5421 [0.5 credit]

Globalizing Public Management

Public sector reform has swept the developed and developing world in the last two decades. The dynamics of this global movement, the models exported and adopted, and the success and failure of these exports.

PADM 5422 [0.5 credit]

Urban and Local Government

The role of municipal government in the context of Canadian federalism. Current economic, political and social trends affecting Canada's major urban centres including growth, amalgamation, fiscal reform, immigration, housing, community engagement, and sustainable development.
Precludes additional credit for PADM 5106.

PADM 5423 [0.5 credit]

Third Sector Governance and Management

Governance and management of voluntary/nonprofit organizations and their role in democracy, public policy, and service delivery.
Precludes additional credit for PADM 5109.

PADM 5424 [0.5 credit]

Evaluation Cases and Applications

Selected case studies in the development, design, management and implementation of policy and program evaluation.
Prerequisite: PADM 5420.

PADM 5472 [0.5 credit]

Policy Seminar (Public Management Concentration)

One or more selected policy areas or specialized aspects of public management. The policy field or topic will change each year.

PADM 5491 [0.5 credit]

Directed Studies (Public Management Concentration)

A tutorial or directed reading course on selected subjects related to public management.

PADM 5611 [0.5 credit]

Science and Technology Policies

Theory and practice regarding governmental policies for science and technology, and the use of scientific knowledge in the policy and regulatory processes of government. Concerns regarding the ethical issues and the transparency of science in government. Also offered at the undergraduate level, with different requirements, as PADM 4611, for which additional credit is precluded.

Precludes additional credit for PADM 5400.

PADM 5612 [0.5 credit]

Industrial Policy, Innovation and Sustainable Production

Sustainable production theory and key drivers, barriers and opportunities influencing innovation in industrial systems and processes. The relationship of public policies and industry practices are explored in a number of sectors.

Precludes additional credit for PADM 4600 and PADM 5600.

Also offered at the undergraduate level, with different requirements, as PADM 4612, for which additional credit is precluded.

PADM 5613 [0.5 credit]

Science, Risk and Evaluation

Risk-benefit theories and practices and related issues in the evaluation of science and technology; how they are handled in applied regulatory and policy institutions in selected sectors (e.g. pesticides; health protection; biotechnology).

Precludes additional credit for PADM 5403.

PADM 5614 [0.5 credit]

Natural Resource Management

Governance and management of natural resources from a Canadian and international perspective. The use of various management instruments, regulatory approaches and community-based and co-management institutions are evaluated with evidence from several case studies from around the world.

PADM 5615 [0.5 credit]

Sustainable Energy Policy

Sustainable energy policy in the Canadian context. Themes may include: continental energy markets, de-regulation, environmental issues and climate change, and policy issues related to specific energy sectors including oil and gas, nuclear, electricity, and new renewables. Also offered at the undergraduate level, with different requirements, as PADM 4615, for which additional credit is precluded.

PADM 5616 [0.5 credit]

Environmental Policy

Canadian environmental policies and programs set in a comparative political-economic and institutional context. Also offered at the undergraduate level, with different requirements, as PADM 4616, for which additional credit is precluded.

Precludes additional credit for PADM 4008 and PADM 5008.

PADM 5617 [0.5 credit]

Implementing Sustainable Development in Industrialized Countries

Genesis and evolution of the idea of sustainable development and the ways in which it is influencing public policy and public sector structures and processes. Canada's performance in implementing sustainable development will be assessed in comparison with other industrialized countries.

PADM 5618 [0.5 credit]

Environmental and Ecological Economics

Environmental and ecological economics with applications to public policy and environmental management issues. Concepts of sustainability, non-market valuation and ecological stability,

the determination of environmental targets, and the use of policy instruments, incentives and emissions markets.

PADM 5619 [0.5 credit]
Urban Sustainability
Impact of economic growth and social change on cities and their attempts to forge sustainable growth. Incorporating political and fiscal issues, the focus is on 'smart growth' policies and initiatives in areas such as environmental control, transport, land use, housing and infrastructure.

PADM 5620 [0.5 credit]
The Science, Politics and Economics of Global Climate Change
Scientific issues at the core of climate change and the domestic and international policy responses. Various environmental, economic, and political implications for both the developed and developing worlds and for the various regions of Canada.

PADM 5672 [0.5 credit]
Policy Seminar (Innovation, Science and Environment Concentration)
One or more selected policy areas and topics related to innovation, science and environment. The topic will change each year.

PADM 5691 [0.5 credit]
Directed Studies (Innovation, Science and Environment Concentration)
A tutorial or directed reading course on selected subjects related to innovation, science and the environment.

PADM 5811 [0.5 credit]
The International Policy Framework
The evolution of the main international rules and institutions governing the economic relationships among nation states, with emphasis on the changing roles of the Bretton Woods institutions (IMF, World Bank, GATT/ WTO).
Precludes additional credit for PADM 5001.

PADM 5812 [0.5 credit]
Governance in Developing Countries
The roles of the state and civil society in the governance of developing countries in the context of public sector reform and globalization.

PADM 5813 [0.5 credit]
The Evolution of World Bank/IMF Policy Conditionality
The changing nature of World Bank/IMF policy conditionality with emphasis on the period since the onset of the 1982 debt crisis.
Precludes additional credit for PADM 5808.

PADM 5814 [0.5 credit]
Program and Project Management
The context, critical issues and methods relating to the planning and implementation of development programs and projects.
Precludes additional credit for PADM 5107.

PADM 5815 [0.5 credit]
Civil Society Organizations and Development
The context, roles, structures and strategies of nongovernmental organizations in the development process at the global, national and local levels. The role of development aid and NGOs is considered.

PADM 5816 [0.5 credit]
Program Evaluation in Developing Countries
The context, critical issues and methods relating to the evaluation of development interventions.

PADM 5817 [0.5 credit]
Health Policy in Developing Countries
Debates regarding health policy in the developing world, in the context of the global health sector reform movement, trade and intellectual property regimes, and strategies of corporate and NGO actors. Issues of gender, class and the determinants of health. Also offered at the undergraduate level, with different requirements, as PADM 4817, for which additional credit is precluded.

PADM 5872 [0.5 credit]
Policy Seminar (International and Development Concentration)
One or more selected policy areas and topics related to policy and administration in the international and development context. The topic will change each year.

PADM 5891 [0.5 credit]
Directed Studies (International and Development Concentration)
A tutorial or directed reading course on selected subjects related to international and development issues.

PADM 5908 [[1.0 credit]
Research Essay

PADM 5909 [2.0 credits]
M.A. Thesis

PADM 6111 [0.5 credit]
Markets, Prices and Government
The contributions and limitations of microeconomic theory for analyzing the behaviour of public and private decision makers. Issues include different forms of market failure, and different understandings of the appropriate role of government in addressing them.
Precludes additional credit for PADM 6008 and PADM 6102.

PADM 6112 [0.5 credit]
Policy Institutions and Processes
Economic and political science approaches to the role of ideas, interests and institutions in the public policy process and instrument choice. Topics may include policy paradigms and political culture, interest groups, theories of state formation, behaviour of bureaucracies and legislative institutions.
Precludes additional credit for PADM 6005, PADM 6007 and PADM 6105.

PADM 6113 [0.5 credit]
Public Policy Analysis
The application of economic and political science approaches to public policy analysis in Canadian and comparative settings. The policy fields examined may include social welfare and labour market policy, tax and trade policy, science policy and environment policy.
Precludes additional credit for PADM 6004, PADM 6009 and PADM 6106.

PADM 6114 [0.5 credit]
Foundations of Policy Analysis
Assessment and comparison of key theoretical traditions in explaining and analyzing public policy.

PADM 6200 [0.5 credit]
Doctoral Research Seminar
Issues in developing research proposals and conducting public policy research; includes research presentations by senior doctoral students and faculty. Required for second-year doctoral students who present their thesis proposals. Issues surrounding quantitative or qualitative methods in public policy analysis may be discussed. Graded Pass/Fail.

PADM 6900 (0.5 credit)

Ph.D. Comprehensive Examination

Ph.D. preparation for the comprehensive examination. The grade to be awarded will be that obtained on the comprehensive examination.

PADM 6901 [0.5 credit]

Ph.D. Specialization Tutorial

A Ph.D. tutorial covering advanced theory and research in an area of specialization generally related to public policy. Specific topics will be selected in consultation with, and must be approved by, the academic supervisor and Ph.D. co-ordinator.

PADM 6902 [0.5 credit]

Ph.D. Specialization Tutorial

A Ph.D. tutorial covering advanced theory and research in an area of specialization generally related to public policy. Specific topics will be selected in consultation with, and must be approved by, the academic supervisor and Ph.D. co-ordinator.

PADM 6909 [6.5 credits]

Ph.D. Thesis

Students will normally be supervised by faculty in the School of Public Administration but may also seek supervision from faculty in other social sciences departments, schools, and institutes.

Social Work

Dunton Tower 509
Telephone: 613-520-5601
Fax: 613-520-7496
carleton.ca/ssw

The School

Acting Director of the School: Diana Majury
Supervisor of Graduate Studies: Steven Hick

The School of Social Work, accredited by the Canadian Association of Schools of Social Work, offers a graduate program leading to the degree of Master of Social Work. Year I will normally be completed over two terms of full-time study. Year II will normally be completed over three terms or twelve months of full-time study. Part-time study is also offered. Year I will normally be completed over two to three years, and Year II will normally be completed over three to four years.

Master of Social Work

The Master of Social Work program is based on an analytical and critical approach to social work practice, and to knowledge related to practice. The program examines the structural context of personal and social problems and of social work practice itself. The structural context refers to the interaction between individuals and the social, political, and economic dimensions of society. The program focuses on the development of social work practices that change the interactions between people and structural contexts.

The curriculum is organized into two concentrations:

1. Social Practices, which includes direct intervention with individuals, families, small groups, and communities; and
2. Social Welfare, which examines the political, economic, and social context within which social policy is made.

The orientation of the School explicitly includes approaches to social policy development and social change that involve working collaboratively with individuals, groups, and communities. Emphasis is placed on sensitivity to the individual, and on the development of new and innovative strategies for working with individuals in the context of their everyday lives. The School also stresses community work and social development that raises awareness of social problems that affect the lives of all people in our society. Analysis of the material conditions of life in Canadian society and the production of class, gender, and race is considered central to all aspects of the curriculum.

The School of Social Work is committed to educational equity. The society in which we live and of which social work is a constituent part is composed of groups of people distinguished by their differential access to power - economic, political, and social. The School affirms the principle that all these groups should have the opportunity to learn in a supportive environment. Educational equity is consistent with a continuing commitment to meeting high standards of academic and practice competence.

The central purpose of the graduate program is to provide students with the opportunity to build on their knowledge and experience. Students will be able to use the program to deepen their understanding of both the methods and contexts of practice, to build new knowledge, and to apply this

new knowledge. The program requirements are designed to be as flexible as possible while at the same time ensuring that all students master core social work knowledge and practice skills. Graduates may expect to use their experience in the School as the basis for continuing to expand their personal knowledge in a society undergoing rapid change.

Admission Requirements

The School of Social Work provides two points of entry into the Master of Social Work program.

Applications are accepted to the first year of a two year M.S.W. program from candidates who hold an Honours bachelor's degree, or the equivalent, with at least high honours standing (normally B+ or higher in honours subject; B- or higher overall) in a discipline other than social work.

Applications are accepted to the one year M.S.W. program from candidates who hold an accredited Bachelor of Social Work degree with honours standing (normally B+ or higher in honours subject; B- or higher overall).

Applications are accepted to the one year M.S.W. program from candidates who are in the final year of a Bachelor of Social Work program, and who have maintained a B+ or higher in social work and B- or higher overall. Applicants with social work experience who hold undergraduate or graduate applied social science degrees from a university or other degree granting institution are directed to apply to the two year M.S.W. program. The School will review the equivalence of such degrees to a Bachelor of Social Work.

Work experience in social work or a related field is considered as one of several selection criteria for both M.S.W. Year I and M.S.W. Year II.

Persons who have a Bachelor of Arts degree and human service experience may also wish to apply to the Bachelor of Social Work program. Please refer to the Undergraduate Calendar for further information.

Applicants must have completed 1.0 credit in research methods in their undergraduate program. The School of Social Work will not normally grant advanced standing for course work completed prior to entry into the M.S.W. program. Students accepted into M.S.W. Year I will be expected to complete 5.0 credits of course work in Year I and 6.0 credits of course work in Year II. Students accepted into M.S.W. Year II will be expected to complete 6.0 credits of course work. Work experience may not be substituted for research or other academic requirements, including the practicum.

Application deadlines can be found at https://gsapplications.carleton.ca .

Part-Time Studies

The School offers part-time studies to a limited number of qualified candidates who cannot participate in a program of full-time study. The requirements for part-time studies are identical to those of the regular program, except that part-time students are limited to a maximum of 1.0 credit of course work per term.

Students registered on a part-time basis must maintain continuous registration for a minimum of two terms per year until all course requirements are completed.

In their first fall term, part-time students in the M.S.W. Year I must register in SOWK 5501 or SOWK 5502 and one of SOWK 5308, SOWK 5408, or SOWK 5608. Part-time students in the M.S.W. year II

register in SOWK 5306 or SOWK 5307 plus an additional 0.5 credit of course work in their first fall term.

Change of Status

Students contemplating changing their full-time or part-time status should consult the General Regulations section of this Calendar.

Program Requirements

Students with an Honours undergraduate degree other than a B.S.W. or the equivalent who are admitted into the two-year M.S.W. program must complete Year I and Year II.

Students with a B.S.W. or equivalent who are admitted into the one-year M.S.W. program must complete Year II.

Year I of the M.S.W. consists of the following 5.0 credits:

- SOWK 5308 [0.5 credit]
- SOWK 5408 [0.5 credit]
- SOWK 5608 [0.5 credit]
- SOWK 5501 [0.5 credit]
- SOWK 5502 [0.5 credit]
- SOWK 5606 [2.0 credits]
- 0.5 credit to be taken from graduate-level course offerings in the School.

Year II of the M.S.W. consists of the following 6.0 credits:

- SOWK 5306 or SOWK 5307
- SOWK 5405
- And one of the following two options:
    - Thesis/Course Work Option
        - SOWK 5909 [2.0 credits] Thesis
        - 2.0 credits of course work
    - Practicum/Course Work Option
        - SOWK 5607 [2.0 credits] Practicum
        - 2.0 credits of course work

For all course options listed above, a minimum of 1.0 credit must be taken from graduate-level course offerings, in the School of Social Work, a maximum of 1.0 credit may be taken outside the School of Social Work, and a maximum of 0.5 credit may be taken at the 4000-level.

All students in SOWK 5903, SOWK 5909, SOWK 5606, SOWK 5607 must maintain continuous registration until completion of the course in accordance with the General Regulations as stated in this calendar.

Academic Standing

Candidates for the M.S.W. degree must complete all course work (or the equivalent) counted towards the degree with a grade of B- or higher. The School of Social Work does not permit the C+ option.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

Note: all seminar courses, directed studies, workshops, independent study courses, and community practice courses are governed by Section 7.7, Tutorials, of the General Regulations.

M.S.W. Year I - Required Courses

SOWK 5308 [0.5 credit]
Direct Intervention
Presentation of a structural framework for social work theory and practice examining assessment and interventive approaches, analytical and interaction skills, helping process and social transformation. Explores interventions with individuals, families, small groups based on an understanding of class, gender, race, age, ability and sexual orientation.
Precludes additional credit for SOWK 5304.
Prerequisite: registration in M.S.W. Year I.

SOWK 5408 [0.5 credit]
Social Administration and Policy
Knowledge and skills required for understanding, analyzing and practicing social policy development and administration in social work. Political, economic, and social context of policymaking, theoretical perspectives for developing policy, and contemporary social policy issues.
Precludes additional credit for SOWK 5304.
Prerequisite: registration in M.S.W. Year I.

SOWK 5501 [0.5 credit]
Theories in Social Science and Social Work
Examines relationships between theories in social science and in social work exploring connections to social work practice and emphasizing theories of inequality.
Precludes additional credit for SOWK 5500.
Prerequisite: registration in M.S.W. Year I.

SOWK 5502 [0.5 credit]
History of Social Welfare and Social Work
Historical development of social welfare policies and the Canadian welfare state. History of relationship of economy, family, welfare institutions and Canadian state. Focus on the origins and development of social work as a profession.
Precludes additional credit for SOWK 5500.
Prerequisite: registration in M.S.W. Year I.

SOWK 5606 [2.0 credits]
Practicum I
Integration of academic and practical aspects of social-work education. 475 hours of guided learning in a community-based setting. Field seminar required.
Prerequisite: registration in M.S.W. Year I, and completion of or concurrent registration in SOWK 5308, SOWK 5408, SOWK 5501, SOWK 5502, and SOWK 5608.

SOWK 5608 [0.5 credit]
Community Work
Models and methods of community organization. Social-economic contexts and ideological approaches to social change work; social change efforts; globalization and corporate rule.
M.S.W. Year II - Required Courses and Program Options

SOWK 5306 [1.0 credit]

Advanced Theory for Social Welfare

Core concepts and ideas about the modern welfare state and the Canadian welfare state. The role and nature of social policy in the Canadian political system. Methods of analysis of contemporary social policy.
Precludes additional credit for SOWK 5305.
Prerequisite: registration in M.S.W. Year II.

SOWK 5307 [1.0 credit]

Advanced Theory for Social Practices

Advanced integration of social work knowledge, skills and ethics for practice with individuals, families, small groups and communities. Structural analysis of personal and social problems. Review of contemporary social work theories and practice approaches.
Precludes additional credit for SOWK 5305.
Prerequisite: registration in M.S.W. Year II.

SOWK 5405 [1.0 credit]

Research and Evaluation in Social Work

Addresses the logic of inquiry, and assesses quantitative and qualitative techniques. Attention to program and direct intervention evaluation especially with the use of action and participatory research approaches. May include research or evaluation project with community agencies and practitioners, or individual research proposal.
Prerequisite: registration in M.S.W. Year II.

SOWK 5607 [2.0 credits]

Practicum II

500 hours integrating advanced social work theories and practice. Field seminar required. Not usually available in the first term of registration.
Prerequisite: B.S.W. or completion of M.S.W. Year 1, and completion of SOWK 5306 or SOWK 5307; SOWK 5306 or SOWK 5307 may be taken concurrently with SOWK 5607 to fulfil this requirement.

SOWK 5909 [2.0 credits]

Thesis

Prerequisite: registration in M.S.W. Year II.

Optional Courses

SOWK 5006 [0.5 credit]

Social Work, Gender and the State

This seminar course examines the construction of the "social" sphere and making the "social" work as it applies to the development of social welfare and the social work profession. An analysis of the gendered character of state provisions, women's participation in their formation, and their implications with regard to race and class is used to examine the current restructuring of social welfare.

SOWK 5101 [0.5 credit]

Social Policy Analysis

Conceptual, theoretical, and empirical tools for the analysis of social policies in Canadian society.

SOWK 5102 [0.5 credit]

Political Economy of Health

Distinctions and connections between health and health care. Who receives care, who provides it, who pays for it, and who makes the decisions affecting it.

SOWK 5105 [0.5 credit]

Poverty and Income Security

Examination of theories of poverty and wealth, conflicting understandings of poverty and the unequal distribution of income and wealth in Canada. Theories of poverty and wealth as they influence social policy, notably universal programs, social welfare services, income redistribution, and taxation.

SOWK 5106 [0.5 credit]

Women and Social Policy

Structural analysis of social policy affecting women. Relationship of feminist scholarship to the practical work of developing policy and to policy outcomes for women. Impact of the women's movement on the formal processes of policy making.

SOWK 5108 [0.5 credit]

Seminar in Social Policy

Social policy analysis of particular fields such as corrections, mental health services, children's services, or health care services. Current programs, historical developments, and the major current issues, developments, and challenges.

SOWK 5207 [0.5 credit]

Community Economic Development

Critical understandings of sustainable Community Economic Development (CED). Diverse local and international CED initiatives. Skills necessary for facilitating CED processes.

SOWK 5301 [0.5 credit]

Women, Male Violence and Social Change

Focus on male violence against women. Theory, responses of the state and the justice system, and practice approaches to helping women and the men who abuse them, and initiatives for social change.

SOWK 5302 [0.5 credit]

Mental Health Policy and Practice

Historical development, legislative framework, institutional and service structure, and practice issues related to mental health services in Canada. The interface between mental health and sexual abuse, family violence, racism, corrections, aging and immigration.

SOWK 5309 [0.5 credit]

Foundations of Direct Intervention

Philosophical and historical evolution of the competing paradigms underlying contemporary social work practice, with individuals, families, and community analyzed using philosophy of science and the sociology of knowledge.

SOWK 5503 [1.0 credit]

Directed Studies - Group

Exploration of selected theoretical perspectives relevant for social work practice that are offered subject to the availability of faculty. Arranged for small groups of students who are interested in a similar substantive area.

SOWK 5504 [1.0 credit]

Directed Studies - Individual

Individual exploration of selected theoretical perspectives for social work practice under the direct supervision of a member of faculty or visiting scholar.

SOWK 5505 [0.5 credit]

Directed Studies - Group

Exploration of selected theoretical perspectives relevant for social work practice that are offered subject to the availability of faculty. Arranged for small groups of students who are interested in a similar substantive area.

SOWK 5506 [0.5 credit]
Directed Studies - Individual
Individual exploration of selected theoretical perspectives for social work practice under the direct supervision of a member of faculty or visiting scholar.

SOWK 5507 [0.5 credit]
Workshop on Selected Topics in Social Work Practice
Approved workshops organized in the School and in the community may be offered subject to the availability of faculty. Evaluation of students is based on the student's role in the workshop and the nature of the assignment(s) required of the student.

SOWK 5508 [1.0 credit]
Studies in Social Work
May combine directed studies - group or individual - workshops, research study, or community practice. Registration is by permission of the supervisor of graduate studies and will be granted only when the student has negotiated an approved study agreement with the social work instructor(s).

SOWK 5509 [0.5 credit]
Studies in Social Work
May combine directed studies - group or individual - workshops, research study, or community practice. Registration is by permission of the supervisor of graduate studies and is granted only when the student has negotiated an approved study agreement with the social work instructor(s).

SOWK 5609 [0.5 credit]
Studies in Community Practice
May be offered subject to the availability of faculty. Studies are supervised by faculty. A written proposal is required that must include learning objectives, practice objectives, time of completion, and criteria and method of evaluation.

SOWK 5700 [0.5 credit]
Special Topics in Social Work
The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

SOWK 5701 [0.5 credit]
Special Topics in Social Work
The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

SOWK 5702 [0.5 credit]
Special Topics in Social Work
The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

SOWK 5703 [0.5 credit]
Special Topics in Social Work
The School will offer lecture courses on substantive topics related to social work and social welfare. Topics will vary each year depending on the interests of faculty and students. Students from outside the School of Social Work may register with permission of the School.

SOWK 5704 [0.5 credit]
Race, Culture and Social Work Practice
Anti-racist framework for social work practice to analyze policy and practice issues. "Privilege" as a critical and essential component for understanding oppression based on race and culture. Complex intersections of race and culture with class, gender, age, and other dimensions.

SOWK 5705 [0.5 credit]

Child Protection Policies and Interventions

Explores child welfare policy and the organization of social work practice particularly in the Canadian context. A range of welfare provisions affecting children and families will be considered as will direct child protection policies and practices.

SOWK 5801 [0.5 credit]

Social Work Practice Seminar: Feminist Social Work Practice with Individuals, Couples, and Families

Theory and practice of feminist approaches to social work with individuals, couples and families. Issues of diversity, such as race, class, and gender. Problem-based learning approach.

SOWK 5802 [0.5 credit]

Social Work Practice Seminar: Cross-cultural Studies of the Self and Related Subjects

Governance and care of the Self in different cultural and historical contexts. Theoretically located in emergent sociology and psychology of governance and care of the self. Cross-cultural perspectives practices and policies of different forms of governance and debates about social regulation.

SOWK 5804 [0.5 credit]

Social Work Practice Seminar: Organizing for Social Change

Hands-on introduction to theories, models, and methods of organizing for social change from grass roots groups to national coalitions. Practical skills for helping people mobilize to influence relevant social issues. Problem-based learning approach.

SOWK 5805 [0.5 credit]

Social Work Practice Seminar: Social Development in the International Context

International social development policies and practices from a cross-cultural perspective. Focus on international social policies and practices, and on economic, health, telecommunication, migration, and education policies and practices.

SOWK 5803 [0.5 credit]

Social Work Practice Seminar

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

SOWK 5806 [0.5 credit]

Social Work Practice Seminar

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

SOWK 5807 [0.5 credit]

Social Work Practice Seminar

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

SOWK 5808 [0.5 credit]

Social Work Practice Seminar

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

SOWK 5809 [0.5 credit]

Social Work Practice Seminar

Applied knowledge for social work practice utilizing "problem-based learning". Examples drawn from the experience of social work practitioners. Self-guided individual and group study, directed by a faculty tutor.

SOWK 5903 [1.0 credit]

Independent Research Studies in Social Work

Individually-arranged independent research study. Requires a written proposal that outlines a research project with clear learning objectives, and practice objectives (where relevant).

SOWK 5904 [0.5 credit]

Independent Research Studies in Social Work

Individually-arranged independent research study. Requires a written proposal that outlines a research project with clear learning objectives, and practice objectives (where relevant).

SOWK 5909

Thesis

Prerequisite: registration in MSW Year II.

Sociology

Department of Sociology and Anthropology
Loeb Building B742
Telephone: 613-520-2582
Fax: 613-520-4062
carleton.ca/socanth

The Department

Chair of the Department: P. Gose
Coordinator of Graduate Programs in Sociology: J. Siltanen

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and the Ph.D. degrees in Sociology, and the M.A. in Anthropology. This section provides information on the degrees offered in the Sociology programs. For information about graduate Anthropology programs, visit the Anthropology program section of this Calendar.

The principal focus of the graduate programs in sociology is the organization and development of contemporary societies in comparative context and with particular reference to Canadian society. The programs specialize in four fields: theory and methodology, stratification and power, cultural studies, and applied social research. See the department website for detailed descriptions of the fields and the variety of sub-fields sub-subsumed under these four areas. In addition, the Master of Arts in Sociology offers a concentration in quantitative methodology, and the Doctor of Philosophy in Sociology offers a collaborative specialization in political economy.

The anthropology program focuses on the social and cultural other, including its popular and scholarly representations, through current emphasis on three fields of study:

- the the anthropology of signs and symbols
- the anthropology of indigenous peoples
- the anthropology of development and underdevelopment

The department strives to achieve a blend of research and formal graduate instruction in its graduate programs.

Qualifying-Year Program

Applicants with general (three-year) bachelor's degrees may be admitted into a qualifying-year program designed to raise their standing to honours status. Students earning at least high honours standing in their qualifying-year courses will be considered for admission into the master's program.

Refer to the General Regulations section of this Calendar for details of the regulations governing the qualifying year.

Master of Arts in Sociology

Admission Requirements

The requirement for admission into the master's program is a B.A.(Honours) (or the equivalent) with at least high honours standing in sociology or a closely-related field. Where relevant, previous

professional experience will be taken into account in determining an applicant's standing on admission.

Application deadlines can be found at https://gsapplications.carleton.ca .

Program Requirements

Master's students in sociology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

5.0 credits including:

- 3.0 credits. Under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. SOCI 5005 and SOCI 5809 are highly recommended, especially for students who at the time of registration have not decided on a thesis topic;
- A thesis equivalent to 2.0 credits; and
- An oral examination on the candidate's thesis and program.

Research Essay Program

5.0 credits including:

- 4.0 credits. Under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. SOCI 5809, is highly recommended, especially for students who at the time of initial registration have not decided on a research topic;
- A research essay equivalent to 1.0 credit; and
- An oral examination on the candidate's research essay and program.

Course Work Program

- 5.0 credits excluding SOCI 5905. Under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level; and
- Written and oral comprehensive examination in the candidate's area of specialization and program.

Concentration in Quantitative Methodology

Students in either the research essay or thesis program options may pursue a concentration in quantitative methodology. For a concentration in quantitative methodology, courses selected must include the following:

- SOCI 5005;
- SOCI 5809;
- At least 1.0 credit selected from: SOCI 5101, SOCI 5102, SOCI 5103 SOCI 5104, SOCI 5105, SOCI 5201 SOCI 5605; and
- At least 1.0 credit in sociology at the graduate level (not including those listed above).

Students in the Concentration in Quantitative Methodology may apply for admission into a Cooperative Education option. This option provides an opportunity for students to enhance their educational

experience through a work placement directly related to their area of interest and expertise. Once admitted into this option, students shall enrol in SOCI 5907. The conditions of the placement are arranged with the student's supervisor and the graduate coordinator. Grades for the cooperative education placement are assigned in consultation between the placement supervisor and the graduate coordinator. Placements can be held for up to two academic terms and count for 1.0 credit.

Transfer from Thesis to Course Work M.A.

Students who choose to change from the thesis to the course work program must normally do so before registering for a third term after initial, full-time registration, or before registering for a fifth term after initial part-time registration.

Academic Standing

A grade of B- or better must normally be obtained in each credit counted toward the master's degree. With the recommendation of the department, and permission of the Dean of the Faculty of Graduate Studies and Research, a candidate may be allowed a grade of C+ in 1.0 credit.

Ph.D. in Sociology

The substantive focus of the Ph.D. program is the organization and development of contemporary societies, both in a comparative context and with particular reference to Canadian society.

The Ph.D. program in sociology normally will be undertaken on a full-time basis; however in exceptional cases the department will consider admission on a part-time basis.

Admission Requirements

The minimum requirement for admission into the Ph.D. program is a master's degree (or the equivalent) in sociology, normally with a minimum average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted to the Ph.D. program, but will normally be required to complete additional course work.

Application deadlines can be found at https://gsapplications.carleton.ca .

Program Requirements

The program requirements of the Department of Sociology and Anthropology are:

- 10.0 credits including SOCI 6000, and a thesis equivalent to a maximum of 7.0 credits or a minimum of 5.0 credits;
- Written and oral comprehensive examinations in two areas of specialization;
- Presentation of a thesis proposal;
- Language requirements as stated below; and
- An oral defence of the thesis.

Comprehensive Examinations

Each Ph.D. candidate is required to write comprehensive examinations in two of the following areas:

- Theory and Methodology
- Stratification and Power
- Cultural Studies
- Applied Social Research

Subjects of instruction and research subsumed under these four areas are:

Theory and Methodology

- Logic of Social Scientific Inquiry
- Classical Social Theories
- Contemporary Social Theories
- Feminist Theories
- Research Methods (Historical, Qualitative, and Quantitative)

Stratification and Power

- Occupations, Organizations, and the Labour Process
- Class Analysis and Social Stratification
- Political Sociology
- Race and Ethnic Relations
- Gender Relations
- Political Economy
- Canadian Society
- Social and Economic Development
- Citizenship Studies
- Governance, Regulation, and Law

Cultural Studies

- Communication and Popular Cultures
- Ethnographic Analysis
- Discourse Analysis
- Social Anthropology
- Social and Virtual Spaces

Applied Social Research

- Criminal Justice
- Health and Illness Policy
- Population Studies
- Sociology of Language
- Built Environments
- Education Policy

Upon petition to the sociology graduate program's coordinator, an approved field in sociology or a related discipline may be substituted for one of the options above. The subjects of instruction and research subsumed under each of the areas are indicative, and may be subsumed under more than one area, depending on the analytic approach adopted.

The comprehensive examinations are to be completed after course requirements for the Ph.D. have been completed. Comprehensive examinations must be completed no later than two years or six terms after initial full-time registration, and four years or twelve terms after initial part-time registration.

The thesis proposal is to be presented after comprehensive requirements have been completed. Normally the thesis proposal must be presented no later than two and one-half years or seven terms after initial full-time registration and five years or fifteen terms after initial part-time registration.

Language Requirement

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the departmental language examination.

Academic Standing

Candidates must obtain a grade of B- or better in each credit, and Satisfactory on the comprehensive examinations, the Ph.D. thesis and its oral defence.

Collaborative Ph.D. with a Specialization in Political Economy

The Department of Sociology and Anthropology and the Institute of Political Economy offer a Collaborative Program in Political Economy at the Ph.D. level. For further details, see the Institute of Political Economy's Collaborative Ph.D. with a Specialization in Political Economy section of this Calendar.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

SOCI 5000 [0.5 credit]
Classical Sociological Theory
Crucial sociological concepts and ideas by the founders of sociology. Attention will be given to Marx, Weber, Durkheim, Pareto, Comte, and Husserl.

SOCI 5001 [0.5 credit]
Selected Topics in Classical Theory
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

SOCI 5002 [0.5 credit]
Contemporary Sociological Theory
Major theoretical perspectives in sociology, including social behaviourism; social action theories such as symbolic interactionism, phenomenological sociology, ethnomethodology; and structuralist theories such as structural functionalism, neo-Marxism and critical theory.

SOCI 5003 [0.5 credit]

Selected Topics in Contemporary Theory

Topic varies from year to year. Students should check with the Department regarding the topic offered.

SOCI 5005 [0.5 credit]

Recurring Debates in Social Thought

Recurring issues and debates in the discipline. Topics such as the nature of social science; the objective world versus social construction; questions of evidence, meaning and measurement; agency versus structure; the relation between research and praxis; knowledge and power, may be considered.

Prerequisite: restricted to M.A. students in sociology. Others may be admitted by permission of the Department.

SOCI 5007 [0.5 credit]

Social Change and Economic Development

Critical examination of studies of change and development in historical and contemporary national and transnational systems.

SOCI 5009 [0.5 credit]

Philosophy of Social Science I

Philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.

SOCI 5101 [1.0 credit]

Research Design and Data Analysis

An integrated approach to the problems involved in the analysis of quantitative data, research design and procedures.

SOCI 5102 [0.5 credit]

Statistical Methods I

A course on multiple regression analysis, with a review of basic statistical assumptions and techniques, followed by a detailed discussion of multiple regression analysis as a statistical technique.

SOCI 5103 [0.5 credit]

Statistical Methods II

The focus will be advanced research methods. Topics will include distributions, sampling distributions, hypothesis testing, and non-parametric methods. There will be an introduction to multivariate techniques, including regression and loglinear models.

SOCI 5104 [0.5 credit]

Multivariate Analysis

This course provides advanced instruction in methods and statistics. Consideration will be given to multiple regression, factor analysis, canonical analysis.

SOCI 5105 [0.5 credit]

Selected Topics in Social Research

Topic varies from year to year. Students should check with the Department regarding the topic offered.

SOCI 5200 [0.5 credit]

Comparative Social Systems

Perspectives and research procedures employed by sociologists in the systematic and explicit comparison of data from two or more societies.

SOCI 5201 [0.5 credit]
Comparative Methods in Social Research
Current analytical problems and applications of comparative methods in social research. Students are expected to participate in a group research project in which one or more of these methods will be applied.

SOCI 5204 [0.5 credit]
Consuming Passions: The Regulation of Consumption, Appearance and Sexuality
Examination of the rise of consumption and private pleasures and their regulation and self-regulation. (Also listed as LAWS 5008.)

SOCI 5205 [1.0 credit]
Canadian Society
A critical examination of sociological models of modern societies and their relevance to Canada.

SOCI 5206 [0.5 credit]
Sociology of Occupations and Professions
A consideration of the development of occupational recruitment patterns and manpower problems in developed and developing areas.

SOCI 5207 [0.5 credit]
Sociology of Formal Organizations
A consideration of the forms and processes of bureaucracy in modern society, government and industry.

SOCI 5209 [0.5 credit]
Sociology of Science and Technology
Study of the interaction among science, technology and change in modern societies.

SOCI 5300 [0.5 credit]
Social Institutions I
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

SOCI 5301 [0.5 credit]
Social Institutions II
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

SOCI 5302 [0.5 credit]
The Labour Process
A consideration of the organization of work and production from feudal times to the present. The purpose of the course is to analyze the labour process in advanced capitalist societies by means of the historical comparative method.

SOCI 5303 [0.5 credit]
Sociology of Education
The relations between education and other social institutions, the structure of educational opportunity, educational systems and organizations, and the sociology of learning.

SOCI 5305 [0.5 credit]
Police and Capital
The idea of ‘police’ as a general historical project aimed at the fabrication of social order and the development of liberal philosophy, political economy and security. Contemporary public and private security provision considered in light of commodification, class conflict, and risk thinking. (Also listed as LAWS 5306)

SOCI 5306 [0.5 credit]
Cultural Studies
The relations between cultural practices and other social practices in definite social formations. Discussions are grounded through the choice of specific Canadian research on topics such as media, art, music, education, pedagogy, etc.

SOCI 5307 [0.5 credit]
Psychoanalysis and Cultural Studies
This course will examine the relationship between psychoanalytic and sociological theory, focussing on the work of feminist theorists.

SOCI 5308 [0.5 credit]
Feminist Analyses
Current theory and research in recent feminist analysis.

SOCI 5309 [0.5 credit]
Cultural Theory
A survey of developments in European and North American Marxist and Post-Marxist cultural theories of the past quarter century.

SOCI 5400 [0.5 credit]
Political Sociology
An examination of theoretical and empirical work on selected aspects of the state, politics and political behaviour, primarily in North America and Europe.

SOCI 5404 [0.5 credit]
Race, Ethnicity and Class in Contemporary Societies
Various theoretical approaches concerning the persistence and re-emergence of ethnic and/or racial groups are examined. Particular emphasis is given to the intersection and overlap of ethnicity and race with social class.

SOCI 5405 [0.5 credit]
Power and Stratification
An examination of theories of elite behaviour, social class, and ideology.

SOCI 5406 [0.5 credit]
Citizenship and Globalization
Examination of debates about the changing nature of citizenship in the context of globalization of capital, culture and peoples. Employing post-Marshallian, political economic, post-structuralist, post-colonial and feminist perspectives, the seminar explores the emergence of market-driven, hierarchical and cosmopolitan notions of citizenship and transnational identities.

SOCI 5407 [0.5 credit]
Governance, Power, and Politics
A survey of critical theories and concepts of governance, and recent developments in political sociology. Topics may include forms of capitalism, governmentality, sovereign power, biopolitics, and citizenship. Also listed as PSCI 5303.

SOCI 5408 [0.5 credit]
Feminism and Materialism
Recent developments of feminist materialist theory and analyses. Topics may include: the gender division of labour; family and economy; gender and class; gender, race and ethnicity; sexuality; reproduction; theory and politics.

SOCI 5409 [0.5 credit]
The Politics of Social Movements and the State
Origins, ideologies, strategies and political implications of social and popular movements in North America and Western Europe. Attention is given to the peace, feminist, gay, ecology, and anti-racist movements, and the emergence of the New Right.

SOCI 5500 [0.5 credit]
Gender Formation and State Formation
The role of states in the formation of gender relations, in the context of class and race, and the production of gender as an aspect of state formation. The various levels of the state are conceived as both a site and object of gender politics.

SOCI 5504 [0.5 credit]
Selected Problems in Political Economy I
A selected topic from current research in political economy. As the topic varies from year to year, students should check with the Department regarding the current offering. (Also listed as PECO 5501 and PSCI 5501.)

SOCI 5505 [0.5 credit]
Selected Problems in Political Economy II
A selected topic from current research in political economy. As the topic varies from year to year, students should check with the Department regarding the current offering. (Also listed as PECO 5502 and PSCI 5502.)

SOCI 5600 [0.5 credit]
Critical Discourse Analysis
Examination of the relations between discourse, social semiotics, extradiscursive semiotics and social organization.

SOCI 5605 [0.5 credit]
Demographic Analysis
Intensive study of analytical strategies and techniques employed in demographic research. Attention is also given to mathematical and statistical models used in demography, which are relevant to research in other areas of sociology.

SOCI 5606 [0.5 credit]
Selected Topics in Sociology
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

SOCI 5607 [0.5 credit]
Contemporary Theories of Crime and Social Regulation
Recent developments in theories of criminality and social regulation. Particular reference will be made to the regulatory mechanisms of both public and private spheres within legal institutions, corrections, economic institutions, and the family.

SOCI 5608 [0.5 credit]
Women and Work
Issues concerning women and work, such as housework, occupational segregation, part-time work, the changing economic structure of work, wage inequality, and state policies with respect to childcare, equal pay and work of equal value, and affirmative action.

SOCI 5707 [0.5 credit]
Crime, Social Control and Social Change
An examination of the role of the discourses and ideologies surrounding crime, criminal processes, and social change. Topics may include such issues as juvenile justice, victimization, corporate crime, criminalization of indigenous peoples, substance use and abuse.

SOCI 5802 [0.5 credit]
Departmental Seminar
Topic varies from year to year. Students should check with the Department regarding the topic offered.

SOCI 5803 [0.5 credit]
Critical Theory
Recent developments in critical theory based upon its initial formulation by the Frankfurt School, with emphasis upon particular contemporary theories in a given year, e.g., J. Habermas, H. Willems, etc.

SOCI 5804 [0.5 credit]
Modern Marxist Theory
An examination of topics of theory and research in modern Marxist literature; the central focus is on problems of class analysis, the state, and politics in advanced capitalist societies.

SOCI 5805 [0.5 credit]
Selected Topics in Sociology
Topic varies from year to year. Students should check with the Department regarding the topic offered.

SOCI 5806 [0.5 credit]
Selected Topics in Sociology
Topic varies from year to year. Students should check with the Department regarding the topic offered.

SOCI 5809 [0.5 credit]
The Logic of the Research Process
An examination of the research process, including the phases of conceptualization, choice of indicators, sampling, data collection, and analysis. Published articles will be studied as exemplars of the range of possible research strategies.

SOCI 5900 [0.5 credit]
Tutorial

SOCI 5905 [2.0 credits]
Course Work Comprehensive in Sociology
Available for students in a course work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of 5.0 credits.

SOCI 5907 [0.5 credit]
Placement in Sociology
This course is required for students in the Concentration in Quantitative Methodology who have been admitted into the Cooperative Education option. This option provides an opportunity to enhance educational experience through work placement.

SOCI 5908 [1.0 credit]
M.A. Research Essay
Students may enrol in this course for a maximum of three consecutive terms of study, including one summer term. Students must enrol in this course not later than the beginning of the second full year of study.

SOCI 5909 [2.0 credits]
M.A. Thesis

SOCI 6000 [1.0 credit]
Doctoral Seminar
An in-depth study of current research in sociology, including an inquiry into research techniques, conceptualization and attendant theoretical issues. This course is required of all first-year doctoral students in sociology.

SOCI 6001 [0.5 credit]
Selected Topics in Sociology
Topic varies from year to year.
Students should check with the Department regarding the topic offered.

SOCI 6900 [0.5 credit]
Tutorial

SOCI 6909 [7.0 credits]
Ph.D. Thesis

Systems and Computer Engineering

Mackenzie Building 4456
Telephone: 613-520-5740
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Email: gradinfo@sce.carleton.ca
sce.carleton.ca

The Department

Chair of the Department: Victor Aitken
Associate Chair for Graduate Studies: Halim Yanikomeroglu
Director, Technology Innovation Management Program: Thomas Kunz

In addition to University and Graduate Faculty regulations, all Engineering departments share common procedures that are described in Section 18 of the General Regulations section of this Calendar.

The Department of Systems and Computer Engineering has a large and active graduate program. We offer seven graduate programs of study:

- M.A.Sc. in Electrical Engineering
- M.Eng. in Electrical Engineering
- M.A.Sc. in Biomedical Engineering
- M.A.Sc. in Technology Innovation Management
- M.Eng. in Technology Innovation Management
- M.Sc. in Information and Systems Science
- Ph.D. in Electrical Engineering

In addition, certain faculty members in the department are members of the Ottawa-Carleton Institute for Computer Science, which offers a program leading to the M.C.S. degree. This program is more fully described in the Institute's section of this Calendar.

The programs are described in more detail below.

Fields of Research and Study

Research in the Department centres upon the analysis and design of engineering systems which process and transmit information and have computers as components. Within this context, several interrelated areas of study receive major attention:

Communication Systems

- Broadband, ATM, and Multimedia Networks
- Wireless Data Networks
- Portable and Mobile Communication Systems
- Signal Processing
- Network Management
- Software Methods
- Coding and Information Theory

Computer Systems

- CAD/CASE of Software and Systems
- Real-Time and Distributed Computing
- Software Engineering
- Object-Oriented Systems
- Design and Management of Distributed Application Systems
- Computer Resource Management
- Modeling of Client-Server Systems
- Data Base Systems
- Knowledge-based Systems
- Image Processing Systems
- Signal Processing Systems
- Robotic Systems
- Control Systems

Analysis Techniques

- Modeling and Simulation
- Performance Analysis
- Optimization

Management of Engineering Processes

- Management of Design Systems
- Software Project Management
- Business and Technology Opportunities
- Integrated Product Development

Course work provides students with the fundamental material and allows specialization in one or more of the above areas as desired. Thesis topics include both theoretical studies and the related problems of practicable realizations.

Industrial Connections

The Department is a member of several Centres of Excellence:

- The Canadian Institute for Telecommunications Research
- Communications and Information Technology Ontario (CITO) (this replaces the older Telecommunications Research Institute of Ontario of which we were founding members).
- TeleLearning Network (TLN), a National Centre of Excellence.

Current research areas of the centres with major participation from the Departments are: broadband ISDN access networks, transmission methods for ISDN, methods for telecommunications software, mobile and portable wireless networks, VLSI in communications and network management using artificial intelligence methods, and wireless indoor digital communications.

Full advantage is taken of the technology-oriented industry-government-university complex in the Ottawa area. Co-operative projects are in progress with Nortel, Newbridge, Mitel, Stentor, the Department of Communications, Communications Research Centre, NRC, Bell Canada and the Department of National Defence. We are also involved in the Research Program in Managing

Technological Change (MATCH), which is of particular interest to students in the M.Eng. in Telecommunications Technology Management.

Research Facilities

The Department has an excellent collection of facilities for advanced research in systems and computer engineering. There are about 100 engineering workstations, primarily SUN, but also NT and other types, on an Ethernet local area network, multiprocessor target systems, and many other stand-alone and networked workstations. The network is part of the Internet and so has access to the World Wide Web, electronic mail, network news, and much public domain research software. There are also numerous high-end PCs and Macintosh computers, many equipped for desktop video conferencing.

Software includes all of the standard programming and AI languages, symbolic algebra systems, wordprocessors, and various packages specific to telecommunications, signal processing, performance analysis, software engineering, and other areas of research.

The communications and image and signal processing labs provide state-of-the-art test, measurement, and prototyping facilities which include radio transmission and test equipment (up to EHF frequencies), co-processor boards, audio equipment, data acquisition hardware, interactive video conferencing lab equipment, robots, etc.

The main research laboratories include the following:

- Broadband Networks
- Digital Signal Processing
- Image Processing
- Internet System Software Performance
- Managing Technological Change
- Mobile and Portable Communications
- Network Management and Artificial Intelligence
- Personal Communication Systems
- Radio Communications
- Real-Time and Distributed Systems
- Robotics, Automation, and Control
- TeleLearning

Master of Applied Science
Master of Engineering in Electrical Engineering

The M.A.Sc. and M.Eng. in Electrical Engineering are offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE) which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the School of Information Technology and Engineering at the University of Ottawa. For further information about the M.A.Sc. and the M.Eng. in Electrical Engineering, including admission and program requirements, please see the Institute's section in this Calendar.

The M.Eng. is also available as part of ConGESE (Consortium for Graduate Education in Software Engineering), a collaborative program offering a specialization in software engineering. This program is geared towards software professionals working for participating industrial partners. The ConGESE program imposes further regulations and requirements on the existing program. The degree awarded will in each case specify the discipline of the participating unit with specialization in software engineering. Additional information is available from the graduate supervisor.

Doctor of Philosophy in Electrical Engineering

The Ph.D. in Electrical Engineering is offered through the Ottawa-Carleton Institute for Electrical and Computer Engineering (OCIECE) which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the School of Information Technology and Engineering at the University of Ottawa. For further information about the Ph.D. in Electrical Engineering, including admission and program requirements, please see the Institute's section of this Calendar.

Master of Applied Science in Biomedical Engineering

The M.A.Sc. in Biomedical Engineering is offered through the Ottawa-Carleton Institute for Biomedical Engineering (OCIBME) in cooperation with the Department of Mechanical and Aerospace Engineering, the School of Computer Science, and the Department of Physics. For further information, see the Biomedical Engineering section of this Calendar.

Master of Science in Information and Systems Science

The M.Sc. in Information and Systems Science is specifically designed for those who do not have a background in electrical engineering or computer science. This program is offered in cooperation with the School of Computer Science and the School of Mathematics and Statistics at Carleton University. Please see the Information and Systems Science section of this Calendar for details.

Master of Applied Science and Master of Engineering in Technology Innovation Management

The Department of Systems and Computer Engineering offers a program in Technology Innovation Management leading to either an M.A.Sc. or an M.Eng. The M.A.Sc. is a thesis-based degree; the M.Eng. is project-based.

The objective of the program is to train engineers and computer scientists to become competent and efficient managers of the engineering processes that deliver innovative telecommunications systems, products, and services. The emphasis is on design, development, manufacture, and technical support, areas for which engineers are normally responsible and where their technical expertise and practical knowledge are critical.

The program focuses on research in the synthesis between communication systems engineering and management of engineering processes. Within this context the following areas receive major attention:

- Management of Engineering Processes
- Network Design, Protocols and Performance
- Software Engineering
- Wireless and Satellite Communications
- Manufacturing Systems Analysis Close links are maintained with the engineering and technological communities, and an effort is made to direct students to thesis and project work of current theoretical and practical significance.

The research results should provide useful contributions to the efficient management of engineering processes and the related activities in the telecommunications field.

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree in electrical engineering, computer science or a related discipline, with at least high honours standing. Candidates are required to have two years experience in technical work in telecommunications prior to admission.

Candidates applying for admission with degrees not in the discipline of engineering will be considered by the admissions committee. The committee is responsible for establishing criteria for degree equivalencies.

Program Requirements

Subject to the approval of the admissions committee, students in the master's program may choose to complete the degree by successfully completing either a thesis or a project.

M.A.Sc. - Master's Degree by Thesis

All master's students in the thesis option are required to complete a total of 5.5 credits as follows:

- 1.5 compulsory credits including: TTMG 5001; TTMG 5002; and TTMG 5003
- 2.0 approved credits from the list of restricted elective courses below
- a thesis equivalent to 2.0 credits

M.Eng. - Master's Degree by Project

All master's students in the project option are required to complete a total of 5.5 credits of which at least 5.0 must be at the 5000-level or above, as follows:

- 1.5 compulsory credits including: TTMG 5001; TTMG 5002; and TTMG 5003
- 2.0 approved credits from the list of restricted elective courses below
- 1.0 credit of approved non-restricted electives
- a graduate project equivalent to 1.0 credit

Restricted Elective Courses

Students in the master's program must complete 1.0 credit in the field of management of engineering processes and 1.0 credit in communication systems engineering. Courses in each of the four sub-fields and the field of management of engineering processes are listed below.

The sub-fields in communication systems engineering are:

- Software Engineering
- Wireless and Satellite Communications
- Network Design, Protocols and Performance
- Manufacturing Systems Analysis

All courses in the field of communication systems engineering are offered by the Department of Systems and Computer Engineering and begin with the prefix SYSC.

Communication Systems Engineering

- Software Engineering
  - SYSC 5007, SYSC 5101, SYSC 5301, SYSC 5503, SYSC 5701, SYSC 5703, SYSC 5704, SYSC 5706, SYSC 5707, SYSC 5709, SYSC 5802
- Wireless and Satellite Communications
  - SYSC 5503, SYSC 5504, SYSC 5606, SYSC 5608
- Network Design, Protocols and Performance
  - SYSC 5001, SYSC 5004, SYSC 5005, SYSC 5007, SYSC 5101, SYSC 5109, SYSC 5201, SYSC 5207, SYSC 5503, SYSC 5607, SYSC 5706, SYSC 5801, SYSC 5808
- Manufacturing Systems Analysis
  - SYSC 5001, SYSC 5004, SYSC 5802, EAJC 5207
- Management of Engineering Processes
  - TTMG 5004, TTMG 5005, TTMG 5006, TTMG 5008, TTMG 5100, TTMG 5101, TTMG 5102, TTMG 5103, TTMG 5104

Non-Restricted Elective Courses

All students in the project option of the master's program are required to complete 1.0 credit from those offered by the Department of Electronics, Department of Mechanical and Aerospace Engineering, Department of Systems and Computer Engineering, School of Industrial Design, or School of Computer Science.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

The list of courses in the field of communication systems engineering, beginning with the prefix SYSC, are described below. Courses in the field of management of engineering processes, beginning with the prefix TTMG are described following this list.

SYSC 5001 [0.5 credit] (ELG 6101)

Simulation and Modeling

Simulation as a problem solving tool. Random variable generation, general discrete simulation procedure: event table and statistical gathering. Analyses of simulation data: point and interval estimation. Confidence intervals. Overview of modeling, simulation and problem solving using SIMSCRIPT, MODSIM and other languages.

SYSC 5003 [0.5 credit] (ELG 6103)

Discrete Stochastic Models

Models for software, computer systems, and communications networks, with discrete states, instantaneous transitions and stochastic behaviour. Communicating finite state machines and Petri Nets. Review of concepts of probability, and of Markov Chains with discrete and continuous parameters. Basic queuing theory. Numerical methods for Markov Models.

SYSC 5004 [0.5 credit] (ELG 6104)

Optimization for Engineering Applications

Introduction to algorithms and computer methods for optimizing complex engineering systems. Includes linear programming, networks, nonlinear programming, integer and mixed-integer programming, genetic algorithms and search methods, and dynamic programming. Emphasizes practical algorithms and computer methods for engineering applications.

SYSC 5005 [0.5 credit] (ELG 6105)

Optimization Theory and Methods

Advanced theory, algorithms and computer methods for optimi zation. Interior point methods for linear optimization, advanced methods for nonlinear and mixed-integer optimization. Search methods. Applications in engineering.
Prerequisite: SYSC 5004 (ELG 6104) or equivalent.

SYSC 5006 [0.5 credit] (ELG 6106)

Design of Real-Time and Distributed Systems

Characteristics of real-time and distributed systems. Modern midware systems, such as CORBA, DCE, RMI for building distributed applications: advantages and disadvantages. Analyzing designs for robustness, modularity, extensibility, portability and performance. Implementation issues. Major course project.
Prerequisites: SYSC 3303 and SYSC 5708 (ELG 6178) or similar experience.

SYSC/COMP 5007 [0.5 credit] (ELG 6107)

Expert Systems

Survey of some landmark expert systems; types of architecture and knowledge representation; interferencing techniques; approximate reasoning; truth maintenance; explanation facilities; knowledge acquisition. A project to implement a small expert system will be assigned.
Prerequisite: COMP 4007 or COMP 5001 (CSI 5113) or permission of the Department.

SYSC 5101 [0.5 credit] (ELG 6111)

Design of High Performance Software

Designing software to demanding performance specifications. Design analysis using models of computation, workload, and performance. Principles to govern design improvement for sequential, concurrent and parallel execution, based on resource architecture and quantitative analysis.
Prerequisite: SYSC 5704 (ELG 6174) and a course in software engineering, or equivalent.

SYSC 5102 [0.5 credit] (ELG 6112)

Performance Measurement and Modeling of Distributed Applications

Performance measurements, metrics and models of midware based systems and applications. Benchmarks, workload characterization, and methods for capacity planning and system sizing. Performance monitoring infrastructures for operating systems and applications. Introduction to the design and analysis of experiments and the interpretation of measurements.
Prerequisite: SYSC 5101 (ELG 6611) or equivalent.

SYSC 5103 [0.5 credit] (ELG 6113)

Software Agents

Agent-based programming; elements of Distributed Artificial Intelligence; beliefs, desires and intentions;component-based technology; languages for agent implementations; interface agents; information sharing and coordination; KIF; collaboration; communication; ontologies; KQML; autonomy; adaptability; security issues; mobility; standards; agent design issues and frameworks, applications in telecommunications.
Prerequisite: Knowledge of Java, C/C++ or Smalltalk.

SYSC 5104 [0.5 credit] (ELG 6114)

Methodologies For Discrete-Event Modeling And Simulation

Methodological aspects of simulation. Modeling discrete events systems. Modeling formalisms: FSA, FSM, Petri Nets, DEVS, others. Verification and validation. Cellular models: Cellular Automata, Cell-DEVS. Continous and hybrid models. Parallel and Distributed simulation (PADS) techniques. PADS middleware: HLA, Parallel-DEVS, Time-Warp.
Prerequisites: knowledge of C++ and of basic concepts of concurrency and distributed systems.

SYSC 5105 [0.5 credit] (ELG 6115)

Software Quality Engineering and Management

All aspects of software quality engineering. Software testing, at all stages of the software development and maintenance life cycle. Software reviews and inspections. Use of software measurement and quantitative modeling for the purpose of software quality control and improvement.

Precludes additional credit for CSI 5111
(COMP 5501).

Prerequisites: an undergraduate course in software engineering such as SYSC 4800 or SEG 3300, or equivalent, and basic statistics.

SYSC 5108 [0.5 credit] (ELG 6118)

Topics in Information Systems

Recent and advanced topics in the field of Information Systems and its related areas.

SYSC 5109 [0.5 credit] (ELG 6119)

Teletraffic Engineering

Congestion phenomena in telephone systems, and related telecommunications networks and systems, with an emphasis on the problems, notation, terminology, and typical switching systems and networks of the operating telephone companies. Analytical queuing models and applications to these systems.

Prerequisite: SYSC 5503 (ELG 5503) or ELG 5119 (EACJ 5109) or equivalent.

SYSC 5135 [0.5 credit] (ELG 6305)

Ethics, Research Methods and Standards

Ethical theories and decision-making, codes; human and animal experimentation, consent, ethical review boards; research methods and regulations for design, manufacture, certification of medical devices; data collection, management, analysis, including security, confidentiality, privacy; bioethical dilemmas, impact of technology and research.

Precludes additional credit for BIOM 5002 (BMG 5102) and EACJ 6132 (ELG 6132).

SYSC 5200 [0.5 credit] (ELG 6120)

Algebraic Coding Theory

Review of Algebra, Finite Fields, Linear Block Codes and their Properties, Hamming Codes, Cyclic Codes, Hadamard Matrices and Hadamard Codes, Golay Codes, Reed-Muller Codes, BCH and Reed-Solomon Codes, Decoding Algorithms, Coding Bounds.

Precludes additional credit for SYSC 5507 (ELG 6157).

SYSC 5201 [0.5 credit] (ELG 6121)

Computer Communication

Computer network types, introductory queuing theory and performance analysis. OSI layering and BISDN layering modifications. Data link layer. Local area networks and random access (CSMA- CD, switched ethernet, token ring, wireless LAN). Public Networks. IP networks, addressing, routing. Transport layer, flow control. Introduction to ISDN.

Precludes additional credit for EACJ 5607
(ELG 5374) or SYSC 4602 (ELG 4181).

Prerequisite: Undergraduate preparation in probability theory equivalent to STAT 3502.

SYSC 5207 [0.5 credit] (ELG 6127)

Distributed Systems Engineering

Techniques for representing distributed systems: graphical and textual models. Processes, threads, synchronization and inter-process communication techniques, RPC. Middleware: client-server (CORBA), grids, Web services. Resource management: processor allocation, load sharing, Grid scheduling, real-time issues. Protocol: OSI model, application and presentation layers.

Prerequisite: permission of the Department.

SYSC 5300 [0.5 credit] (ELG 6130)

Health Care Engineering

Overview of health care system/participants; biophysical measurements for diagnosis/monitoring; biomedical sensors/technology; telemedicine and applications; safety considerations; managing medical technologies/funding models for clinical engineering departments; considerations for developing countries.
Precludes additional credit for BIOM 5401 (BMG 5401) and ELG 5123 (COMP 5206).
Prerequisite: permission of the instructor.

SYSC 5301 [0.5 credit] (ELG 6131)

Advanced Topics in Biomedical Engineering

Topics vary from year to year. Also offered as EACJ 5127 (ELG 6131).
Prerequisite: permission of the Department.

SYSC 5302 [0.5 credit] (ELG 6321)

Biomedical Instrumentation

Instrumentation designed to measure physiological variables related to the function of the heart, lungs, kidney, nervous and musculo-skeletal system; emergency, critical care, surgery and anaesthesia equipment.
Precludes additional credit for BIOM 5100 (BMG 5103).
Prerequisite: permission of the instructor.
Also offered as EACJ 5302 (ELG 6321).

SYSC 5303 [0.5 credit] (ELG 6133)

Interactive Networked Systems and Telemedicine

Telemanipulator; human motoring and sensory capabilities; typical interface devices; mathematical model of haptic interfaces; haptic rendering; stability and transparency; remote control schemes; time delay compensation; networking and realtime protocols, history and challenges of telemedicine; telemedicine applications: telesurgery, telemonitoring, telediagnosis and telehomecare.
Prerequisite: permission of the Department.

SYSC 5304 [0.5 credit] (ELG 5127)

Medical Image Processing

Mathematical models of image formation based on the image modality and tissue properties. Linear models of image degradation and reconstruction. Inverse problems and regularization for image reconstruction. Image formation in radiology, computed tomography, magnetic resonance imaging, nuclear medicine, ultrasound, positron emission tomography, electrical impedance tomography.
Also offered as EACJ 5304.
Precludes additional credit for EACJ 5601 (ELG 7173) if EACJ 5601 was taken as this topic.
Prerequisites: one of ELG 4172, CEG 4311, SYSC 4405 or permission of the Department.

SYSC 5306 [0.5 credit] (ELG 6136)

Mobile Computing Systems

Systems to build mobile applications. Covers data link layer to application layer. Emphasis on existing wireless infrastructure and IETF protocols. Focuses on view of mobile application developer; communication systems, middleware and application frameworks, defacto standards proposed/developed by industry consortia.
Precludes additional credit for COMP 5402 (CSI 5142).
Prerequisites: EACJ 5607 (ELG 5374) or SYSC 5201 (ELG 6121) or permission of the Department.

SYSC 5307 [0.5 credit] (ELG 6307)

Biological Signals

Modeling of neuromuscular biological signals, including subthreshold phenomena, active behaviour of cell membranes, and innervation processes. Measurement of biological signals, including electrode effects. Time domain, frequency domain, and adaptive filtering techniques

for noise reduction.
Precludes additional credit for BIOM 5101 (BMG 5104).

SYSC 5401 [0.5 credit] (ELG 6141)

Adaptive and Learning Systems

System identification. Least squares and recursive identification techniques. Asymptotic and theoretical properties. Model structure selection. Prediction and estimation. Model reference adaptive control and self-tuning regulators. Nonlinear adaptive systems. Stability. Neural networks and neuro-control. Applications to robotics, control and pattern recognition.
Prerequisite: SYSC 5502 (ELG 6152) or equivalent.

SYSC 5402 [0.5 credit] (ELG 6142)

Advanced Dynamics With Applications to Robotics

Lagrange equations and Hamilton's principle. Dynamics of lumped parameter and continuous systems. Natural modes and natural frequencies. Forced vibrations. Stability and bifurcation. Kinematics and dynamics of rigid bodies. Gyroscopic effects. Forward and inverse kinematics of robot manipulators. Denavit-Hartenberg notation. Derivation of manipulator dynamics.

SYSC 5403 [0.5 credit] (ELG 6143)

Network Access Techniques

A range of access technologies with emphasis on broadband access. Physical channels and the state-of-the-art of coding, modulation, multiplexing strategies to overcome physical impairments. including high-speed transmission over twisted pair, wireless, fibre and co-axial media.
Prerequisites: SYSC 5503 (ELG 6153), and SYSC 5504 (ELG 6154) or ELG 5375 (EACJ 5506).

SYSC 5502 [0.5 credit] (ELG 6152)

Advanced Linear Systems

Modeling and state space realization. Review of signals and systems. Solution to the matrix DE. Discrete time systems and the Z transform. Canonical representations and transformations. Controllability, observability and controller and observer design. LQR design and the Kalman filter. Numerous examples and applications.

SYSC 5503 [0.5 credit] (ELG 6153)

Stochastic Processes

Basic concepts of randomness, as applied to communications, signal processing, and queuing systems; probability theory, random variables, stochastic processes; random signals in linear systems; introduction to decision and estimation; Markov chains and elements of queuing theory.
Precludes additional credit for EACJ 5109 (ELG 5119).

SYSC 5504 [0.5 credit] (ELG 6154)

Principles of Digital Communication

Elements of communication theory and information theory applied to digital communications systems. Characterization of noise and channel models. Optium Receiver theory. Modulation and coding for reliable transmission: MPSK, MQAM, M-ary orthogonal modulation. Channel coding, trellis coded modulation. Spread spectrum and CDMA communications.
Precludes additional credit for EACJ 5506 (ELG 5375).
Prerequisite: SYSC 5503 (ELG 5503) or ELG 5119 (EACJ 5109) or equivalent (may be taken concurrently).

SYSC 5506 [0.5 credit] (ELG 5170)

Information Theory

Measure of information: entropy, relative entrophy, mutual information, asymptotic equipartition property, entropy rates for stochastic processes; data compression: Huffman code, arithmetic coding; channel capacity: random coding bound, reliability function, Blahut-Arimoto algorithm, Gaussian channels, coloured Gaussian noise and 'water-filling'; rate

distortion theory; network information theory.
Prerequisite: SYSC 5503 (ELG 6153) or EACJ 5109 (ELG 5119) or equivalent.
Precludes credit for EACJ 5501 (ELG 5170).

SYSC 5508 [0.5 credit] (ELG 6158)

Digital Systems Architecture

New architectural concepts are introduced. Discussion of programmable architectures (micro-controllers, DSPs, GP) and FPGAs. Memory interfacing. Scalable, superscalar, RISC, CISC, and VLIW concepts. Parallel structures: SIMD, MISD and MIMD. Fault tolerant systems and DSP architectures. Examples of current systems are used for discussions.
Prerequisite: SYSC 4507 or equivalent.

SYSC 5600 [0.5 credit] (ELG 6160)

Adaptive Signal Processing

Theory and techniques of adaptive filtering, including Wiener filters, gradient and LMS methods; adaptive transversal and lattice filters; recursive and fast recursive least squares; convergence and tracking performance; implementation. Applications, such as adaptive prediction, channel equalization, echo cancellation, source coding, antenna beamforming, spectral estimation.
Precludes additional credit for EACJ 5800 (ELG 5377).
Prerequisites: SYSC 5503 (ELG 5503)or ELG 5119 (EACJ 5109) or equivalent; SYSC 5602 (ELG 6162) or ELG 5376 (EACJ 5507) or equivalent.

SYSC 5601 [0.5 credit] (ELG 6161)

Neural Signal Processing

Multidimensional function approximation. The least squares adaptive algorithm and the generalized dela rule. Multi-layered perceptrons and the back-propagation algorithm. Approximation of non-linear functions. Radial basis functions. Self-organizing maps. Applications of neural signal processing to control, communications and pattern recognition.
Precludes additional credit for EACJ 5709 (ELG 5796).
Prerequisite: SYSC 5503 (ELG 6153) or equivalent. May be taken concurrently with SYSC 5503 (ELG 5503).

SYSC 5602 [0.5 credit] (ELG 6162)

Digital Signal Processing

Review of discrete time signals and systems, A/D and D/A conversions, representation in time, frequency, and Z domain, DFT/FFT transforms, FIR/IIR filter design, quantization effects. Correlation functions. Cepstrum analysis. Multi-rate signal processing. Power spectrum estimation. Introduction to joint time-frequency analysis. DSP architecture: implementation approaches. Applications.
Precludes additional credit for EACJ 5507 (ELG 5376).

SYSC 5603 [0.5 credit] (ELG 6163)

Digital Signal Processing: Microprocessors, Software and Applications

Characteristics of DSP algorithms and architectural features of current DSP chips: TMS320, DSP-56xxx, AD-21xxx and SHARC. DSP multiprocessors and fault tolerant systems. Algorithm/software/hardware architecture interaction, program activity analysis, development cycle, and design tools. Case studies: LPC, codecs, FFT, echo cancellation, Viterbi decoding.
Prerequisite: SYSC 5602 (ELG 6162) or ELG 5376 (EACJ 5507) or equivalent.

SYSC 5604 [0.5 credit] (ELG 6164)

Advanced Topics in Digital Signal Processing

Recent and advanced topics in the field of digital signal processing and its related areas.
Prerequisites: SYSC 5602 (ELG 6162) or ELG 5376 (EACJ 5507) or equivalent.

SYSC 5605 [0.5 credit] (ELG 6165)

Advanced Digital Communication

Techniques and performance of digital signalling and equalization over linear bandlimited channels with additive Gaussian noise. Fading multipath channels: diversity concepts,

modeling and error probability performance evaluation. Synchronization in digital communications. Spread spectrum in digital transmission over multipath fading channels. Precludes additional credit for EACJ 5704 (ELG 5780).
Prerequisite: SYSC 5504 (ELG 6154) or equivalent.

SYSC 5606 [0.5 credit] (ELG 6166)

Introduction to Mobile Communications

Mobile radio channel characterization: signal strength prediction techniques and statistical coverage; fading; delay spread; interference models and outage probabilities. Digital modulation and transmission system performance. Signal processing techniques: diversity and beamforming, adaptive equalization, coding. Applications to TDMA and CDMA cellular systems.
Prerequisite: SYSC 5503 (ELG 5503) and SYSC 5504 (ELG 6154) (may be taken concurrently with SYSC 5606).

SYSC 5607 [0.5 credit] (ELG 6167)

Source Coding and Data Compression

Discrete and continuous sources. Discrete sources: Huffman coding & run length encoding. Continuous sources: waveform construction coding; PCM, DPMC, delta modulation; speech compression by parameter extraction; predictive encoding; image coding by transformation and block quantization. Fourier and Walsh transform coding. Applications to speech, television, facsimile.
Prerequisite: SYSC 5503 (ELG 5503) or ELG 5119 (EACJ 5109) or equivalent.

SYSC 5608 [0.5 credit] (ELG 6168)

Wireless Communications Systems Engineering

Multi-user cellular and personal radio communication systems; frequency reuse, traffic engineering, system capacity, mobility and channel resource allocation. Multiple access principles, cellular radio systems, signalling and interworking. Security and authentication. Wireless ATM, satellite systems, mobile location, wireless LANs, wireless local loops, broadband wireless, etc.
Prerequisites: SYSC 5503 (ELG 5503) or ELG 5119 (EACJ 5109), and SYSC 5504 (ELG 6154) or ELG 5375 (EACJ 5506), or their equivalents. May be taken concurrently.

SYSC 5609 [0.5 credit] (ELG 6169)

Digital Television

Television standards: NTSC, PAL, SECAM, and HDTV. Sampling and quantization of television signals: rec 601-1. Digital video compression: inter and intra-frame methods, spatial and transform/wavelet coding; H.261 and MPEG standards. Video conferencing systems and other digital video processing applications.

SYSC 5700 [0.5 credit] (ELG 6170)

Spread Spectrum Systems

Types of spread spectrum systems, FH, DS-SS,TH-SS using impulse-radio. Hybrid DS/FH-SS. Pseudo-noise generators: statistical properties of M sequences, Galois field connections, Gold codes, OVSF codes. Code tracking loops, initial synchronization of receiver spreading code. Performance in interference environments and fading channels. CDMA systems. SS applications in UWB communications and Imaging systems.
Prerequisite: SYSC 5504 (ELG 6154) or equivalent.

SYSC 5701 [0.5 credit] (CSI 5117)

Operating System Methods for Real-Time Applications

Principles and methods for operating system design with application to real-time, embedded systems. Concurrent programming: mechanisms and languages; design approaches and issues; run-time support (kernel). Methods for hard real-time applications. Methods for distributed systems. Programming assignments in a suitable programming language.
Prerequisites: SYSC 3303 or SYSC 5704 (ELG 6174) or equivalent courses and/or experience. Programming experience in high level and assembly languages.

SYSC 5703 [0.5 credit] (ELG 6173)

Integrated Database Systems

Database definitions, applications, architectures. Conceptual design based on entity-relationship, object-oriented models. Relational data model: relational algebra and calculus, normal forms, data definition and manipulation languages. Database management systems: transaction management, recovery and concurrency control. Current trends: object-oriented, knowledge-based, multimedia, distributed databases.

SYSC 5704 [0.5 credit] (ELG 6174)

Elements of Computer Systems

Concepts in basic computer architecture, assembly languages, high level languages including object orientation, compilers and operating system concepts (including concurrency mechanisms such as processes and threads and computer communication). Designed for graduate students without extensive undergraduate preparation in computer system engineering (or equivalent experience).
Prerequisites: programming experience with at least one high level language and permission of the Department.

SYSC 5706 [0.5 credit] (ELG 6176)

Analytical Performance Models of Computer Systems

Analytical modeling techniques for performance analysis of computing systems. Theoretical techniques covered include single and multiple class queuing network models, together with a treatment of computational techniques, approximations, and limitations. Applications include scheduling, memory management, peripheral devices, databases, multiprocessing, and distributed computing.
Prerequisite: SYSC 5003 (ELG 6103), SYSC 5503 (ELG 5503) or ELG 5119 (EACJ 5109), or equivalent.

SYSC 5708 [0.5 credit] (ELG 6178)

Model-Driven Development of Real-Time and Distributed Software

Advanced development of real-time and distributed systems by model-driven development that shifts the focus from coding to modeling. Different types of models. Generating code by model transformations. Design patterns for distributed/concurrent systems with examples from communication applications. Design issues for reusable software.
Prerequisites: knowledge of UML and operating systems concepts, and permission of the Department.

SYSC 5709 [0.5 credit] (ELG 6179)

Advanced Topics in Software Engineering

Recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field.
Prerequisite: permission of the Department.

SYSC 5800 [0.5 credit] (ELG 6180)

Network Computing

Design and Java implementation of distributed applications that use telecommunication networks as their computing platform. Basics of networking; Java networking facilities. Introduction to open distributed processing; CORBA, JavaIDL, JavaRMI, CGI/HTTP, DCOM, Componentware; Enterprise JavaBeans, ActiveX. Agents: Java code mobility facilities. Security issues; Java security model.

SYSC 5801 [0.5 credit] (ELG 6181)

Advanced Topics in Computer
Communications

Recent and advanced topics in computer-communication networks intended as a preparation for research. Students are expected to contribute to seminars or present lectures on selected topics.
Prerequisites: SYSC 5201(ELG 6121) or ELG 5374 (EACJ 5607) or equivalent and permission of the Department.

SYSC 5802 [0.5 credit] (ELG 6182)

Introduction to Information and System Science

An introduction to the process of applying computers in problem solving. Emphasis on the design and analysis of efficient computer algorithms for large, complex problems. Applications in a number of areas are presented: data manipulation, databases, computer networks, queuing systems, optimization. (Also listed as MATH 5802, COMP 5802 and ISYS 5802.)

SYSC 5803 [0.5 credit] (ELG 6183)

Logic Programming

Review of relational databases, first order predicate calculus, semantics of first order models, deductive querying. Proof theory, unification and resolution strategies. Introduction to Prolog, and/or parallelism and Concurrent Prolog. Applications in knowledge representation and rule-based expert systems.

SYSC 5804 [0.5 credit] (ELG 6184)

Advanced Topics in Communications Systems

Recent and advanced topics in communications systems.
Prerequisite: permission of the Department.

SYSC 5806 [0.5 credit] (ELG 6186)

Object Oriented Design of Real-Time and Distributed Systems

Advanced course in software design dealing with design issues at a high level of abstraction. Design models: use case maps for high-level behaviour description; UML for traditional object-oriented concerns. Design patterns. Forward, reverse, and re-engineering. Substantial course project on applications chosen by students.
Prerequisite: permission of the Department.

SYSC 5807 [0.5 credit] (ELG 6187)

Advanced Topics in Computer Systems

Recent and advanced topics in computer systems. The course will generally focus on one or more of the following areas: specification, design, implementation, and modeling/analysis. Students may be expected to contribute to lectures or seminars on selected topics.
Prerequisite: permission of the Department.

SYSC 5808 [0.5 credit] (ELG 6188)

Communications Network Management

Network management issues. WANs and LANs. The Internet and ISO models of network management. Network management protocols SNMP, CMIP, CMOT, etc. Events, Managed Objects and MIBs. Fault management techniques. Current diagnostic theory and its limitations. AI and Machine learning approaches. Monitoring and fault management tools.
Prerequisite: SYSC 5201 (ELG 6121) or equivalent.

SYSC 5900 [0.5 credit]

Systems Engineering Project

Students pursuing the non-thesis M.Eng. program conduct an engineering study, analysis, and/or design project under the supervision of a faculty member.

SYSC 5901 [1.0 credit]

Systems Engineering Project

Project similar to SYSC 5900, but either of greater scope or longer duration.

MATH/SYSC/COMP 5905 [2.0 credits]
M.C.S. Thesis

SYSC 5906 [0.5 credit] (ELG 6196)
Directed Studies

MATH/ISYS/SYSC/COMP 5908 [1.5 credits]
M.Sc. Thesis in Information and Systems Science

SYSC 5909 [2.0 credits]
M.A.Sc. Thesis

SYSC 6909
Ph.D. Thesis
The following are courses in the field of management of engineering processes, and begin with the prefix TTMG.

TTMG 5001 [0.5 credit]
Management Principles for Engineers
Develops a common level of knowledge among students on topics in project management, leadership, industrial marketing, managerial economics and organizational behaviour. These topics are relevant for engineers and computer scientists who manage the engineering processes that deliver innovative telecommunications systems, products and services.

TTMG 5002 [0.5 credit]
Telecommunications Technology
Fundamentals of telecommunications technology with emphasis on importance of bandwidth, communications reliability and networks. Topics include: information sources and coding of outputs; channel characteristics; signals; networks, signalling and switching; standards and regulation; major world systems and operators; and the thrust of new and future technology.

TTMG 5003 [0.5 credit]
Issues in Telecommunications
Discussion of key readings relevant to the telecommunications industry. Topics include the introduction of new products to the global market, technology sourcing, intellectual property rights, industry trends, technology and ethics, user interface design, new business opportunities and product identification, industry characteristics, regulation and international competition.

TTMG 5004 [0.5 credit]
Management of Design Systems
The focus is on how to design, maintain, expand and evolve organizations that deliver hardware, software and systems designs, and on the methods and tools used to improve their performance. Topics include: essence of design; how to set-up and lead fast-to-market organizations.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5005 [0.5 credit]
Management of Telecommunications System Design
The focus is on the groups that evolve the architecture and technological infrastructures of firms and on product management. Topics include: relationship between architecture and product management; appropriability regimes; technology and complementary assets; managing projects that deliver products at different stages of their life cycles.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5006 [0.5 credit]
Management of Software Engineering Projects
Models for the development of software. Software project management tools. Quality control. Risk assessment and management. Examples are drawn from software development in telecommunications applications.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5008 [0.5 credit]

Corporate Communications Networks

Communications networks as a vital resource within organizations. Private networks as an infrastructure for information flow within a firm and across its interfaces. Applications and operations of corporate telecommunications networks. Networks as a source of competitive advantage. Implementation issues.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5100 [0.5 credit]

Communications Standards

Importance of global standards in telecommunications and information technology for product development and business. Relevant public standards classified by type. The standards setting process. Formulation and execution of standards setting strategies. Integrating the firm's standards program with engineering processes, product management, systems groups and marketing.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5101 [0.5 credit]

Integrated Product Development

The new product introduction process and time-based competition, basic concepts of integrated product development (concurrent engineering), the voice of the customer, quality function deployment, cross-functional teams, integrating information systems and technical tools, organizational support, manufacturing and design, cost estimation, implementation problems.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5102 [0.5 credit]

Managing Full-Scale Production

Overall philosophy of just-in-time and time-based competition; just-in-time production and manufacturing resource planning; total quality management; socio-technical systems and employee participation; advanced manufacturing; manufacturing and facilities strategy, capacity planning; manufacturing flexibility; product/process evolution and the experience curve; service aspects of manufacturing.
Prerequisite: TTMG 5001 and TTMG 5002.

TTMG 5103 [0.5 credit]

Advanced Topics in Telecommunications Technology Management

In-depth exploration of an advanced topic in the field of telecommunications technology management. A different topic is covered each semester and more than one section, with different topics, may be offered in the same semester.
Prerequisite: One of TTMG 5004, TTMG 5005, TTMG 5101, or TTMG 5102.

TTMG 5104 [0.5 credit]

Directed Studies in Design and Manufacturing Management

The student explores, through extensive literature surveys, specific topics in the areas of design and manufacturing management. The objective is to acquire a suitable background to initiate and complete thesis work requiring this preparation. Precludes credit for any other directed studies in the program.

TTMG 5901 [1.0 credit]

M.Eng. Project

TTMG 5909 [2.0 credits]

M.Eng. Thesis

TTMG 5104 [0.5 credit]

Directed Studies in Design and Manufacturing Management

The student explores, through extensive literature surveys, specific topics in the areas of design and manufacturing management. The objective is to enable study on a specific topic to

acquire a suitable background to initiate and complete thesis work. Precludes credit for any other directed studies.

TTMG 5901 [1.0 credit]
M.Eng. Project

TTMG 5909 [2.0 credits]
M.Eng. Thesis

Women's and Gender Studies

Dunton Tower 1501
Telephone: 613-520-6645
Fax: 613-520-2622
carleton.ca/womensstudies

The Institute

Director: Virginia Caputo

The Pauline Jewett Institute of Women's and Gender Studies does not offer a program at the graduate level. However, it does offer graduate-level courses which can, with the permission of the school, institute, or department in which the student is enrolled, be used towards a degree program.

Graduate Courses

Not all of the following courses are offered in a given year. For an up-to-date statement of course offerings and to determine the term of offering, consult the class schedule at central.carleton.ca

WGST 5000 [0.5 credit]
Issues for Feminist Scholarship
An interdisciplinary examination of the development of feminist scholarship. Critical analysis of such questions as the connection between feminist scholarship and activism; the interconnections between gender and social class, race/ethnicity, and sexual orientation; the challenge of integrating feminist research into the traditional disciplines.
Prerequisite: graduate standing and permission of the Institute.

WGST 5001 [0.5 credit]
Research Seminar in Women's and Gender Studies
A seminar in which each student undertakes a cross-disciplinary research project for which gender is a primary category of analysis.
Prerequisite: WGST 5000 and permission of the Institute.