

**SENATE UNDERGRAD COUNCIL**  
 MONDAY, 5 FEBRUARY 2024  
 12:30 P.M. EST  
 NH 3318 / Zoom  
[Governing Documents and Resources](#)

TIMING	AGENDA ITEM	PAGE	ACTION
	<b>OPEN SESSION</b>		
12:30 p.m. (5 mins)	1. <a href="#">Conflict of Interest</a>	3	Declaration
	2. Minutes of <a href="#">21 November 2023 Meeting</a>	4	Decision (SUC)
	3. Business Arising from the Minutes	Oral	Input
	<b>Consent Agenda</b>		
	<i>Motion: To approve the items on the consent agenda, listed as items 4 a-f below.</i>		
	4. <a href="#">Curricular Submissions</a>	7	
	a. <a href="#">Faculty of Arts</a> (Katherine Acheson)	8	Decision (SUC)
	b. <a href="#">Faculty of Engineering</a> (Jason Grove)	56	Decision (SUC)
	c. <a href="#">Faculty of Environment</a> (Johanna Wandel)	263	Decision (SUC)
	d. <a href="#">Faculty of Health</a> (Leeann Ferries)	288	Decision (SUC)
	e. <a href="#">Faculty of Mathematics</a> (Cecilia Cotton)	296	Decision (SUC)
	f. <a href="#">Faculty of Science</a> (Laura Deakin)	318	Decision (SUC)
	<b>Regular Agenda</b>		
12:35 p.m. (30 mins)	5. Academic Program Reviews		
	a. Final Assessment Report: <a href="#">Civil Engineering, Environmental Engineering, Geological Engineering, and Water Resources</a> (Rania Al Hammoud)	351	Decision (SUC)
	b. Final Assessment Report: <a href="#">Computer Science, Computer Science - Data Science, Business Administration and Computer Science, and Computing</a> (Martin Karsten & Ondrej Lhotak)	366	Decision (SUC)
	c. Final Assessment Report: <a href="#">Nanotechnology Engineering</a> (Ting Tsui)	384	Decision (SUC)
1:05 p.m. (10 mins)	6. <a href="#">Curricular Submissions</a>	405	
	a. <a href="#">Faculty of Engineering</a> (Jason Grove)	406	Decision (1-2 SEN-R, 3 SEN-C)
	b. <a href="#">Faculty of Environment</a> (Johanna Wandel)	423	Decision (SEN-C)
	c. <a href="#">Faculty of Science</a> (Laura Deakin)	424	Decision (SEN-R)
1:15 p.m. (30 mins)	7. Kuali Presentation (Danielle Jeanneault & Tim Weber-Kraljevski)	Oral	Information

TIMING	AGENDA ITEM	PAGE	ACTION
1:45 p.m. (45 mins)	8. Evidence Based Teaching (Brianna Bennett, Annik Bilodeau, Anne-Marie Fannon & Kyle Scholz).	Oral	Information/Input
	9. Other Business	Oral	Input
	10. Adjournment	Oral	Input

“Decision (SUC)” to be approved on behalf of Senate

“Decision (SEN-C)” to be recommended to Senate for approval (consent agenda)

“Decision (SEN-R)” to be recommended to Senate for approval (regular agenda)

29 January 2024

Tim Weber-Kraljevski  
Governance Officer  
Secretary to SUC

### Important Dates

**4 March 2024** Senate Meeting

**5 March 2024** SUC Meeting

**8 April 2024** Senate Meeting

# Excerpt from Senate Bylaw 1

## 8. Declarations of conflict of interest

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8.01	At the beginning of each meeting of Senate or any of Senate’s committees or councils, the chair will call for members to declare any conflicts of interest with regard to any agenda item. For agenda items to be discussed in closed session, the chair will call for declarations of conflict of interest at the beginning of the closed portion of the meeting. Members may nonetheless declare conflicts at any time during a meeting.
8.02	A member shall be considered to have an actual, perceived or potential conflict of interest, when the opportunity exists for the member to use confidential information gained as a member of Senate, or any of Senate’s committees or councils, for the personal profit or advantage of any person, or use the authority, knowledge or influence of the Senate, or a committee or council thereof, to further her/his personal, familial or corporate interests or the interests of an employee of the university with whom the member has a marital, familial or sexual relationship.
8.03	Members who declare conflicts of interest shall not enter into debate nor vote upon the specified item upon which they have declared a conflict of interest. The chair will determine whether it is appropriate for said member to remove themselves from the meeting for the duration of debate on the specified item(s).
8.04	Where Senate or a committee or council of Senate is of the opinion that a conflict of interest exists that has not been declared, the body may declare by a resolution carried by two-thirds of its members present at the meeting that a conflict of interest exists and a member thus found to be in conflict shall not enter into debate on the specified item upon which they have declared a conflict of interest. The chair will determine whether it is appropriate for said member to remove themselves from the meeting for the duration of debate on the specified item(s).

**University of Waterloo**  
**SENATE UNDERGRADUATE COUNCIL**  
**Minutes of the 21 November 2023 Meeting**  
**[in agenda order]**

**Present:** Katherine Acheson, Logan Baston, Cecilia Cotton, Victoria Chu, Vivian Dayeh, Laura Deakin, David DeVidi (chair) Leeann Ferries, Jason Grove, Fatma Gzara, Carol Ann MacGregor, Kristiina Montero, Catherine Newell Kelly, Rory Norris, Chris Vigna, Johanna Wandel, Tim Weber-Kraljevski (secretary), Richard Wikkerink.

**Resources/Guests:** Pam Charbonneau, Jennifer Coghlin, Anne-Marie Fannon, Sacha Geer, Danielle Jeanneault, Sandra Lopez-Rocha, Carrie MacKinnon, Maysah Eid, Kyle Scholz.

**Absent:** Janice Aurini, Viv Hoang, Alysia Kolentsis\*, Grace Marshal, Isaac Ocampo, Helen Shilomboleni, Theodore Thompson, Ryan Trelford.

\*regrets

**Organization of Meeting:** David DeVidi took the chair and Tim Weber-Kraljevski acted as secretary. The secretary advised that a quorum was present. The agenda was approved without formal motion.

**1. DECLARATIONS OF CONFLICTS OF INTEREST**

No conflicts of interest were declared.

**2. APPROVAL OF THE 17 OCTOBER 2023 MINUTES**

The minutes were approved without formal motions.

**3. BUSINESS ARISING FROM THE MINUTES**

The chair informed member that the Curriculum Subcommittee pilot have been endorsed by Senate and the Subcommittee has began reviewing curriculum submission and making recommendations to Council. The chair also informed members that Senate Graduate and Research Council (SGRC) has endorsed the new Quality Assurance Senate Committee proposal and thanked Ferries for presenting the proposal to SGRC. There was no further business arising.

**CONSENT AGENDA**

Grove requested a revision to item 4b. to add "BET 210 or level at least 3A" as a pre-requisite to new course BET 405. A motion was heard to approve consent agenda as revised. Wandel and Ferries. Carried.

**4. CURRICULAR SUBMISSIONS**

Council approved items a-f as presented, with noted revision.

**REGULAR AGENDA**

**5. ACADEMIC PRGORAM REVIEWS**

**a. Progress Report: Global Business and Digital Arts, and Digital Experience Innovation:** Jessica Thompson presented a brief overview of the report. Members discussed: the timing of the report and why it does not have the signature page; operational differences for the satellite campus, particularly transportation challenges; and clarification on recommendations 12, 14 and 15. Thompson left the meeting. Members discussed the accuracy of some of the recommendations progress details, particularly: recommendation 12 needs to ensure the program response



addresses the recommendation fully; recommendation 14 needs a more accurate update as the building timeline is not realistic; recommendation 15 needs the program response to clarify specific plans for networking opportunities in Toronto; and the program needs to confirm with the Dean's Office the accuracy of statements relating to references to the new MA/PhD program. A motion was heard to approve the progress report on behalf of Senate, subject to updates correcting the recommendations progress details to ensure their accuracy. MacGregor and Acheson. Carried.

## 6. Curriculum Submission

**a. Engineering:** Grove spoke to the proposed new plans: the Quantum Engineering Specialization in Computer Engineering and the Quantum Engineering Specialization in Electrical Engineering, as well as the Nanoelectronics Specialization, Nanobiosystems Specialization, Nanofabrication Specialization, and Nanomaterials Specialization in Nanotechnology Engineering. A motion was heard to recommend Senate approve the creation of the specializations, as presented. Grove and Acheson. Carried.

**b. Environment:** Wandle spoke to the proposed Social Planning and Community Development Specialization in Planning Honours, the major modifications to the Environmental Planning and Management Specialization, Land Development Planning Specialization, Urban Design Specialization in Planning Honours, the inactivation of Decision Support and Geographical Information Systems Specialization in Planning Honours, and the regulation revision to remove the invalid combination of the Diploma of Excellence in Geographic Information Systems with Planning. A motion was heard to recommend Senate approve the new plan, the major modifications, the plan inactivation, and the academic regulation revision, as presented. Wandel and Ferries. Carried. Wandel also spoke to the other academic regulation revision for Diploma of Sustainability invalid combination with Sustainability and Financial Management, the overview of Co-op plan requirements, and the Repeated Course text. A motion was heard to recommend that Senate approve the academic regulation revisions, as presented. Wandel and Acheson. Carried.

**c. Student Success Office (SSO):** Geer and Charbonneau spoke to the proposal to inactivate the Global Experience Certificate (GEC) and the Global Learning and Intercultural Development Experience (GLIDE) being designed to replace GEC. Members discussed: graduate rates for the GEC and potential impact of the pandemic; the ability for students who have declared their intention to obtain a GEC prior to the inactivation to transfer into GLIDE; resource constraints of the SSO; the GEC's language course requirement; if students value having something on their transcript versus receiving a certificate; and the implications for GLIDE should the GEC not be inactivated. A motion was heard to recommend that Senate approve the inactivation of the Global Experience Certificate, as presented. Montero and Grove. Carried with three abstaining.

## 7. REGISTRAR'S OFFICE

**a. Academic Considerations and Accommodations Report:** Coghlin provided an overview of the material provided. Members discussed: possible confusion in the proposed wording that could read that students need to use the Self-Declaration of Absence Form before Verification of Illness Form (VIF); guidelines needed for instructors; and what students are able to do while on a short-term self-declared absence. A motion was heard to recommend Senate approve the regulation revision to the Academic Considerations and Accommodations, subject to wording revisions to clarify intent agreed upon by the Associate Deans, Undergraduate Studies and Coghlin. Newell-Kelly and Deakin. Carried.

## 8. Revisions to the Institutional Quality Assurance Process

The chair presented an overview of material provided. A motion was heard to recommend Senate approve the envisions to the Institutional Quality Assurance Process (IQAP), as presented. Jason and Laura. Carried.

**9. Evidence Based Teaching**

Fanon and Scholz presented on the Learning Innovation & Teaching Enhancement (LITE) Grants and the Work-Learn Institute (WxL), highlighting: the history of the LITE grants; how the knowledge is disseminated; recent themes of LITE grants; and the history of WxL and examples of recent studies. Fanon and Scholz requested feedback and members discussed how the University be doing to make better use of evidence being gathering about teaching and learning and how this research can be best disseminated. Fanon and Scholz will be asked back at a future meeting to continue the conversation.

**10. OTHER BUSINESS**

Members discuss potential topics for future meetings, including grade inflation.

**11. ADJOURNMENT**

With no further business, the meeting adjourned. The next meeting is Monday, 5 February 2024, 12:30 to 2:30 p.m. in NH 3318.

29 November 2023

Tim Weber-Kraljevski  
Governance Officer

**For Approval****Consent Agenda****Open Session**

**To:** **Senate Undergraduate Council**

**Sponsor:** David DeVidi, Associate Vice-President, Academic  
**Contact Information:** [david.devidi@uwaterloo.ca](mailto:david.devidi@uwaterloo.ca)

**Presenter:** David DeVidi, Associate Vice-President, Academic  
**Contact Information:** [david.devidi@uwaterloo.ca](mailto:david.devidi@uwaterloo.ca)

**Date of Meeting:** **February 5, 2024**

**Agenda Item Identification:** **Approval of Curricular Items on Behalf of Senate**

**Recommendation/Motion:**

To approval the included curricular items on behalf of Senate, as presented.

**Summary:**

The SUC Curriculum Subcommittee has reviewed and agreed, via an e-vote which closed on January 26, 2024, to recommend to SUC for approval as part of the consent agenda, the items included in the appendices of this report. These items include minor plan changes, new courses, course changes, and course inactivations for the Faculty of Arts, the Faculty of Engineering, the Faculty of Environment, the Faculty of Health, the Faculty of Science, and the Faculty of Mathematics.

**Documents Included:**

- Appendix A: Faculty Arts
- Appendix B: Faculty of Engineering
- Appendix C: Faculty of Environment
- Appendix D: Faculty of Health
- Appendix E: Faculty of Science
- Appendix F: Faculty of Mathematics

# Appendix A: Faculty of Arts

## Undergraduate Affairs Group Report to Senate Undergraduate Council February 2024

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### For approval

#### 1. New Courses

PSCI  
LS, SOC

#### 2. Course changes

AFM  
ANTH  
BLKST  
MEDVL  
COMMST  
ECON  
ENGL  
HIST  
PSCI  
PSYCH  
SDS, SOCWK  
LS, SOC  
HHUM

#### 3. Course Inactivations

ECON  
ENGL  
PSYCH

#### 4. Academic Plan Changes – minor modifications effective 01 September 2024

##### 4.1. Accounting and Finance

- Bachelor of Accounting and Finance

##### 4.2. Anthropology

- Honours Anthropology, Four-Year General Anthropology, Three-Year General Anthropology, Anthropology Minor

##### 4.3. Classical Studies/St. Jerome's University

- Honours Medieval Studies, Four-Year General Medieval Studies, Three-Year General Medieval Studies, Medieval Studies Minor

##### 4.4. Economics

- Econometrics Specialization

##### 4.5. Political Science

- Honours Political Science, Four-Year General Political Science, Three-Year General Political Science

##### 4.6. Renison University College

- Honours Social Development Studies, Four-Year General Social Development Studies, Three-Year General Social Development Studies, Social Development Studies Minor

## 5. For Information

### 5.1. Philosophy/Psychology

- Cognitive Science Minor

1. NEW COURSES (for approval)

**Political Science**

**Effective 01-SEP-2024**

PSCI 224 (0.50) DIS, LEC Research and Methods in Political Science

How does one go about the study of politics? The purpose of this course is to familiarize students with how researchers attempt to explain political phenomena and the various methodological approaches used for designing and evaluating research. Through a variety of different assignments (both written and oral) students will develop research skills and basic methodological literacy in political science as a discipline.

Requisites :

Prereq: Level at least 2A Political Science majors

Rationale :

The political science department would like to decouple methods from the current theory and methods requirement and offer a stand-alone methods course. This is the norm in most political science departments of similar size and calibre across Canada. This course is intended to familiarize students with different methodologies so that they can be methods literate. We do not expect students to become experts in research methods, but instead have the ability to recognize methods and appreciate when certain methods are suitable for the research question being posed. This course should not be mistaken as a research writing course. These skills are introduced in ARTS 130 (Inquiry and Communication) and 140 (Information and Analysis) and honed throughout a political science major's academic career. Short title: Research & Methods in Pol Sci.

**Effective 01-SEP-2024**

PSCI 284 (0.50) LEC Introduction to Security Studies

Students will gain an understanding of how political actors at the international level coerce one another and try to gain security for themselves. Through a variety of research-based readings and assignments, students will examine coercive diplomacy and the organization and pursuit of military power in this course. Students will enhance their ability to understand the concepts and practices that states and non-state groups around the world adopt to achieve their political objectives with violence or thereof.

Requisites :

Prereq: Level at at least 2A. Antireq: PSCI 290 Winter 2024

Rationale :

The PSCI department offers PSCI 384 Technology and International security and PSCI 481 Interstate War. We have found that students come to these upper-division courses lacking any conceptual understanding in coercion and military power. This is because there is no introductory course that would equip students with a grasp of how countries think about, and organize, military power. Being a 200-level course, it will also round out the

selection that the political science department already offers - PSCI 282 Foreign Policy, and PSCI 283 International Political Economy. These courses represent introductory courses to foreign policy analysis and the study of international political economy, respectively, with both also representing subfields within the broader study of international relations. Short title: Intro Security Studies.

**Effective 01-SEP-2024**

PSCI 365 (0.50) LEC The Law and Politics of Free Speech

Students will learn about and analyze the political and legal implications of contemporary free speech controversies and explore proposed solutions to related policy challenges. Through a variety of research-based reading and writing assignments, students will critically reflect on the social and moral challenges, state responses to, and rights implications of a host of free speech challenges, including hate speech, misinformation, protest, and campus speech issues.

Requisites : Prereq: Level at least 2A. Antireq: PSCI 390 or LS 330 topic title: Free Speech

Rationale : This course is expected to add to the department's roster of courses that deal with political and civil rights such as PSCI 363 Constitutional Law and Politics, PSCI 463 Rights and Public Policy. It will be a regular course offering that we anticipate, in this political climate, will attract students. Short title: Politics of Free Speech.

**Effective 01-SEP-2024**

PSCI 457 (0.50) SEM Contemporary Narratives of Exile

This seminar examines global narratives of statelessness and exile through an interdisciplinary approach. It exposes students to an unconventional, yet legitimate source of knowledge about exile and statelessness by focusing on the emotional elements and transformative impacts of displacement experiences on refugees' identities. This approach allows students to gain better understanding of the impacts of policies, wars, and conflicts on people's lives and rights. Students will examine notions of power, borders, belonging, memory, and home while engaging with narratives of loss, exile, and yet resilience. Additionally, students will develop a greater awareness of the ethics of writing about and presenting on refugees and forcibly displaced individuals which they will be encouraged to apply in their research and reflective papers, presentations, and during discussion sessions.

Requisites : Prereq: Level at least 3B. Antireq: PSCI 490 topic title: Narratives of Exile

Rationale : The department already offers PSCI 389 Global Governance and PSCI 375 Transnational Migration, both of which explore the problems associated with movements of people. In keeping with these courses and also the regional studies courses on the Middle East and South Asia, that cover vulnerable populations in the developing world, PSCI 457 Contemporary Narratives of Exile will explore displacement, statelessness, and exile. This course, in

keeping with a departmental commitment to equity, diversity, and inclusion, will also help students develop greater awareness and understanding about the ethics of studying and writing about vulnerable populations. Short title: Narratives of Exile.

## Sociology and Legal Studies

### Effective 01-SEP-2024

LS 301 (0.50) LEC Legal Studies Research Methods for a Global Age

Students will be introduced to, and engage with, research methods specific to legal studies, including primary legal sources (case law, statute), legal ethnography, comparative law, post-colonial and critical legal approaches. Students will learn how legal studies methods are used to identify legal problems, and to formulate original questions about law's origin, application, and uses. Methods explored will enable students to conduct law-focused research and to develop an awareness of ethical and political considerations involved in conducting legal research.

Requisites :

Prereq: Level at least 3A Legal Studies students

Rationale :

This course introduces students to the research skills needed for independent research in the field of Legal Studies. By engaging with a range of primary legal sources, this course develops basic yet specific legal literacy skills, practical approaches to demystifying law, and an appreciation for the depth and diversity of law-focused research, including comparative, international, and non-Western dimensions. The legal studies research methods taught in this course build on foundations introduced in LS 101 (Introduction to Legal Studies) and enhanced in second-year Legal Studies courses. Students will benefit from learning how to uncover meaningful legal problems, formulate original questions (Program Learning Outcome [PLO]: Depth and Breadth of Knowledge), and employ various methods to conduct law-focused research (PLO: Application of Knowledge). Students will also develop an awareness of the ethical, geographical/spatial, and political considerations involved in carrying-out law-focused research (PLO: Awareness of Limits of Knowledge).

### Effective 01-SEP-2024

LS 348 (0.50) LEC Animal Law

Through examination of issues such as anti-cruelty legislation, animal rights movements, pet bans, and the recent popularization of animal therapy, this course provides students with a critical understanding of the history and current state of animal law in Canada. Students will define and use foundational concepts in this area of law and use reflexive socio-legal reasoning to evaluate the strengths and weaknesses of current principles of animal law. Assessments activities such as written essays, case briefs, and research presentations will help students broaden their knowledge of law and to recognize the limitations of law to address issues in animal-human relationships.



Requisites : Prereq: LS 101. Antireq: LS 330 Topic title: Animals & the Law  
Rationale : Currently there are no Legal Studies courses that teach animal law despite a growing scholarly interest in the complexities born from the legal regulation of non-human species. This course will build upon theories, concepts, and legal practices introduced in LS 101 (Introduction to Legal Studies) to provide an expanded discussion of Western anthropocentrism in law and introduce new frameworks such as moral theory and feminist care to inspect rights/welfare discourses and broader issues related to speciesism. Prominent court cases (including case law) will be incorporated into the curriculum to showcase the varied responses by politicians, the judiciary (including mental health, domestic violence, drug and Indigenous specialized courts), and lobbyists to issues in animal law. By taking this course, students have the opportunity to accomplish the following: to broaden their knowledge within an area of law that is often overlooked (Depth and Breadth of Knowledge), to recognize the limits of law to address social problems in this field (Application of Knowledges; Awareness of Limits of Knowledge), and to apply socio-legal knowledge to critically evaluate social issues (Application of Knowledge, Depth and Breadth of Knowledge).

**Effective 01-SEP-2024**

LS 409 (0.50) SEM Health, Surveillance, and Law

In this course students will examine how state institutions mobilize public health expertise for regulatory purposes that are instantiated in law and carried out through various forms of social surveillance. With a focus on research in a range of topical fields such as regulatory responses to infectious disease and pandemics, the regulation of people who use drugs, and criminal legal responses to mental health crises, students will apply socio-legal theories to understand and critically evaluate the forms of coercive legal power, intensive surveillance, and formal and informal social control that are authorized in the name of public health.

Requisites : Prereq: Level at least 4A Legal Studies students. Antireq: LS 496 or SOC 430 Topic title: Health, Surveillance, and Law  
Cross-listed as: SOC 409  
Rationale : This course will provide students at the fourth-year level with an in-depth examination of the ways in which medical and public health knowledges are implicated in the development of various forms of surveillance and social control. The course is a further addition to two of the department's overall thematic areas of research: Crime, Law, & Security and Social Inequality & Public Policy. It will support the Depth & Breadth of Knowledge and Application of Knowledge learning outcomes of Legal Studies by examining how social processes shape law and mechanisms of social control and the Application of Knowledge learning outcomes of Sociology to understand, examine, and critically evaluate social phenomena including behaviours, institutions, and trends related to public health and social

regulation. This course is the formalization of a special topics course that is being offered in Fall 2022 and Fall 2023. The appropriate antirequisite will be applied to prevent students from re-taking the same substantive material. Both units are in agreement with this new course.

**Effective 01-SEP-2024**

LS 410 (0.50) SEM Law and Emergency Governance

Most western states have some form of emergency power that allows governments to suspend normal democratic processes and protections to decisively confront an emergency crisis or condition. The course will examine the origins of emergency law in western jurisprudence and the range of forms that emergency powers can take. Through an examination of specific case studies in which emergency laws have been invoked, students will develop an in-depth understanding of the tensions between emergency law and core principles of liberal democracies as well as apply socio-legal reasoning to how such tensions may be revolved.

Requisites : Prereq: Level at least 4A Legal Studies students. Antireq: LS 496 Topic title: Law & Emergency Powers

Rationale : This is a new Legal Studies course that will expand our LS offerings at the 400-level and contribute to our thematic focus on Crime, Law, & Security. By focusing on how emergency powers are utilized in liberal democracies through various case studies, this course will support the program learning objective of "applying socio-legal knowledge, ethical reasoning, and reflexive analytical skills to critically evaluate the relationship between the law and inequality" as well as training students to "communicate effectively to a diverse range of audiences on the import of legal rules, policies, and practices." The course has been offered as a special topics course in Winter 2023 and Fall 2023 and the appropriate antirequisite has been included to prevent students from re-taking the same substantive material.

**Effective 01-SEP-2024**

SOC 409 (0.50) SEM Health, Surveillance, and Law

In this course students will examine how state institutions mobilize public health expertise for regulatory purposes that are instantiated in law and carried out through various forms of social surveillance. With a focus on research in a range of topical fields such as regulatory responses to infectious disease and pandemics, the regulation of people who use drugs, and criminal legal responses to mental health crises, students will apply socio-legal theories to understand and critically evaluate the forms of coercive legal power, intensive surveillance, and formal and informal social control that are authorized in the name of public health.

Requisites : Prereq: Level at least 4A Sociology students. Antireq: LS 496/SOC 430 Topic title: Health, Surveillance, and Law

Cross-listed as: LS 409

Rationale : This course will provide students at the fourth-year level with an in-depth

examination of the ways in which medical and public health knowledges are implicated in the development of various forms of surveillance and social control. The course is a further addition to two of the department's overall thematic areas of research: Crime, Law, & Security and Social Inequality & Public Policy. It will support the Depth & Breadth of Knowledge and Application of Knowledge learning outcomes of Legal Studies by examining how social processes shape law and mechanisms of social control and the Application of Knowledge learning outcomes of Sociology to understand, examine, and critically evaluate social phenomena including behaviours, institutions, and trends related to public health and social regulation. This course is the formalization of a special topics course that is being offered in Fall 2022 and Fall 2023. The appropriate antirequisite will be applied to prevent students from re-taking the same substantive material. Both units are in agreement with this new course.

## 2. COURSE CHANGES (for approval)

### Accounting & Finance - School of

#### Current Catalog Information

AFM 127 (0.50) LEC, TST, TUT Introduction to Global Capital Markets and Financial Analytics

This course introduces financial markets and institutions, examining the role of finance in the global economy while introducing foundational principles of financial decision making. The course utilizes analytic and computational approaches to the topics, enabling students to develop data management and analysis competencies.

No Special Consent Required

Requisites : Prereq: CS 115 or CS 135; Accounting and Financial Management or Mathematics/Chartered Professional Accountancy students. Antireq: CFM 101, AFM 121  
ACTSC 127

Cross-listed as:

#### Effective 01-SEP-2024

Requisite Change : Prereq: CS 115 or CS 135; Accounting and Financial Management, Biotechnology/Chartered Professional Accountancy, Mathematics/Chartered Professional Accountancy, or Sustainability and Financial Management students. Antireq: CFM 101, AFM 121

Rationale : To change prerequisites. Adding the two additional academic plans make the analytics stream courses potentially available to BioTech/Chartered Professional Accountancy and Sustainability and Financial Management students. Both units agree with this change.

#### Current Catalog Information

AFM 272 (0.50) LEC, TST, TUT Global Capital Markets and Financial Analytics

This course offers an overview of global capital markets and asset valuation. Topics may include an overview of financial markets and instruments, time value of money,

valuation of financial assets, and financial risk and portfolio management. The course utilizes an analytic and computational approach to the topics, enabling students to develop data management and analysis competencies.

No Special Consent Required

Requisites :

Prereq: CFM 101 or AFM 127/ACTSC 127; Accounting and Financial Management, Computing and Financial Management, or Mathematics/Chartered Professional Accountancy students. Antireq: AFM 273, ACTSC 372, ECON 371  
ACTSC 291

Cross-listed as:

**Effective 01-SEP-2024**

Requisite Change :

Prereq: CFM 101 or AFM 127/ACTSC 127; Accounting and Financial Management, Biotechnology/Chartered Professional Accountancy, Computing and Financial Management, Mathematics/Chartered Professional Accountancy, or Sustainability and Financial Management students. Antireq: AFM 273, ACTSC 372, ECON 371

Rationale :

To change prerequisites. Adding the two additional academic plans make the analytics stream courses potentially available to BioTech/Chartered Professional Accountancy and Sustainability and Financial Management students. Both units agree with this change.

## Anthropology

### Current Catalog Information

ANTH 289 (0.50) LEC Special Topics in Anthropology

Analysis of a special topic in anthropology, as announced by the department. [Note: This is a repeatable course, subject to different content; it may be completed a total of two times.]

No Special Consent Required

Requisites :

Prereq: Level at least 2A

**Effective 01-SEP-2024**

Description Change:

Analysis of a special topic in anthropology, as announced by the department. [Note: This is a repeatable course, subject to different content; it may be completed a total of three times.]

Rationale :

To change repeat rules and description notes. Anthropology is composed of four sub-fields: cultural anthropology, archaeology, linguistic anthropology, and biological anthropology, and faculty members teaching in one of these four sub-fields often wish to offer special topics courses (e.g., ANTH 289, 389, and 489). Currently, students may take any one of these courses up to two times, but the wide variety of special topics offered by faculty along with our inability to offer a broad array of courses in most terms means students would benefit from having the option of taking any one of these courses a third time, subject to different content.

### Current Catalog Information

ANTH 389 (0.50) LEC Special Topics in Anthropology

Analysis of a special topic in anthropology, as announced by the department. [Note:

This is a repeatable course, subject to different content; it may be completed a total of two times.]

No Special Consent Required

Requisites :

Prereq: Level at least 3A

**Effective 01-SEP-2024**

Description Change:

Analysis of a special topic in anthropology, as announced by the department. [Note: This is a repeatable course, subject to different content; it may be completed a total of three times.]

Rationale :

To change repeat rules and description notes. Anthropology is composed of four sub-fields: cultural anthropology, archaeology, linguistic anthropology, and biological anthropology, and faculty members teaching in one of these four sub-fields often wish to offer special topics courses (e.g., ANTH 289, 389, and 489). Currently, students may take any one of these courses up to two times, but the wide variety of special topics offered by faculty along with our inability to offer a broad array of courses in most terms means students would benefit from having the option of taking any one of these courses a third time, subject to different content.

**Current Catalog Information**

ANTH 489 (0.50) SEM Special Topics in Anthropology

Analysis of a special topic in anthropology, as announced by the department. [Note:

This is a repeatable course, subject to different content; it may be completed a total of two times. Formerly ANTH 400.]

No Special Consent Required

Requisites :

Prereq: Level at least 4A

**Effective 01-SEP-2024**

Description Change:

Analysis of a special topic in anthropology, as announced by the department. [Note: This is a repeatable course, subject to different content; it may be completed a total of three times.]

Rationale :

To change repeat rules and description notes. Anthropology is composed of four sub-fields: cultural anthropology, archaeology, linguistic anthropology, and biological anthropology, and faculty members teaching in one of these four sub-fields often wish to offer special topics courses (e.g., ANTH 289, 389, and 489). Currently, students may take any one of these courses up to two times, but the wide variety of special topics offered by faculty along with our inability to offer a broad array of courses in most terms means students would benefit from having the option of taking any one of these courses a third time, subject to different content. The note stating the previous number is no longer required.

**Dean of Arts**

**Current Catalog Information**

BLKST 103 (0.50) DIS, LEC Combating Racisms

This course examines historical and contemporary practices, theories, principles,

figures, and allies of anti-racism. Students will learn methods of communicating and pursuing anti-racism in culture, society, and in personal and professional interracial relationships. Coursework will immerse students in recognizing language, behaviours, institutions, and discourses that maintain white supremacies and further enable racist policies and practices in North America. Students will be challenged to apply course material to real issues of racism in local contexts and communities.

No Special Consent Required

Cross-listed as: COMMST 103

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change:

BLKST 103

Unit Change:

( 0.50 )

Component Change:

DIS, LEC

Title Change:

Combating Racisms

Description Change:

This course examines historical and contemporary practices, theories, principles, figures, and allies of anti-racism. Students will learn methods of communicating and pursuing anti-racism in culture, society, and in personal and professional interracial relationships. Coursework will immerse students in recognizing language, behaviours, institutions, and discourses that maintain white supremacies and further enable racist policies and practices in North America. Students will be challenged to apply course material to real issues of racism in local contexts and communities.

Consent Change:

No Special Consent Required

New Cross Listing :

COMMST 103 ENGL 103

Rationale :

To add cross-listing to BLKST 103/COMMST 103 thereby creating ENGL 103. This interdisciplinary course was developed by an English faculty member and engages concepts and approaches from English and rhetorical studies. All units are in agreement with this change.

**Classical Studies**

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MEDVL307

Unit Change:

( 0.50 )

Component Change:

LEC

Title Change:

Concepts of Health and Disease in Western Medical History

Description Change:

This course introduces students to three paradigms in Western medical history, characterized by the primary clinical locations at which they were practiced: bedside medicine (a holistic approach), hospital medicine (a localized approach), and laboratory medicine (a lab-based approach). It does this by exploring the origins of Western medicine in premodern and medieval contexts. Students will engage in close readings of primary and

secondary sources to explore how and why certain diseases, like cancer and tuberculosis, were understood differently within these three paradigms. They will learn to engage in an interdisciplinary dialogue by applying humanities-based methodologies and vocabularies to the study of health and disease. By focusing on historical case studies and asking students to look at how ancient, medieval, and premodern people conceived of health, the course shows how all perceptions of well-being, including our own, are socially constructed and in constant negotiation.

Consent Change: No Special Consent Required  
Course Attribute Change: Also offered at St. Jerome's University  
New Cross Listing : HHUM 307  
Rationale : To add cross-listing to HHUM 307 thereby creating MEDVL 307, add attribute, and change description. This course enhances the medieval studies curriculum and contributes to interdisciplinary inquiry at St. Jerome's University and the University of Waterloo. All units approve of this change.

## Communication Arts

### Current Catalog Information

COMMST 103 (0.50 ) DIS, LEC Combating Racisms

This course examines historical and contemporary practices, theories, principles, figures, and allies of anti-racism. Students will learn methods of communicating and pursuing anti-racism in culture, society, and in personal and professional interracial relationships. Coursework will immerse students in recognizing language, behaviours, institutions, and discourses that maintain white supremacies and further enable racist policies and practices in North America. Students will be challenged to apply course material to real issues of racism in local contexts and communities.

No Special Consent Required

Cross-listed as: BLKST 103

#### Effective 02-SEP-2024

Subject/Catalog Nbr Change: COMMST103  
Unit Change: (0.50 )  
Component Change: DIS, LEC  
Title Change: Combating Racisms  
Description Change: This course examines historical and contemporary practices, theories, principles, figures, and allies of anti-racism. Students will learn methods of communicating and pursuing anti-racism in culture, society, and in personal and professional interracial relationships. Coursework will immerse students in recognizing language, behaviours, institutions, and discourses that maintain white supremacies and further enable racist policies and practices in North America. Students will be challenged to apply course material to real issues of racism in local contexts and communities.

Consent Change: No Special Consent Required  
New Cross Listing : BLKST 103 ENGL 103



Rationale : To add cross-listing to BLKST 103/COMMST 103 thereby creating ENGL 103. This interdisciplinary course was developed by an English faculty member and engages concepts and approaches from English and rhetorical studies. All units are in agreement with this change.

## Economics

### Current Catalog Information

ECON 425 (0.50) LEC Non-Parametric Methods in Economics

This course explores estimation and inference techniques that do not impose any parametric assumption on the data. Topics may include kernel estimation and sieve estimation methods. Students may also be introduced to semi-parametric methods such as empirical likelihood.

No Special Consent Required

Requisites : Prereq: One of ECON 323, STAT 221, STAT 231, STAT 241; Honours students or Economics majors

### Effective 01-SEP-2024

Title Change:

Topics in Econometrics

Description Change:

Special topics that may vary with individual instructor's areas of research interest. [Note: This is a repeatable course, subject to different content; it may be completed a total of three times.]

Rationale :

To change titles, description, and add description note and repeat rules. Better to have a topics course that provides more flexibility to the instructors willing to teach new methods than courses tied to specific techniques. The current ECON 425 has never been taught and there is no faculty interested in doing so. The course is repeatable in the same term (does not show on report).

### Current Catalog Information

ECON 443 (0.50) LEC Advanced Public Economics

This course covers advanced topics in public economics and introduces students to the current research frontier in public economics. Examined areas may include topics such as public choice and voting, dynamic tax policy modelling, tax competition, regulatory capture, policy reform, fiscal federalism, and equalization. Both theoretical and empirical recent research will be covered. For each research topic covered, the course provides an introduction to the relevant background literature. A key course aim is to gain an appreciation of how research can inform public policy.

No Special Consent Required

Requisites : Prereq: ECON 323, 393

### Effective 01-SEP-2024

Title Change:

Political Economy

Description Change:

In this course students will learn how to apply the tools of economic analysis to the study of political phenomena. Topics include voting behaviour, partisan competition and polarisation, electoral accountability, bureaucracy, lobbying, the politics of redistribution, and non-democratic



Rationale : policy making. Both theoretical and empirical approaches can be considered. To change titles and description. Faculty interest in teaching these topics, and preference for the new framing. The "advanced" title previously used was disingenuous. ECON 441 Public Economics examines different themes, but the two courses are on a level, one is not a prerequisite for another.

### Current Catalog Information

ECON 474 (0.50) LEC Numerical Methods for Economists

This course covers important topics related to scientific computing through applications in microeconomics, macroeconomics, and econometrics. The topics include floating point arithmetic, nonlinear equations, constrained and unconstrained optimization, numerical derivatives and numerical integration, differential equations, and dynamic models. Students will also develop their programming skills by learning strategies to write structured and efficient programs.

No Special Consent Required

Requisites :

Prereq: ECON 311, 392, 393; Level at least 4A

### Effective 01-SEP-2024

Description Change:

In this course students learn about topics in scientific computing that arise when economic models are implemented numerically. The topics may include floating point arithmetic, nonlinear equations, constrained and unconstrained optimization, numerical derivatives and numerical integration, differential equations, and dynamic models.

Requisite Change :

Prereq: ECON 323, ECON 393

Rationale :

To change description and prerequisites. The aim is to have a single computational economics course at the 400-level. We are inactivating ECON 471 (Computational Economics) at the same time. The content is instructor dependent, but generally meant to teach students how to solve economics problems numerically. The main challenge of this course is coding. The change in prerequisites involves removing ECON 311 (Mathematical Economics), which is infrequently offered and concerns material which may not be needed for every delivery of the course. ECON 392 (Strategic Situations and Welfare Economics) is not required material to the topics to be examined in ECON 474. By contrast, a background in empirical work and computing (as shown by completion of ECON 323) is important. The highly structured course sequence ECON 290 (2B), 391(3A), 393 (3B), means the 4A level is redundant. Students who have completed ECON 393 will be in 4A.

## English Language & Literature

### Current Catalog Information

(0.00)

### Effective 02-SEP-2024

Subject/Catalog Nbr Change:

ENGL 103

Unit Change:

(0.50)

Component Change: DIS, LEC  
Title Change: Combating Racisms  
Description Change: This course examines historical and contemporary practices, theories, principles, figures, and allies of anti-racism. Students will learn methods of communicating and pursuing anti-racism in culture, society, and in personal and professional interracial relationships. Coursework will immerse students in recognizing language, behaviours, institutions, and discourses that maintain white supremacies and further enable racist policies and practices in North America. Students will be challenged to apply course material to real issues of racisms in local contexts and communities.

Consent Change: No Special Consent Required  
New Cross Listing : BLKST 103 COMMST 103  
Rationale : To add cross-listing to BLKST 103/COMMST 103 thereby creating ENGL 103. This interdisciplinary course was developed by an English faculty member and engages concepts and approaches from English and rhetorical studies. All units are in agreement with this change.

### Current Catalog Information

ENGL 336 (0.50) WSP Creative Writing 2

This course is designed to assist advanced creative writers in developing a body of work in one or more genres by means of supervised practice, discussions of craft, and peer critiques. [Note: Admission by portfolio review]

Instructor Consent Required

Requisites : Prereq: Level at least 3A and ENGL 335

#### Effective 01-SEP-2024

Description Change: This course is designed to assist advanced creative writers in developing a body of work in one or more genres by means of supervised practice, discussions of craft, and peer critiques.

Consent Change: No Special Consent Required

Requisite Change : Prereq: ENGL 335; Level at least 3A

Rationale : To remove description note and consent, and to edit prerequisite formatting. The portfolio requirement is a deterrent to some students enrolling in the course; the prerequisite of ENGL 335 will ensure that students have adequate preparation for this advanced creative writing course. The prerequisite change is formatting only.

### History

#### Current Catalog Information

HIST 233 (0.50) DIS, LEC Modern Japan

This survey course covers Japanese history from the 1800s to the present. During these two hundred years, Japan went from a closed feudal society through a rollercoaster of events: the arrival of the American "Black Ships," the Meiji Restoration, industrial revolution, fascism, wars, atomic bombs, an economic miracle,

a "lost" decade, and recently, a devastating tsunami and nuclear disaster. We will examine books, films, manga, and news materials to embark on our own search for modern Japan. Learning activities may include a historical paper, short answer/essay exam(s), and a debate project based on team research.

No Special Consent Required

### Effective 02-SEP-2024

Requisite Change :

Antireq: HIST 291 topic title: Modern Japan

Rationale :

To add antirequisite. This course was new, effective 2024, and was taught using a special topics course before the new course was created, so the topics course is being added as an antirequisite.

### Current Catalog Information

HIST 238 (0.50) DIS, LEC Hodinohso:ni History

Focusing on Hodinohso:ni perspectives, this course flows through the history of the Hodinohso:ni confederacy beginning with creation up to modern times. Students will learn of the four epics, treaties and alliances, historic and present-day connections to land (including the Haldimand Tract), and the importance of language, storytelling and creating in Hodinohso:ni communities. Throughout this course, students will learn to summarize and explain key themes and events in Hodinohso:ni histories. Upon completion, students will be able to show how these themes and events relate to contemporary Hodinohso:ni communities and experiences.

No Special Consent Required

### Effective 02-SEP-2024

Requisite Change :

Antireq: HIST 391 topic title: Hodinohso:ni History

Rationale :

To add antirequisite. This course was new, effective 2024, and was taught using a special topics course before the new course was created, so the topics course is being added as an antirequisite.

### Current Catalog Information

HIST 324 (0.50) DIS, LEC Gardens and Gardeners in Canada: a History

This course explores historical relationships amongst gardens, plants, and peoples in Canada from the 16th-century to the present. Approaches include the material, cultural, social, and political histories of gardens and their gardeners across time and geographical space. Course goals include demonstrating an emerging awareness of periodization in Canadian garden history, developing an understanding of garden history as a field of knowledge, and identifying some of the various sources of garden history and their usefulness. Assigned work may include discussion of primary and secondary sources, research and/or reflective essays or projects, individual and/or group work, and experiential learning through actual gardening whenever possible.

No Special Consent Required

### Effective 02-SEP-2024

Requisite Change :

Prereq: Level at least 2A. Antireq: HIST 391 topic title: Gardens and Gardeners in Canada

Rationale :

To add antirequisite. This course was new, effective 2024, and was taught using a special topics course before the new course was created, so the

topics course is being added as an antirequisite.

## Political Science

### Current Catalog Information

PSCI 250 (0.50) DIS, LEC The Comparative Politics of State and Nation

How do states and regimes interact with cultural and national identity? In this core comparative politics course, students will assess various approaches to the study of politics within states, emphasizing political developments, institutions, and processes in countries both across the Global South and advanced industrial worlds.

No Special Consent Required

Requisites :

Prereq: One of PSCI 100, 101, 110, 150

### Effective 01-SEP-2024

Description Change:

This course introduces students to the concepts of comparative politics, including state, nation, regime type, political identity, and collective action. Students will be exposed to different democratic and authoritarian regimes around the world and will examine how the design of political institutions ensures the survival and longevity of these regimes. The course also grapples with the question of why people participate in politics and why violence is often adopted as a strategy of resistance. Students will learn how to use the comparative method to analyze contemporary political systems in a research-based assignment.

Requisite Change :

Prereq: Level at least 1B

Rationale :

To change description and prerequisites. The prerequisite change is part of a broader review of our 200-level courses. We have also changed the course description to align with plan-level learning outcomes.

### Current Catalog Information

PSCI 252 (0.50) DIS, LEC Global South

Why are some countries in the world poor and others rich? Why have some developing countries experienced rapid economic growth in recent years while others remain stagnant? What are some of the costs and benefits of development for societies and the environment? Students will explore multiple factors shaping economic growth, and political and social development in the Global South.

No Special Consent Required

Requisites :

Prereq: PSCI 150 or INTST 101

### Effective 01-SEP-2024

Description Change:

In this course students will articulate an understanding of the major theoretical and policy-oriented debates about the Global South. Students will critically examine various narratives of development and modernization and their implications on the political and economic dynamics in the Global South. The carefully selected course materials and assignments offer students the opportunity to analyze, reflect, and present on the main global processes and structures that have shaped the identity of Global South and its development trajectories including the processes of colonialism, imperialism, neoliberalism, and globalization.

Requisite Change : Prereq: Level at least 1B  
Rationale : To change description and prerequisites. The prerequisite change is part of a broader review of our 200-level courses. We have also changed the course description to align with plan-level learning outcomes.

### Current Catalog Information

PSCI 257 (0.50) DIS, LEC Introduction to Middle East Politics

An introduction to modern Middle East political dynamics and the important role this strategic region has played in world affairs. The course examines Middle Eastern states, their domestic political challenges, geopolitical complexities, and relations with the international political community.

No Special Consent Required

Requisites : Prereq: Level at least 2A. Antireq: HIST 230/PSCI 257 taken before fall 2021

### Effective 01-SEP-2024

Description Change: This course introduces students to the Middle East, a region with distinctive history, vivid cultures, and complex politics. Yet, it presents a unique case of misrepresentation and misapprehension. Students will gain an understanding of the Middle East's enduring foreign interventions, unsettled conflicts, and crises of social injustice. Students will critically examine several key questions related to power dynamics and politics and the impact of these politics on people of the region. Through a variety of reflective assignments and engaging class discussions, students will utilize course materials to articulate critical perspectives on the historical and contemporary political developments in the Middle East including military and political conflicts, crises of displacements and statelessness, and forms of resilience.

Rationale : To change description. We are changing the description to provide a more thorough description of the course, and in this process, better align the course description with course content and include reference to plan-level learning outcomes.

### Current Catalog Information

PSCI 259 (0.50) DIS, LEC Government and Politics of Asia

How are countries in Asia (including East, South, and South East Asia) governed and what policies have helped make them one of the fastest growing economic centers in the world in recent decades? Using a comparative perspective of the political economy of major countries in Asia, students will study their political histories and government institutions.

No Special Consent Required

Requisites : Prereq: One of PSCI 100, 101, 110, 150

### Effective 01-SEP-2024

Description Change: This course is a survey of East Asia, Southeast Asia and South Asia and is designed to provide students with an introduction to the political complexities and the prospects for economic growth in these regions by

accounting for not only their breath-taking diversity but also their shared political inheritances, historical trajectories, cultural values, and geographical contiguity. Students will define and utilize concepts and terms that are central to comparative politics in their oral and written assignments to explain with reference to examples, why some Asian countries have experienced profound political change while others have remained relatively stable.

Requisite Change :

Prereq: Level at least 2A

Rationale :

To change description and prerequisites. We are changing the course prerequisite to make it more accessible to students in their second year. We are also changing the description to provide a more thorough description of the course, and in this process, better align the course description with course content and include reference to plan-level learning outcomes.

### Current Catalog Information

PSCI 281 (0.50) DIS, LEC World Politics

What patterns the distribution of power around the globe? When, where, and why does violent conflict or war break out? When, where, and why do co-operation and peace prevail? Students will study how billions of people live together in various degrees of harmony and disharmony.

No Special Consent Required

Requisites :

Prereq: PSCI 150 or INTST 101

### Effective 01-SEP-2024

Title Change:

Introduction to International Relations

Description Change:

Students will learn theories, concepts, and paradigms used to study international relations and global politics, and reflect on their merits and limits. Through individual and group assignments, students will analyze current and historical events, as well as key issues, actors, and processes in global politics.

Requisite Change :

Prereq: Level at least 2A

Rationale :

To change titles, description, and prerequisites. This prerequisite change is part of a broader change in Political Science to harmonize 200-level prerequisites. This is an introductory course from the perspective of content, but requires academic skills reflective of the 2A level. In addition, we think that it is more appropriate to change the course title to International Relations. As PSCI 281 is the gateway course, which together with PSCI 282 Foreign Policy, PSCI 283 International Political Economy, and PSCI 284 Introduction to Security Studies comprise and reflect the major sub-fields of International relations. The course description has been updated to reflect plan-level learning outcomes. Short title: International Relations.

### Current Catalog Information

PSCI 283 (0.50) DIS, LEC International Political Economy

How is the world economy governed? Students will study the politics of international trade, global money and finance, foreign investment, global agriculture and

resources, regional economic integration, global inequality and development, and international economic governance.

No Special Consent Required

Requisites :

Prereq: At least 0.50 unit in PSCI or ECON, or INTST 101

**Effective 01-SEP-2024**

Description Change:

How is the world economy governed? What are the politics of global economic relationships? Through written assignments and analyzing texts, students will learn theories, concepts and topics in international political economy and discuss multiple ways of seeing topics such as the politics of global money and finance, international trade, global development, transnational corporations, the illicit world economy and the interface between the global economy and environmental issues.

Requisite Change :

Prereq: Level at least 2A

Rationale :

To change description and prerequisites. The prerequisite has been changed to make learning pathways through political science more accessible and flexible. The course description has also been updated to match current course content and to include reference to plan-level learning outcomes.

**Current Catalog Information**

PSCI 300 (0.50) LEC

Theories of Political Economy

What is the relationship between politics and economics, power and wealth, states and markets? Students will study influential historical and contemporary works that shape political economy debates in the contemporary world.

No Special Consent Required

Requisites :

Prereq: PSCI 110 or 150; ECON 101 or 102; Level at least 3A

**Effective 01-SEP-2024**

Description Change:

Students will gain an understanding of the foundational theories and perspectives that form and inform the political economy tradition. Through course-assigned and research-based writing and discussion, students will critically analyze the principal ideas upon which capitalism (and/or other political-economic systems) has been explained, defended, and criticized.

Requisite Change :

Prereq: Level at least 2A

Rationale :

To change description and prerequisites. The prerequisite has been changed to make learning pathways through political science more accessible and flexible. The course description has also been updated to match current course content and to include reference to plan-level learning outcomes.

**Current Catalog Information**

PSCI 334 (0.50) LEC

Public Policy

Students will gain an understanding of the dynamics of public policy development in Canada. They will learn to identify key actors, interests, and institutions involved in policy development and articulate diverse perspectives on policy problems. Using sources such as peer-reviewed publications, government reports, and think tank analyses, students will complete research-based writing assignments to analyze the social context of public problems and identify, compare, and recommend potential solutions.



No Special Consent Required

Requisites :

Prereq: One of PSCI 250, 255, 264, LS 206/PSCI 260

Cross-listed as:

SOC 334

**Effective 02-SEP-2024**

Requisite Change :

Prereq: Level at least 2A

Rationale :

To change prerequisites (PSCI offering only). We are changing the course prerequisite to make it more accessible to students in their second year and to align with other similar PSCI courses. Both units approve of these changes.

**Current Catalog Information**

PSCI 358 (0.50) LEC Political Change in China

How does political change in China occur? Students will study China's political history, contemporary political institutions, political economy, and foreign relations.

No Special Consent Required

Requisites :

Prereq: Level at least 3A

**Effective 01-SEP-2024**

Description Change:

This course provides an overview of political development in China with a focus on the post-1949 period. Through readings and discussions, students will gain an understanding of China's political history, contemporary political institutions, and political economy. They will also develop research and communication skills by conducting and presenting independent research projects. The course encourages students to debate over policy and ethical issues.

Requisite Change :

Prereq: Level at least 2B

Rationale :

To change description and prerequisites. We are requesting a change in the prerequisite for this course to make it more accessible to students in their second and/or third year. Additionally, we would like to align the course description with course content and include reference to plan-level learning outcomes.

**Current Catalog Information**

PSCI 359 (0.50) LEC Politics of South Asia

How do international and domestic politics interact in South Asia? Students will study bilateral relations between countries within South Asia and the involvement of external powers, such as the U.S. and China, and delve into the challenges of political development in the region as they are shaped by class, ethnicity, religion, and gender.

No Special Consent Required

Requisites :

Prereq: Level at least 3A

**Effective 01-SEP-2024**

Description Change:

This course provides students with the analytical tools to understand the international politics of South Asia and how it has been shaped by domestic political considerations. Students will study bilateral relations between



South Asian countries within South Asia and the involvement of external powers, such as the U.S., Russia, and China, and delve into the challenges of political development in the region as they are shaped by class, ethnicity, religion, and gender. Through academic scholarship, newspaper analysis, film review, and research-based written assignments students will learn the nuances of political decision-making in the South Asian context in comparison to the rest of the world.

Requisite Change :

Prereq: Level at least 2B

Rationale :

To change description and prerequisites. We are changing the course prerequisite to make it more accessible to students in their second and/or third year. We are also changing the description to provide a more thorough description of the course, and in this process, better align the course description with course content and include reference to plan-level learning outcomes.

### Current Catalog Information

PSCI 387 (0.50) LEC Globalization

How is globalization changing the nature of politics? Students will examine leading political debates surrounding the forces that promote and resist global integration in the contemporary age.

No Special Consent Required

Requisites :

Prereq: PSCI 150 or INTST 101; Level at least 2A

**Effective 01-SEP-2024**

Description Change:

In this course students will examine the complex phenomenon of globalization from an interdisciplinary perspective. Students will critically analyse various perspectives of globalization and explore a number of global contemporary themes including global pandemics, forced displacement, global wars, climate change, indigenous identities, and social movements. The interdisciplinary scholarly literature and other assigned materials will offer students a better understanding of the conceptual framework, emergence and historical development of globalization, structures and politics of global governance, global institutions and actors, and, most importantly, the impacts of globalization on communities and individuals in different parts of the world. Through presentations, discussion, reflective and analytical essays, students will demonstrate communication and critical thinking skills.

Requisite Change :

Prereq: Level at least 2A

Rationale :

To change description and prerequisites. The prerequisite has been changed to make learning pathways through political science more accessible and flexible. The course description has also been updated to match current course content and to include reference to plan-level learning outcomes.

### Current Catalog Information

PSCI 405 (0.50) SEM Chinese Political Economy

How has China been able to achieve decades of sustained economic growth? Students will study various aspects of the deep economic, political, and social changes

associated with China's transition from an insular command economy to an increasingly internationalized and market-oriented economy.

No Special Consent Required

Requisites :

Prereq: PSCI 259 or 358

**Effective 01-SEP-2024**

Description Change:

In this course students will learn about the profound economic, political, and social changes associated with China's transition from an insular command economy to an increasingly internationalized and market-oriented economy. Through readings, discussions, and independent research projects, students will develop the skills for critical thinking and evidence-based analysis of complex issues. The course encourages to debate about diverse models of economic development.

Requisite Change :

Prereq: Level at least 3B

Rationale :

To change description and prerequisites. The prerequisite has been changed to make learning pathways through political science more accessible and flexible. The course description has also been updated to match current course content and to include reference to plan-level learning outcomes.

**Current Catalog Information**

PSCI 420 (0.50) SEM Gender and Global Politics

Does looking at the world through the lens of gender change how we see the state, sovereignty, diplomacy, security, trade, migration, globalization, governance, and other foundational concepts in global politics? Students will review feminist theories of politics, with a particular focus on international relations and global governance; examine how gender shapes the roles and experiences of women and men in global politics; and discuss how to do feminist research.

No Special Consent Required

Requisites :

Prereq: One of PSCI 281, 282, 283, WS 202. Antireq: PSCI 490 (LEC 002) taken winter 2015

**Effective 01-SEP-2024**

Description Change:

Students will use the lens of gender to critically engage with the structures, interests, institutions and practices of international relations, including sovereignty, the UN, political economy, climate and health, and security. They will learn methods and approaches to studying global politics from a gendered perspective. Students will analyze primary sources (such as treaties, speeches, policies, and popular culture) as well as secondary sources in global politics to understand gendered power and gendered silences, how discourses of gender shape global politics, and how actual human bodies challenge those discourses.

Requisite Change :

Prereq: Level at least 3B

Rationale :

To change description and prerequisites, and to remove antirequisites. This prerequisite change reflects the fact that while advanced academic skills are required to succeed in this course, many disciplinary and subject backgrounds can provide adequate preparation. The description change reflects current course practice, political science degree-level outcomes, and the Faculty of Arts best practices. The antirequisite is no longer

required.

### Current Catalog Information

PSCI 450 (0.50) SEM Kings, Generals, and Tyrants

What are the differences between non-democracies like China, hybrid regimes like Russia, one-party states like Singapore, patrimonial and personalist states in Africa, and military dictatorships in Latin America? Students will study how political power is structured in authoritarian regimes and how it shapes the relationship between state and society.

No Special Consent Required

Requisites :

Prereq: PSCI 250

### Effective 01-SEP-2024

Title Change:

Kings, Generals and Tyrants: Politics of Authoritarianism

Description Change:

What is the difference between non-democracies like China, hybrid regimes like Russia, one-party states like Singapore, patrimonial and personalist states in Africa or military dictatorships in Latin America? This course examines the dictator's playbook and how political power is structured in authoritarian regimes in a quest to attain absolute power and keeping it for as long as possible. Students will learn how to draw the main argument from a text, formulate critical responses to existing claims, and analytically interpret political contexts of authoritarian regimes as written in current scholarship, and visually presented in film.

Requisite Change :

Prereq: Level at least 3A

Rationale :

To change titles, description, and prerequisites. We are changing the course prerequisite to make it more accessible to students in their third and/or fourth year. We are also changing the description to provide a more thorough description of the course, and in this process, better align the course description with course content and include reference to plan-level learning outcomes. The short and long title change, we hope is both catchy and descriptive enough to attract students. Short title: Politics of Authoritarianism.

### Current Catalog Information

PSCI 482 (0.50) SEM Critical Security Studies

This course reviews critical analytical models for the study of security and covers a range of issues which might be considered non-traditional including environmental security, public safety, cyber security, and counter-terrorism.

No Special Consent Required

Requisites :

Prereq: PSCI 281 or 282; Level at least 4A

### Effective 01-SEP-2024

Title Change:

Advanced Issues in Security Studies

Description Change:

This course reviews critical analytical models for the study of security and covers a range of issues which might be considered non-traditional including environmental security, public safety, cyber security, and counter-terrorism. Students will learn theories and concepts for advanced analysis of contemporary issues in security studies. Through reading and

Requisite Change :  
Rationale :

understanding a variety of primary and secondary sources, and through original research, students will demonstrate their understanding of the politics of security, the analysis of threats, and the implications of security responses as they relate to state, human, and global security. Prereq: One of PSCI 281, PSCI 284, PSCI 387, PSCI 389; Level at least 3B  
To change titles, description, and prerequisites. The prerequisite change reflects the addition of a 200-level course in the field of security studies (PSCI 284 Introduction to Security Studies) that is an appropriate prerequisite. Adding PSCI 387 Globalization and PSCI 389 Global Governance reflects the fact that these courses provide adequate background to the study of international security. The change in title is to more clearly show that this course builds on lower-division courses in global politics and security studies. The title and description change reflect the fact that this course is not primarily taught as a theoretical overview of the field of critical security studies, but rather an advanced assessment of various contemporary issues in security studies, analyzed from a variety of theoretical perspectives. Short title: Advanced Security Studies.

### Current Catalog Information

PSCI 485 (0.50) SEM Selected Topics in International Political Economy

Students will study particular issues of relevance to the latest debates in the field of international political economy. Topics may include the politics of global money and finance.

No Special Consent Required

Requisites : Prereq: PSCI 283 or 387; Level at least 3B

**Effective 01-SEP-2024**

Description Change:

Students will learn theories, concepts, and topics relevant to the latest debates in the field of international political economy. Topics may include the politics of global money and finance. Students will discuss multiple ways of seeing the politics of the world economy by analyzing texts, making presentations, and conducting independent research.

Requisite Change :

Prereq: At least 0.5 units in PSCI or ECON at the 300-level or above; Level at least 3B

Rationale :

To change description and prerequisites. The prerequisite has been changed to make learning pathways through political science more accessible and flexible. The course description has also been updated to match current course content and to include reference to plan-level learning outcomes.

## Psychology

### Current Catalog Information

PSYCH 352 (0.50) LEC Culture and Psychology

Special emphasis will be given to questions of how some cultural patterns get established, and how they are maintained once they are established. Topics may include aggression, individualism and collectivism, perspectives on the self, and methodological concerns.

**University of Waterloo**  
**Undergraduate Catalog Report**  
**Faculty of Arts**

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No Special Consent Required  
Requisites : Prereq: PSYCH 253/253R; Level at least 2B. Antireq: PSYCH 349R/SWREN 349R  
**Effective 01-SEP-2024**  
Subject/Catalog Nbr Change: PSYCH 352  
Unit Change: ( 0.50 )  
Component Change: LEC  
Title Change: Culture and Psychology  
Description Change: In this course students gain an awareness and understanding of the role of culture for a range of psychological phenomena, including psychological dimensions along which cultures vary (e.g., behaviours, cognition, emotion, motivation, personality), as well as the implications for interacting with people within and across societies. Students will examine theoretical, methodological, and ethical issues in cultural psychology in light of the current literature.  
  
Consent Change: No Special Consent Required  
New Cross Listing : PSYCH 352R  
Rationale : To add cross-listing and change description. After consultation with relevant departments, PSYCH 349R will be inactivated and instead cross-listed as PSYCH 352R with PSYCH 352. The description has been revised to meet program objectives.

**Current Catalog Information**

PSYCH 352 ( 0.50 ) LEC Culture and Psychology

Special emphasis will be given to questions of how some cultural patterns get established, and how they are maintained once they are established. Topics may include aggression, individualism and collectivism, perspectives on the self, and methodological concerns.

No Special Consent Required

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: PSYCH 352R  
Unit Change: ( 0.50 )  
Component Change: LEC  
Title Change: Culture and Psychology  
Description Change: In this course students gain an awareness and understanding of the role of culture for a range of psychological phenomena, including psychological dimensions along which cultures vary (e.g., behaviours, cognition, emotion, motivation, personality), as well as the implications for interacting with people within and across societies. Students will examine theoretical, methodological, and ethical issues in cultural psychology in light of the current literature.  
  
Consent Change: No Special Consent Required  
New Cross Listing : PSYCH 352  
Rationale : To add cross-listing and change description. After consultation with relevant departments, PSYCH 349R will be inactivated and instead cross-listed as PSYCH 352R with PSYCH 352. The description has been revised

to meet program objectives.

### Current Catalog Information

PSYCH 417 (0.50) LEC, SEM Mindfulness and Clinical Psychology: An Experiential Introduction

This course will introduce students to mindfulness and its links to the field of clinical psychology. Experiential learning will be central: students will participate in guided mindfulness meditations in class and use the support and structure of the course to develop and maintain a daily mindfulness practice at home. Readings, reflections, lectures, and in-class discussions will supplement students' experiential learning to provide a deeper understanding of the topic.

Department Consent Required

Requisites :

Prereq: PSYCH 257, PSYCH 291, PSYCH 292; Level at least 3A Honours Psychology or Make-up Psychology; Psychology average of at least 75%

### Effective 01-SEP-2024

Component Change:

SEM

Title Change:

Mindfulness-Based Stress Reduction: Advanced Topics in Mental Health

Description Change:

Through training attention via mindfulness, this course provides a deeper personal and general understanding of stress, stress reactivity, adaptive stress responses, and wellness. Experiential learning will be central: students will participate in guided mindfulness practices in class and use the support and structure of the course to develop and maintain a daily mindfulness practice at home. Reflections on personal experience, rooted in both scientific and meditative inquiry, will enrich experiential learning. A signed consent form is required to participate in the course.

Consent Change:

No Special Consent Required

Requisite Change :

Prereq: PSYCH 257; Level at least 3A Honours Psychology or Make-up Psychology; Psychology average of at least 70%

Rationale :

To change titles, description, components, prerequisites, and remove enrollment consent. The LEC component is being removed, as this is consistent with other 400-level seminars in Psychology. Upon further discussion, departmental permission before enrolment was unnecessarily limiting. The prerequisites of PSYCH 291 and PSYCH 292 were redundant with level 3A Honours Psychology students. The title and description are now more tightly tied to course content upon further development of materials based on the latest research.

### Renison University College

### Current Catalog Information

SDS 250R (0.50) LEC Social Statistics

This introductory level statistics course will emphasize the collection, manipulation, descriptive presentation, and statistical analysis of social research data. [Note: SWREN 250R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: Level at least 2A; Not open to Math. Antireq: ARTS 280, ECON 221, ENV5 278, GBDA 205, ISS 250A/B, ISS 250R, KIN 232, LS/SOC 280, PSYCH 292, REC 371, SMF 230, STAT 202, 206, 211, 221, 231, 241  
SWREN 250R

Cross-listed as:  
**Effective 01-SEP-2024**

Description Change: In this introductory level statistics course students will learn when and how to apply basic principles in the collection, manipulation, presentation, and analysis of numerical social science data. Students will build capacity to be informed consumers of quantitative and hypothesis testing information in social science research. [Note: SWREN 250R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SDS 251R (0.50) LEC

Social Research

Introduction to the philosophy and methodology of applied social science research, including treatment of the problems and strategies of research design and execution. [Note: SWREN 251R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: Level at least 2A; Not open to students in the Faculty of Mathematics. Antireq: ISS 251R, LS/SOC 221, LS/SOC 321, PSYCH 291, REC 270, SMF 220  
SWREN 251R

Cross-listed as:

**Effective 01-SEP-2024**

Description Change: This course provides students with a fundamental grounding in social science research. Students will examine various conceptual and practical approaches to planning research and learn to apply both qualitative and quantitative methods to investigating social science research questions. [Note: SWREN 251R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SDS 311R (0.50) LEC

Indigenous Peoples and Canadian Public Policy

Framed within the Truth and Reconciliation process underway in Canada, this course examines the historical and ongoing colonial processes and impacts of government



policies targeting First Nations, Inuit, and Métis peoples. Particular analysis will be given to government policy as a cause of (and response to) social, political, and economic problems experienced by Indigenous peoples in Canada. [Note: SWREN 311R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: Level at least 2A. Antireq: ISS 311R

Cross-listed as: SWREN 311R LS 373

**Effective 01-SEP-2024**

Description Change:

Framed within truth, justice, and reconciliation processes underway in Canada, students will examine the historical and ongoing colonial processes and impacts of government policies that target First Nations, Inuit, and Metis peoples. Students will engage in critical analysis of government policy as a cause of (and response to) social, political, and economic problems experienced by Indigenous peoples in Canada. [Note: SWREN 311R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale :

To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

**Current Catalog Information**

SDS 312R (0.50 ) LEC Homelessness and Public Policy

This course provides students with a basic overview of homelessness in modern society. Its goal is to familiarize students with the human, social, political and economic aspects of homelessness. Throughout, the emphasis will be on understanding homelessness from a public policy framework - its incidence and prevalence, etiology, consequences, and strategies for its prevention and amelioration. [Note: SWREN 312R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: Level at least 2A. Antireq: ISS 312R

Cross-listed as: SWREN 312R

**Effective 01-SEP-2024**

Description Change:

Students will explore the root causes of the multifaceted problem of housing insecurity, examine its impact on individuals and society, and deconstruct the programs and policies for addressing it. Through a combination of theoretical exploration, case studies, and real-life examples, students will gain a deeper understanding of the challenges faced by unhoused people and the systemic factors that contribute to their status. [Note: SWREN 312R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale :

To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where



applicable.

### Current Catalog Information

SDS 331R (0.50) LEC Social Inequality, Social Justice, and Social Action

This course examines the hidden causes of inequality and associated social injustices. It provides a snapshot of main issues associated with modern society and the evidence that ties them to persistent inequality and injustice. The course reviews not only the major types of inequality but also social and public policy responses to them. [Note: Formerly ISS 331R. SWREN 331R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: Level at least 2A

Cross-listed as: SWREN 331R

### Effective 01-SEP-2024

Description Change: In this course students explore the relationship between structural power and social inequality through engagement with historic and contemporary social justice movements. Students will critically analyze economic, social, and cultural factors that perpetuate inequality and develop tools to amplify the voices of marginalized communities and seek meaningful social change. [Note: Formerly ISS 331R. SWREN 331R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 120R (0.50) LEC Introduction to Social Work

This course provides an overview of the social work profession as part of the social welfare system in Canada, emphasizing Indigenous and Eurocentric histories, worldviews, values, ethics, and practice approaches, including individual, family, community, and structural settings. [Note: SWREN 120R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Cross-listed as: SWREN 120R

### Effective 01-SEP-2024

Description Change: This course provides an overview of the social work profession and its place in the social welfare system in Canada. Students will examine Indigenous and Eurocentric histories, worldviews, values, and ethics while considering approaches to practice with individuals, families, and communities. Students will learn to think critically about various fields of social work practice as they impact marginalized and disadvantaged social groups. [Note: SWREN 120R is available only to students who have been given conditional admission to the BSW program; such students must

Rationale : have already completed their first undergraduate degree.]  
To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 220R (0.50 ) LEC Social Work with Individuals - Theory and Practice 1

A presentation of some of the theoretical constructs necessary for the understanding of the individual in the casework relationship, as well as an introduction to some appropriate casework interventions. Emphasis in the course will be theoretical.

[Note: SWREN 220R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOCWK 120R. Antireq: SMF 301/311

Cross-listed as: SWREN 220R

### Effective 01-SEP-2024

Description Change: Students will be introduced to several theoretical approaches and interventions in the field of social work and begin to develop interview and assessment skills. Students will consider how experiences of oppression and social identities provide the necessary context for understanding the individual in the therapeutic social work relationship. [Note: SWREN 220R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 221R (0.50 ) LEC Social Group Work

Presentation of some of the theoretical constructs necessary for an understanding of social group work as well as an introduction to methodology and interventions. [Note: SWREN 221R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOCWK 120R

Cross-listed as: SWREN 221R

### Effective 01-SEP-2024

Title Change: Social Work with Groups  
Description Change: This course introduces students to the theoretical constructs necessary for an understanding of social work with groups. Students will gain knowledge and develop skills regarding group counseling strategies, effective team functioning, and Indigenous approaches to group work. [Note: SWREN 221R is available only to students who have been given conditional admission to the

Rationale : BSW program; such students must have already completed their first undergraduate degree.]  
To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 222R (0.50) LEC Community Organization

An examination of social work practice as it relates to functional and geographical communities. The course will explore the theoretical foundations of organization practice as well as a variety of models. [Note: SWREN 222R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOCWK 120R

Cross-listed as: SWREN 222R

### Effective 01-SEP-2024

Description Change: This course presents students with an overview of different approaches to community organization and community development, and engages students in critical assessment of the theoretical foundations, assumptions, and shortcomings of each approach. Drawing on historical and current examples of social movements and community projects, students will practice analyzing the operations of power, and learn strategies for improving wellbeing and initiating progressive social change at the community level. [Note: SWREN 222R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 300R (0.50) LEC Canadian Social Welfare Policy

This course will introduce students to the concept of social welfare as it has evolved in the post-industrial era. It will examine various social, economic and political factors that have shaped Canadian social welfare policy and it will consider present-day factors that are transforming that policy. [Note: SWREN 300R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOCWK 120R

Cross-listed as: SWREN 300R

### Effective 01-SEP-2024

Description Change: In this course students will gain an understanding of key concepts in social welfare policy as it has evolved in the post-industrial era and develop their skills in social policy research and analysis. Students will

examine various social, economic, and political factors that shape Canadian social welfare policy, critically assess contemporary social policy, discuss policy change processes, and debate current controversies and dilemmas regarding capitalism and the welfare state. [Note: SWREN 300R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale :

To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 301R (0.50) LEC Understanding Diversity in Canada

This course explores the meaning of diversity in contemporary Canadian society through social work and social justice perspectives. Students will critically analyze the ideas of "self" and "others" across micro, mezzo, and macro levels of practice. Concepts of power, privilege, oppression, discrimination, stereotypes, prejudice, multidimensionality, and intersectionality will be explored. [Note: SWREN 301R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOCWK 120R

Cross-listed as: SWREN 301R

### Effective 01-SEP-2024

Description Change:

In this course, students will explore diversity of worldviews (e.g., Indigenous, Eurocentric, Eastern) and critically analyze the notion of diversity and inequities in Canada. Students will examine the Eurocentric ideas of "self" and "others," power, privilege, colonization, oppression, discrimination, and intersectionality as they relate to lived experiences of dominance, subjugation, social justice, and social work practice. [Note: SWREN 301R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale :

To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOCWK 321R (0.50) LEC Social Work with Families

Presentation of some of the theoretical constructs necessary for an understanding of the family in the social work relationship as well as an introduction to methodology and interventions. [Note: SWREN 321R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOCWK 120R

Cross-listed as:  
**Effective 01-SEP-2024**

SWREN 321R

Description Change:

In this course students will learn how political, social, and institutional contexts shape social work practice with families. Students will learn to apply diverse theoretical approaches to working with families, analyze complex situations that social workers and families encounter, and build respectful and anti-oppressive relationships with different family members. [Note: SWREN 321R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale :

To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

## Sociology and Legal Studies

### Current Catalog Information

LS 300 (0.50) LEC

Sociology of Law

This course examines the social construction of law and its administration as a social process. Topics will include law as an instrument of social control and social change, legal culture, the identification and evaluation of criminal suspects, the trial process and the rights of special groups. The specific laws highlighted will vary.

No Special Consent Required

Requisites :

Prereq: SOC 101/101R or SOC 120R; Level at least 3A

Cross-listed as:

SOC 370

**Effective 01-SEP-2024**

Description Change:

Through the study of current events in North America, students will examine key theoretical frameworks and questions in the sociology of law. Topics may include the contradictory role law plays in both resolving and exacerbating social inequalities, the persistence of racism, sexism, and other forms of marginalization despite the successes of progressive civil and human rights movements, and controversies surrounding the administration of criminal justice. In examining these questions, students will engage with ideas, arguments, and strategies within socio-legal scholarship and will learn to recognize the strengths and limitations of the law to address social problems.

Requisite Change :

Prereq: SOC 101/101R or LS 101; Level at least 3A

Rationale :

To change description and prerequisites. This course description is being updated to better reflect how the course is taught by our full-time course instructors as well as align it with plan learning outcomes. By focusing on the role of law in contesting and reproducing inequality in society, the revised course description supports the learning outcomes of fostering the application of "socio-legal knowledge, ethical reasoning, and reflexive analytical skills to critically evaluate the relationship between the law

and inequality." Both units are in agreement with these changes.

### Current Catalog Information

LS 373 (0.50) LEC Indigenous Peoples and Canadian Public Policy

Framed within the Truth and Reconciliation process underway in Canada, this course examines the historical and ongoing colonial processes and impacts of government policies targeting First Nations, Inuit, and Métis peoples. Particular analysis will be given to government policy as a cause of (and response to) social, political, and economic problems experienced by Indigenous peoples in Canada. [Note: SWREN 311R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Cross-listed as: SDS 311R SWREN 311R

### Effective 01-SEP-2024

Description Change: Framed within truth, justice, and reconciliation processes underway in Canada, students will examine the historical and ongoing colonial processes and impacts of government policies that target First Nations, Inuit, and Metis peoples. Students will engage in critical analysis of government policy as a cause of (and response to) social, political, and economic problems experienced by Indigenous peoples in Canada. [Note: SWREN 311R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

LS 403 (0.50) LEC Socio-Legal Responses to Crime

This course examines responses to crime from historical, philosophical, legal, psychological, sociological, and other related perspectives. The primary focus is on the relationship between the law, motivations of offenders, and responses by individuals and the criminal justice system to chronic, sex, and violent offenders.

No Special Consent Required

Requisites : Prereq: Level at least 4A Legal Studies students

### Effective 01-SEP-2024

Component Change: SEM  
Description Change: Public policy responses to crime includes patterns in police decision making about what constitutes a crime, expert and lay theories on the causes of crime, political pronouncements on what to do about criminal offenders, and beliefs about the purposes of incarceration, amongst other formal and informal facets of the criminal justice system. Focusing on the experience of marginalized groups such as youth, women, and racialized persons, this course will help students develop a critical understanding of the ways in which public policy responses to crime can reproduce wider patterns of discrimination in society, especially those pertaining to race

Rationale : and Indigeneity. Through examination of current research in this area students will gain reflexive analytical skills to critically evaluate the relationship between the law and inequality.  
To change titles, description, and components. The proposed course change contains two parts. The first is to change the course component from lecture to a seminar delivery format. With the introduction of several new 400-level Legal Studies courses over the past several years, it is no longer necessary to deliver a large lecture course at the 400-level to satisfy student demand. Second, the updated course description more directly aligns with and supports the Legal Studies Program Learning Outcome for students to "apply socio-legal knowledge, ethical reasoning, and reflexive analytical skills to critically evaluate the relationship between the law and inequality."

### Current Catalog Information

SOC 224R (0.50) LEC Poverty in Canada and its Social Consequences

A sociological analysis of poverty in contemporary Canada as it underlies a multiplicity of interlocking social problems. [Note: SWREN 224R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

No Special Consent Required

Requisites : Prereq: SOC 101/101R or 120R

Cross-listed as: SWREN 224R

### Effective 01-SEP-2024

Description Change: In this course students will delve into the foundations of poverty in Canadian society. From historical roots to contemporary manifestations, students will gain a comprehensive knowledge of how poverty is socially understood and the wide-ranging disparities it generates. Students will critically analyze the various stakeholders involved in designing and influencing poverty-related programs and policies, as well as the main approaches to addressing poverty. [Note: SWREN 224R is available only to students who have been given conditional admission to the BSW program; such students must have already completed their first undergraduate degree.]

Rationale : To change description to update descriptions to reflect student learning outcomes, informed by consultation with relevant departments where applicable.

### Current Catalog Information

SOC 334 (0.50) LEC Public Policy

Students will gain an understanding of the dynamics of public policy development in Canada. They will learn to identify key actors, interests, and institutions involved in policy development and articulate diverse perspectives on policy problems. Using sources such as peer-reviewed publications, government reports, and think tank analyses, students will complete research-based writing assignments to analyze the social context of public problems and identify, compare, and recommend potential solutions.



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No Special Consent Required

Requisites :

Prereq: Level at least 2A

Cross-listed as:

PSCI 334

**Effective 02-SEP-2024**

Rationale :

To change prerequisites (PSCI offering only). We are changing the course prerequisite to make it more accessible to students in their second year and to align with other similar PSCI courses. Both units approve of these changes.

**Current Catalog Information**

SOC 370 (0.50) LEC

Sociology of Law

This course examines the social construction of law and its administration as a social process. Topics will include law as an instrument of social control and social change, legal culture, the identification and evaluation of criminal suspects, the trial process and the rights of special groups. The specific laws highlighted will vary.

No Special Consent Required

Requisites :

Prereq: SOC 101/101R or SOC 120R; Level at least 3A

Cross-listed as:

LS 300

**Effective 01-SEP-2024**

Description Change:

Through the study of current events in North America, students will examine key theoretical frameworks and questions in the sociology of law. Topics may include the contradictory role law plays in both resolving and exacerbating social inequalities, the persistence of racism, sexism, and other forms of marginalization despite the successes of progressive civil and human rights movements, and controversies surrounding the administration of criminal justice. In examining these questions, students will engage with ideas, arguments, and strategies within socio-legal scholarship and will learn to recognize the strengths and limitations of the law to address social problems.

Requisite Change :

Prereq: SOC 101/101R or LS 101; Level at least 3A

Rationale :

To change description and prerequisites. This course description is being updated to better reflect how the course is taught by our full-time course instructors as well as align it with plan learning outcomes. By focusing on the role of law in contesting and reproducing inequality in society, the revised course description supports the learning outcomes of fostering the application of "socio-legal knowledge, ethical reasoning, and reflexive analytical skills to critically evaluate the relationship between the law and inequality." Both units are in agreement with these changes.

**St Jerome's University**

**Current Catalog Information**

HHUM 307 (0.50) LEC

Concepts of Health and Disease in Western Medical History

This course introduces students to three paradigms in Western medical history,



characterized by the primary clinical locations at which they were practiced: bedside medicine (a holistic approach), hospital medicine (a localized approach), and laboratory medicine (a lab-based approach). Students will engage in close readings of primary and secondary sources to explore how and why certain diseases, like cancer and tuberculosis, were understood differently within these three paradigms. They will learn to engage in an interdisciplinary dialogue by applying humanities-based methodologies and vocabularies to the study of health and disease, from antiquity through to the modern period.

No Special Consent Required

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: HHUM307  
Unit Change: ( 0.50 )  
Component Change: LEC  
Title Change: Concepts of Health and Disease in Western Medical History  
Description Change: This course introduces students to three paradigms in Western medical history, characterized by the primary clinical locations at which they were practiced: bedside medicine (a holistic approach), hospital medicine (a localized approach), and laboratory medicine (a lab-based approach). It does this by exploring the origins of Western medicine in premodern and medieval contexts. Students will engage in close readings of primary and secondary sources to explore how and why certain diseases, like cancer and tuberculosis, were understood differently within these three paradigms. They will learn to engage in an interdisciplinary dialogue by applying humanities-based methodologies and vocabularies to the study of health and disease. By focusing on historical case studies and asking students to look at how ancient, medieval, and premodern people conceived of health, the course shows how all perceptions of well-being, including our own, are socially constructed and in constant negotiation.

Consent Change: No Special Consent Required  
Course Attribute Change: Also offered at St. Jerome's University  
New Cross Listing : MEDVL 307  
Rationale : To add cross-listing to HHUM 307 thereby creating MEDVL 307, add attribute, and change description. This course enhances the medieval studies curriculum and contributes to interdisciplinary inquiry at St. Jerome's University and the University of Waterloo. All units approve of this change.

3. **COURSE INACTIVATIONS** (for approval)

**Economics**

Effective 01-SEP-2024  
ECON 426 ( 0.50 )  
Rationale :

Quantile Regression in Economics  
The current ECON 426 has never been taught, and there is no faculty

interested in doing so. The revised ECON 425 Topics in Econometrics (to accompany this change) is a more suitable home for delivering such specific material as this course was designed to provide. This course is listed in a specialization but there are other options for students to chose from.

Effective 01-SEP-2024  
ECON 471 (0.50 )  
Rationale :

**Computational Economics**

The course material can be delivered through ECON 474 Numerical Methods for Economists. ECON 471 predated ECON 474, and was more narrowly defined. There is no longer interest among faculty in regularly teaching the original material in ECON 471. This course is listed in a specialization but there are other options for students to chose from.

**English Language & Literature**

Effective 01-SEP-2024  
ENGL 103B (0.50 )  
Rationale :

**Varieties of English**

This course is to be replaced by a new course currently in development; we want to free up the number to use with the BLKST 103 cross-listing.

Effective 01-SEP-2024  
ENGL 208H (0.50 )  
Rationale :

**Arthurian Legend**

This course has not been offered in many years and there are no plans to offer it in the future. Faculty wishing to teach this subject in the future can do so using a Special Topic. This course is listed in the Medieval Studies plans but there are many other options for students to chose from.

**Psychology**

Effective 01-SEP-2024  
PSYCH 349R (0.50 )  
Rationale :

**Cross-Cultural Psychology**

After consultation with relevant departments, PSYCH 349R will be inactivated and replaced with the newly cross-listed PSYCH 352R/PSYCH 352.

End of Report

## 4. Academic Plan Changes – Minor Modifications

Effective Date: 01 September 2024

### 4.1 Academic Unit: Accounting and Finance

#### Plan Title(s): Bachelor of Accounting and Financial Management

**Rationale:** Previous plan changes were made to the program degree requirements allowing students to select between AFM 121 and AFM 127 as alternatives for the first, degree required finance course. AFM 127 provides a more analytical approach to the content covered in AFM 121 using larger datasets processed using Python. The intention was that AFM 127 would be the prerequisite course for AFM 272 which would be the next course in the analytics stream where AFM 272 is a more analytical treatment of the content in AFM 273. However, at the time the changes were made to the calendar, revisions to allow students to opt between AFM 272 or AFM 273 were not made.

Calendar text, including additions and ~~deletions~~:

.....

- Successful completion of the following 13.5 academic course units:
  - AFM 112, AFM 113, AFM 132, AFM 182, AFM 191, AFM 205 (0.25 unit), AFM 206 (0.25 unit), AFM 207 (0.25 unit), AFM 208 (0.25 unit), AFM 212, AFM 241, AFM 244, ~~AFM 273~~, AFM 274, AFM 291, AFM 321, AFM 335, AFM 373, AFM 391, AFM 433, AFM 480
  - AFM 311 or SFM 309
  - AFM 121 or AFM 127/ACTSC 127 (see Note 3)
  - **AFM 272/ACTSC 291 or AFM 273**
  - one of AFM 323/STAT 374, AFM 341, AFM 345, AFM 346
  - BET 100
  - ECON 101, ECON 102
  - AFM 111, COMMST 111 (see Note 1)

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Course List

AFM 272/ACTSC 291 – Global Capital Markets and Financial Analytics

AFM 273 – Financial Instruments and Capital Markets

### 4.2 Academic Unit: Anthropology

**Rationale:** Owing to the recent addition of numerous 200-level courses in sociocultural anthropology, along with changes in pedagogy surrounding what constitutes an effective grounding in this component of the discipline, these courses are alternates to ANTH 202 and provide students with a similar background in the discipline.

## Plan Title(s): Honours Anthropology Four-Year General Anthropology

Calendar text, including additions and ~~deletions~~:

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- at least eight academic course units (16 courses) in Anthropology, including:
  - ANTH 201/CLAS 221, ~~ANTH 202~~, ANTH 204
  - **at least one of ANTH 202, ANTH 221, ANTH 241, ANTH 245, ANTH 251, ANTH 290**
  - at least 10 ANTH courses at the 300-level or above, of which two must be at the 400-level

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## Plan Title(s): Three-Year General Anthropology

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- at least six academic course units (12 courses) in Anthropology, including:
  - ANTH 201/CLAS 221, ~~ANTH 202~~, ANTH 204
  - **at least one of ANTH 202, ANTH 221, ANTH 241, ANTH 245, ANTH 251, ANTH 290**
  - at least six ANTH courses at the 300-level or above, of which one must be at the 400-level

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## Plan Title(s): Anthropology Minor

The Anthropology Minor requires successful completion of a minimum of four academic course units (eight courses) in Anthropology with a minimum cumulative minor average of 65%, including:

- ANTH 201/CLAS 221, ~~ANTH 202~~, ANTH 204
- **at least one of ANTH 202, ANTH 221, ANTH 241, ANTH 245, ANTH 251, ANTH 290**

### Course List

ANTH 202 – Social and Cultural Anthropology  
ANTH 221 – Language and Society  
ANTH 241 – Food as Culture  
ANTH 245 – Anthropology of Education  
ANTH 251 – Doing Ethnography  
ANTH 290 – Visual Anthropology

## 4.3 Academic Unit: Classical Studies/St. Jerome's University

Plan Title(s): Honours Medieval Studies  
Four-Year General Medieval Studies  
Three-Year General Medieval Studies  
Medieval Studies Minor

**Rationale:** HHUM 307/MEDVL 307 has sufficient historical medieval content to be an option for students in the History category of list of approved courses in the medieval studies plans.

Calendar text, including additions and ~~deletions~~:

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- list of Medieval Studies approved courses:
  - Languages: ARABIC 101R, ARABIC 102R, ARABIC 120R, ENGL 305A, ENGL 305B, FR 101, FR 151, FR 152, FR 192A, FR 192B, FR 410, FR 424, GER 101, GER 102, GRK/RS 101, GRK/RS 102, GRK 201/RS 223, GRK 202/RS 224, ITAL 101, ITAL 102, ITAL 155, ITAL 201, ITAL 202, LAT 101, LAT 102, 201, LAT 202, LAT 331, LAT 332, LAT 341, LAT 351, LAT 381, LAT 421, LAT 422, LAT 451, MEDVL 492, RUSS 101, RUSS 102, SPAN 101, SPAN 102, SPAN 446W (see Laurier calendar)
  - Cultures: CLAS 104, CLAS 202, CLAS 205/MEDVL 205, CLAS 220/PHIL 220J, CLAS 221/ANTH 201, CLAS 231, CLAS 232, CLAS 242/FINE 242, CLAS 261/PHIL 283, CLAS 325/RS 315, CLAS 326/GSJ 327/RS 327, CLAS 327, CLAS 361/PHIL 380, CLAS 390, CLAS 461/PHIL 403, DUTCH 271, ENGL 200A, ENGL 208H, ENGL 310A, ENGL 310B, ENGL 310C, ENGL 361, FINE 212, FINE 214, FR 291, FR 296, FR 410, FR 424, GER 130/MEDVL 130, GER 271, GER 298, GER 330, ITALST 291, ITALST 311, ITALST 360, MEDVL 305, MEDVL 492, MUSIC 253, MUSIC 363/RS 357/CMW 363, PHIL 207J, PHIL 382, PHIL 404, PHIL 451J, RS 250, RS 110, RS 314/JS 314, RS 354, SI 230R
  - History: CLAS 242/FINE 242, CLAS 252/HIST 252, HHUM 306/MEDVL 306, **HHUM 307/MEDVL 307**, HIST 110, HIST 115/MEDVL 115, GER 230/MEDVL 230, HIST 211, HIST 235/RS 240, HIST 236/LS 236, HIST 262, HIST 304/MEDVL 304/RS 342, HIST 317/SMF 317, HIST 329, HIST 347/GSJ 347, HIST 379/RS 343, HIST 421, HIST 422, FINE 212, FINE 214, MEDVL 250R/SI 250R, MEDVL 251R/SI 251R, MEDVL 305, MEDVL 492

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Course List

HHUM 307/MEDVL 307 – Concepts of Health and Disease in Western Medical History

## 4.4 Academic Unit: Economics

### Plan Title(s): Econometrics Specialization

**Rationale:** By removing the unused current ECON 426 (Quantile Regression in Economics) and making ECON 425 (now “Topics in Econometrics”) a topics course, we need to adjust the requirements. It has been found that having only 400-level courses for a specialization makes it hard for students to complete it. ECON 323 (Econometric Analysis 2) covers enough topics that are specific to economics to be included in the specialization.

The specialization involves three components: an intermediate level applied course in Econometrics (ECON 323), two advanced level applied courses in Econometrics (from ECON 422, ECON 423, ECON 424, ECON 425), and one advanced theoretical treatment of the Linear Regression Model (ECON 421, STAT 321, or STAT 331). A third bullet has been introduced to simplify the presentation of the advanced courses in terms of the two treatments (applied and theoretical).

Calendar text, including additions and ~~deletions~~:

The Econometrics Specialization requires successful completion of four courses:

- **ECON 323**
- ~~four of ECON 422, ECON 423, ECON 424, ECON 425, ECON 426 one of ECON 421, STAT 321, STAT 331~~
- **two of ECON 422, ECON 423, ECON 424, ECON 425**
- **one of ECON 421, STAT 321, STAT 331**

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#### Course List

ECON 323 – Econometric Analysis 2  
 ECON 422 – Microeconomic Analysis  
 ECON 423 – Time Series Econometrics  
 ECON 424 – Machine Learning in Economics  
 ECON 425 – Topics in Econometrics  
 ECON 421 – Econometric Theory  
 STAT 321 – Regression and Forecasting  
 STAT 331 – Applied Linear Models

## 4.6 Academic Unit: Political Science

**Governance path:** These changes to the calendar were first discussed in response to the external reviewer’s report on the department’s cyclical review on May 8, 2023 at a departmental retreat. It was decided that:

- Theory and methods requirements should be decoupled.
- Students should be required to do a theory course chosen from an expanded list of theory courses.
- Students should be required to take PSCI 2XX methods course.
- ARTS 280 should be removed from the list of acceptable methods courses. Similarly, we should remove all the courses that are anti-requisites to ARTS 280.

The undergraduate committee discussed and adopted these changes on September 5, 2023. The department voted on these calendar changes on September 15, 2023.

**Rationale and Consultations:** The rationale for adopting these proposals is to mitigate the following concerns faced by the department:

- 1) External reviewers have recommended that the department introduce a methods requirement, which is the norm in other political science departments of this size and caliber. They have also encouraged the department to introduce political theory earlier on in a student’s academic career.
- 2) When we count courses during degree audits ARTS 280 counts as one of 16 PSCI courses required for the degree. But it does not count towards the 14 PSCI courses required over the 200-level. This means that all students taking ARTS 280 inadvertently complete 17 PSCI courses instead of 16 to fulfill degree requirements.
- 3) We are taking into consideration capacity constraints and would like to offer a course that does not have to be offered by a trained methodologist but could potentially be taught by all faculty members in the department.
- 4) The rationale for the expanded list of theory courses is that they broadly require students to engage substantively with “big thinkers” and critical concepts in politics and government. This list includes courses that address classic, modern, and contemporary political thought, Indigenous political thought, and key topics in political theory (e.g., democracy, justice, liberty, rights, forms of oppression, identity).
- 5) These proposals directly respond to the consensus established at the department retreat in May 2023 that the new methods course (PSCI 224 Research and Methods in Political Science) ought to familiarize students

with different methodologies so that they can be “methods literate”. We do not expect students to become experts in research methods, but instead have the ability to recognise methods and appreciate when certain methods are suitable for the research question being posed. We also do not want this course to be a research writing course.

Calendar text, including **additions** and ~~deletions~~:

## Plan Title(s): Honours Political Science Four-Year General Political Science

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- at least eight academic course units (16 courses) in Political Science, including:
  - 14 PSCI courses at the 200-level or above including
    - **PSCI 224**
    - **at least one of PSCI 225/CLAS 225, PSCI 226, PSCI 228, PSCI 300, PSCI 324, PSCI 326, PSCI 370, PSCI 421/LS 464, PSCI 423, PSCI 426, PSCI 462/LS 462**
    - ~~one of PSCI 225/CLAS 225, PSCI 226, PSCI 314, PSCI 315, PSCI 324, ARTS 280, ECON 221, ENVS 278, GBDA 205, KIN 232, LS 280/SOC 280, PSYCH 292, REC 371, SDS 250R, SMF 230, STAT 202, STAT 206, STAT 211, STAT 221, STAT 231, STAT 241~~
    - one experiential learning course (see Note) from PSCI 494, PSCI 495, PSCI 496, PSCI 497
    - one of the following sets of courses:
      1. two PSCI seminar or field courses at the 400-level
      2. PSCI 400 and one additional PSCI seminar or field course at the 400-level
      3. PSCI 499A, PSCI 499B, and one additional PSCI seminar or field course at the 400-level

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## Plan Title(s): 3 Year General Political Science

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- at least six academic course units (12 courses) in Political Science, including:
  - **one of PSCI 224, PSCI 225/CLAS 225, PSCI 226, PSCI 228, PSCI 300, PSCI 324, PSCI 326, PSCI 370, PSCI 421/LS 464, PSCI 423, PSCI 426, PSCI 462/LS 462**
  - 10 PSCI courses at the 200-level or above, four of which must be at the 300-level or above

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### Course List

PSCI 224 – Research and Methods in Political Science

PSCI 225/CLAS 225 – Classics in Political Thought

PSCI 226 – Modern Political Thought

PSCI 228 – Introduction to Indigenous Political Thought

PSCI 300 – Theories of Political Economy

PSCI 324 – Issues in Contemporary Political Theory

PSCI 326 – Multiculturalism and Democracy: Within, Against, and Beyond

PSCI 370 – Gender and Politics

PSCI 421/LS 464 – Justice and Gender

PSCI 423 – Democratic Theory and Practice

PSCI 426 – Selected Subjects in Political Philosophy

## 4.6 Academic Unit: Renison University College

**Rationale:** Update to all Social Development Studies plans which have PSYCH 349R due to planned inactivation of the course and new cross-listing (PSYCH 352R/PSYCH 352).

### Plan Title(s): Honours Social Development Studies Four-Year General Social Development Studies Three-Year General Social Development Studies

Calendar text, including additions and ~~deletions~~:

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additional courses ..... from the courses listed below:

- Social Development Studies: any SDS course
- Social Work: any SOCWK course
- Psychology: PSYCH 212R/PSYCH 212, PSYCH 213R, PSYCH 226R, PSYCH 257R/PSYCH 257, PSYCH 312R/PSYCH 312, PSYCH 334R, ~~PSYCH 349R~~, PSYCH 352R/PSYCH 352, PSYCH 354R/PSYCH 354, PSYCH 356R/PSYCH 356, PSYCH 375R, PSYCH 398R, PSYCH 399R, PSYCH 444R, PSYCH 448R, PSYCH 450R, PSYCH 490R
- Sociology: SOC 204R, SOC 207R/SOC 207, SOC 223R/SOC 223/LS 223, SOC 224R, SOC 375R, SOC 398R, SOC 399R, SOC 450R, SOC 490R

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### Plan Title(s): Social Development Studies Minor

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additional courses ..... from the courses listed below:

- Social Development Studies: any SDS course
- Social Work: any SOCWK course
- Psychology: PSYCH 212R/PSYCH 212, PSYCH 213R, PSYCH 226R, PSYCH 253R/PSYCH 253, PSYCH 257R/PSYCH 257, PSYCH 312R/PSYCH 312, PSYCH 334R, ~~PSYCH 349R~~, PSYCH 352R/PSYCH 352, PSYCH 354R/PSYCH 354, PSYCH 356R/PSYCH 356, PSYCH 375R, PSYCH 398R, PSYCH 399R, PSYCH 444R, PSYCH 448R, PSYCH 450R, PSYCH 490R
- Sociology: SOC 204R, SOC 207R/SOC 207, SOC 223R/SOC 223/LS 223, SOC 224R, SOC 375R, SOC 398R, SOC 399R, SOC 450R, SOC 490R

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#### Course List

PSYCH 352R/PSYCH 352 – Culture and Psychology



## 5. For Information

### 5.1 Academic Unit: Philosophy/Psychology

#### Plan Title(s): Cognitive Science Minor

**The proposal:** Move the administrative home of the Cognitive Science Undergraduate Minor from the Philosophy Department to the Psychology Department.

**Consultation:**

Matt Doucet, Chair of Philosophy

Heather Henderson, Chair of Psychology

Patricia Marino, Former Chair of Philosophy

Stephanie Denison, Associate Chair, Undergraduate, Psychology

**Rationale:** There are three linked reasons that the Cognitive Science program would be a better fit for the Psychology Department: students, teaching resources, and administrative resources.

**1. Students:** At the undergraduate level, between 2017 and 2021, 88 students graduated with a Cognitive Science Minor. Of those, 25 were from the Faculty of Arts, 31 from Math and Computer Science, 16 from Engineering, and 16 from Environment (all from the Knowledge Integration Program). Despite drawing slightly more students from Math and Computer Science, there are good reasons to keep the home of this interdisciplinary program in the Faculty of Arts. But within the Faculty of Arts, most students graduating with a Cognitive Science Minor are drawn from Psychology: of the 25 students from the Faculty of Arts, 17 were Psychology Majors. Only 1 Cognitive Science Minor in the past 5 years has been a Philosophy Major.

While Philosophy administers the program, the Minor mainly draws Psychology students and contributes enrolments to Psychology courses. Philosophy's main teaching contribution is PHIL/PSYCH 256: Introduction to Cognitive Science, which is the one required course in the program. Philosophy also regularly offers PHIL/PSYCH 447 Seminar in Cognitive Science. Only three Philosophy classes that are not cross listed with Psychology count toward the Cognitive Science Minor. (PHIL 255: Philosophy of Mind, PHIL 363: Philosophy of Language, and PHIL 356/COGSCI 300: Intelligence). By contrast, 10 Psychology classes that are not cross listed with Philosophy count toward the Cognitive Science Minor.

**2. Teaching:** The Cognitive Science program was founded by Philosophy Professor Paul Thagard. Several years ago, when all minor programs were given administrative homes in Departments, it made sense to move it to Philosophy, because Prof. Thagard was the natural choice to serve as the Cognitive Science program advisor. Since that time, however, Prof Thagard has retired, and the Philosophy Department has not hired a replacement. There is relatively little prospect in the short- to medium-term that the Philosophy Department will hire a new tenure stream faculty member to teach in the Cognitive Science program. The two faculty members in the Philosophy Department with primary research expertise in Cognitive Science are Chris Eliasmith and John Turri. Both are Canada Research Chairs, and Chris Eliasmith is jointly appointed to Systems Design Engineering. This means that in a standard year our Cognitive Science subject matter experts teach a total of 3 Philosophy Department-scheduled courses between them (2 for John Turri and 1 for Chris Eliasmith). In effect, the Department has 0.75 FTE tenure-stream faculty members who teach in the CogSci program, and both John Turri and Chris Eliasmith also teach non-Cognitive Science Philosophy courses for the Department.

By contrast, the Psychology Department currently has fifteen faculty members with research expertise in areas related to Cognitive Science (Anderson, Colombatto (effective January 2024), Danckert, Denison, Fernandes, Friedman, Fugelsang, Grossmann, Hester, Itier, Johnson, Koehler, Risko, Smilek, White).

**3. Administrative resources:** Only two Philosophy faculty members have the subject-matter expertise to serve as the Cognitive Science advisor. When they are not available, whichever faculty member serves in the role needs to call on Psychology faculty for subject-matter assistance. And even when those subject-matter experts are serving as advisors, they are largely advising students majoring in Psychology. Philosophy has two staff members: an Administrative Manager/Graduate Coordinator and an Undergraduate Coordinator. Neither are in Advisor roles. This staff team supports the Philosophy Undergraduate and Graduate programs, the Gender and Social Justice Program (which has both a minor and a major), and the Cognitive Science program (which has both a minor and a Graduate Diploma). So, the Cognitive Science program creates extra administrative work for both of our staff, and that work supports students who are not, for the most part, Philosophy majors or Philosophy graduate students. In sum, the Philosophy Department is managing a program that draws few if any Philosophy students and is short both the teaching and administrative resources to deliver and administer the Cognitive Science program effectively.

Calendar text, including additions and ~~deletions~~:

#### Admission

~~Applications may be submitted to the cognitive science academic advisor at any time, and should include a brief (one-page) statement of the student's interest in cognitive science. Students applying should have a minimum cumulative average of 65% and should have successfully completed at least one of the required courses. Students must also submit a Plan Modification Form to declare their intent to add the minor.~~

#### Requirements

Students enrolled in any degree program may pursue a minor designation in Cognitive Science.

The Cognitive Science Minor requires successful completion of a minimum of four academic course units (eight courses) with a minimum cumulative minor average of 65%, including:

- PHIL 256/PSYCH 256
- three of
  - PHIL 447/PSYCH 447
  - one of PSYCH 207, PSYCH 261
  - one of ENGL 306A, FR 303
  - one of COGSCI 300/PHIL 356, CS 486, ECE 457A, PSYCH 420, SYDE 522, SYDE 552/BIOL 487, SYDE 556
- four electives to be chosen, with no more than two in the same subject, from the remaining courses in the list above or from the following:
  - ANTH 204
  - CS 349, CS 449, CS 479, CS 480, CS 484, CS 485
  - ECE 457B, ECE 486
  - ENGL 309A, ENGL 392B, ENGL 409A
  - INTEG 220/PHIL 290, INTEG 251
  - KIN 255, KIN 354, KIN 356, KIN 357, KIN 359, KIN 459
  - MSCI 343, MSCI 446, MSCI 452
  - PHIL 255, PHIL 363

- PSYCH 101/PSYCH 101R, PSYCH 306, PSYCH 307, PSYCH 314, PSYCH 320, PSYCH 335, PSYCH 353, PSYCH 458, PSYCH 461
- SYDE 533, SYDE 543, SYDE 548, SYDE 572
- Relevant advanced seminars and topics courses in the participating academic units, approved by the cognitive science academic advisor or the ~~Philosophy~~ **Psychology** Department undergraduate officer.

## WATERLOO | ENGINEERING

Engineering Undergraduate Office

# MEMORANDUM

February 5, 2024

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**TO:** Tim Weber-Kraljevski, Governance Officer, Secretariat

**FROM:** Jason Grove, Associate Dean, Undergraduate Studies, Faculty of Engineering

**SUBJECT:** Consent Agenda Items for Approval by Senate Undergraduate Council

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ALL CHANGES ARE EFFECTIVE SEPTEMBER 2024.

## 1. Courses

### 1.1. Faculty of Engineering

#### 1.1.1. New Courses

- 1.1.1.1. Biomedical Engineering:  
BME 564; Regular Calendar Courses for Special Topics Offerings – BME 552, 553, 582
- 1.1.1.2. General Engineering:  
GENE 120
- 1.1.1.3. Systems Design Engineering:  
Regular Calendar Courses for Special Topics Offerings - SYDE 534, 535, 536, 537, 554, 577, 586

#### 1.1.2. Course Changes

- 1.1.2.1. School of Architecture:  
Core Course Department Drop Consent
- 1.1.2.2. Chemical Engineering:  
CHE 561 Title & Description Change; Core Course Department Drop Consent
- 1.1.2.3. Architectural Engineering:  
Core Course Department Drop Consent

- 1.1.2.4. Civil Engineering  
Core Course Department Drop Consent
- 1.1.2.5. Geological Engineering  
Core Course Department Drop Consent
- 1.1.2.6. Electrical & Computer Engineering:  
ECE 405A, 405B, 405C, 405D Requisite Change; Core Course Department Drop Consent
- 1.1.2.7. Biomedical Engineering:  
New Cross-Listing for Special Topics Offering - BME 561; Core Course Department Drop Consent
- 1.1.2.8. Environmental Engineering:  
Core Course Department Drop Consent
- 1.1.2.9. General Engineering:  
GENE 199, 299, 399, 499 Description & Requisite Change; GENE 119 Title, Description, Consent & Requisite Change; GENE 123 Description & Requisite Change
- 1.1.2.10. Nanotechnology Engineering:  
Core Course Department Drop Consent
- 1.1.2.11. Mechanical Engineering:  
Core Course Department Drop Consent
- 1.1.2.12. Mechatronics Engineering:  
Core Course Department Drop Consent
- 1.1.2.13. Management Science & Engineering:  
MSCI to MSE Subject Code Change; MSCI 432 Requisite Change; MSCI 597 Title & Description Change; Core Course Department Drop Consent
- 1.1.2.14. Systems Design Engineering:  
Core Course Department Drop Consent

### **1.1.3. Course Inactivations**

- 1.1.3.1. General Engineering:  
GENE 191

## **1.2. Interdisciplinary Studies**

### **1.2.1. Course Changes**

- 1.2.1.1. Work-term Report:  
Core Course Department Drop Consent

### **1.2.2. Course Inactivations**

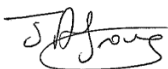
- 1.2.2.1. Work-term Report:  
WKRPT 101, 201, 301, 401 Inactivation

## **2. Academic Plan Changes (Minor Modifications)**

- 2.1. School of Architecture**
- 2.2. Biomedical Engineering**
- 2.3. Chemical Engineering**
- 2.4. Mechanical Engineering**
- 2.5. Mechatronics Engineering**
- 2.6. Nanotechnology Engineering**
- 2.7. Systems Design Engineering**
- 2.8. Computer Engineering Option**
- 2.9. Software Engineering Option**
- 2.10. Management Sciences Option**

## **3. Other Business**

- 3.1. Drop Consent for Core Courses**
- 3.2. Complementary Studies Electives**



Jason Grove  
Associate Dean, Undergraduate Studies  
Faculty of Engineering

## 1. Courses

**NEW COURSES** (for approval)

**Dean of Engineering**

**Effective 01-SEP-2024**

BME 552 (0.50) LEC, TUT Computational Biomechanics

This course will introduce engineering students to the topic of computational biomechanics. Students will gain practical experience in biomechanical modeling and simulation, with a specific focus on the musculoskeletal (MSK) system and human body movement, injury and repair.

Requisites : Prereq: Level at least 3A Biomedical Engineering, Systems Design Engineering, Mechanical Engineering and Mechatronics Engineering students.  
Antireq: BME 588 (Topic 4: Computational Biomechanics)  
Rationale : BME courses previously offered as special topics courses are being given regular calendar course codes to help increase clarity for students when selecting required courses for specializations. Short Title: Computational Biomechanics

**Effective 01-SEP-2024**

BME 553 (0.50) LEC, TUT Introductory Mechanics of Biomedical and Biological Materials

This course covers select topics fundamental to the study of the mechanical behaviour of biological (e.g., bone, tendon, skin, cartilage, etc) and synthetic (polymers, ceramics, metals, etc.) biomaterials with a strong emphasis on materials found in medicine (biomedical materials). Topics will include a selection of basics of continuum mechanics, structure-function-property (mechanistic) relationships, linear and non-linear elasticity, viscoelasticity, anisotropy, failure criteria, fracture, fatigue, and fundamentals of mechanical testing in the biomaterials and tissues context.

Requisites : Prereq: Level at least 3A Biomedical Engineering, Systems Design Engineering, Mechanical Engineering and Mechatronics Engineering students  
Antireq: BME 588 (Topic 5: Introductory Mechanics of Biomedical and Biological Materials)  
Rationale : BME courses previously offered as special topics courses are being given regular calendar course codes to help increase clarity for students when selecting required courses for specializations. Short Title: Intro Mech of Biomed Materials

**Effective 01-SEP-2024**

BME 564 (0.50) LEC, TUT Biocompatibility and Biomedical Design

The course covers fundamental topics of biocompatibility of materials in medicine (polymers, ceramics, metals, composites) in the areas of implantable, extracorporeal and untethered medical devices. Biocompatibility issues of biomaterials, such as



protein adsorption, foreign body reaction, immune and inflammatory response, and thrombosis will be presented. Biomaterial characterization, structure-property relationship, and surface modification will be discussed in the context of improving biocompatibility. Clinical applications and design strategies to reduce complications associated with medical devices will be explored.

Requisites : Prereq: Level at least 3A Biomedical Engineering students or SYDE584 or NE481  
Rationale : BME 564 is a new course that has been created to cover topics related to medical devices that cannot be covered in BME 561 (previously taught under BME 589 and cross-listed with CHE 561 and NE 488). Short Title: Biocompat & Biomed Design

**Effective 01-SEP-2024**

BME 582 (0.50) LEC, TUT Biomedical Optics

This course provides a comprehensive exploration of optical principles, techniques, and instrumentation used in pre-clinical research and clinical diagnosis settings. The fundamental principles of light-tissue interactions and biophotonics will be presented as well as optical sensing and the design of spectroscopy systems tailored for applications in biomedical research and healthcare.

Requisites : Prereq: Level at least 3A BASc/BSE students.  
Antireq: BME 587 (Topic 3: Optics and Biomedical Optics)  
Rationale : BME courses previously offered as special topics courses are being given regular calendar course codes to help increase clarity for students when selecting required courses for specializations. Short title: Biomedical Optics

**Effective 01-SEP-2024**

GENE 120 (0.00) SEM First-Year Engineering Seminar

Seminar series focusing on topics relating to success in Waterloo Engineering.

Requisites : Prereq: Level 1B BASc/BSE students  
Rationale : This creates a seminar course for first-year engineering students in the 1B term, similar to the existing GENE 119 seminar in the 1A term. Short title: First-Year Eng Seminar

**Systems Design Engineering**

**Effective 01-SEP-2024**

SYDE 534 (0.50) LEC, TUT Electric Energy Systems

Traditional electric energy systems comprising generation, transmission, and distribution are examined. Emerging technologies and trends are considered, such as competition, smart grids, energy storage, demand side management, renewable energy, and P2P. Future challenges and possibilities are then explored. Issues will be explored from technical, economic, environmental, sustainability, and social

perspectives.

Requisites : Prereq: Level at least 3A BASc/BSE students  
Antireq: SYDE 599 (Topic 10: Electric Energy Systems)

Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Held with ENBUS 475 & GEOG 474. Short title: Electric Energy Systems

**Effective 01-SEP-2024**

SYDE 535 (0.50) LEC, TUT Computational Simulations for Societal and Environmental Systems

This course will introduce and apply the fundamentals of computational simulation for complex systems. Data collection and analysis, conceptual modelling, computational modelling, output analysis, and communication of results to non-expert audiences will be covered extensively. Students will develop computational simulations to explore potential solutions for complex societal problems, identifying emergent scenarios, costs, and benefits with the goal of informing decision-makers.

Requisites : Prereq: Level at least 3A BASc/BSE students  
Antireq: SYDE 599 (Topic 9: Computational Simulations for Societal and Environmental Systems)

Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Short title: Soc & Env Systems Comp Sim

**Effective 01-SEP-2024**

SYDE 536 (0.50) LEC, TUT Modelling Transportation Systems

Overview of frameworks used to model the global and community transportation systems followed by four case studies: Bayesian modelling of collision rates; discrete choice modelling of travel mode; operating mode-based time series modelling of tailpipe emissions, and simulation of traffic operations including congestion.

Requisites : Prereq: Level at least 3A BASc/BSE students  
Antireq: SYDE 599 (Topic 7: Transportation Modelling)

Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Short title: Modelling Transport Systems

**Effective 01-SEP-2024**

SYDE 537 (0.50) LEC, TUT Artificial Life: Biology and Computation

Artificial life is the study of the simulation and synthesis of living or life-like systems. This course treats the basic principles of biology and computation in nature that underpin the organization of living systems in life as we know it, as it might exist elsewhere in the universe, and in digital or artificial media. We explore the

mechanisms within living individuals that grow and change in a complex environment. This provides a variety of methods for understanding, modelling, and designing complex adaptive systems, whether naturally occurring or engineered, in simulation, in physical systems, with a view to applications in artificial life as the foundation for artificial intelligence and biological modelling.

Requisites : Prereq: Level at least 3A BASc/BSE students\  
Antireq: SYDE 599 (Topic 3: Biology and Computation)  
Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Short title: Artificial Life: Biol & Comp

**Effective 01-SEP-2024**

SYDE 554 (0.50) LEC, TUT Nonlinear Dynamic Systems

This course introduces nonlinear systems with applications in realistic ecological, mechanical, electrical, and chemical engineering systems. The properties of those systems are investigated via analytical and numerical tools, with particular application to MEMS and NEMS actuators & sensors. Students will develop knowledge and appreciation of the following concepts and tools: differences between linear and nonlinear dynamic systems; autonomous and non-autonomous systems; existence and uniqueness of solutions; equilibrium points and limit cycles; phase plane analysis; nonlinear phenomena; Poincare section analysis; multi-frequency oscillations; notions of system stability (e.g., Lyapunov functions).

Requisites : Prereq: Level at least 3A BASc/BSE students  
Antireq: SYDE 599 (Topic 14: Nonlinear Dynamic Systems)  
Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Short title: Nonlinear Dynamic Systems

**Effective 01-SEP-2024**

SYDE 577 (0.50) LEC, TUT Deep Learning

Introduction to deep learning. Regression and classification; backpropagation; convolutional and recurrent networks; optimization and regularization of deep networks; transformers; recent developments in the field.

Requisites : Prereq: Level at least 3A BASc/BSE students  
Antireq: SYDE 599 (Topic 4: Deep Learning)  
Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Short title: Deep Learning

**Effective 01-SEP-2024**

SYDE 586 (0.50) LEC, TUT Material Selection for Design

Material selection based on material property and design requirements. Design a product and selected material against failure. Select a manufacturing process that meets design requirements and constraints. Incorporate economic analysis and environmental impact in the selection process. Assess life cycle of the product and the selected material. Case studies related to general engineering applications and biomedical applications.

Requisites : Prereq: Level at least 3A BASc/BSE students  
Antireq: SYDE 599 (Topic 2: Material Selection for Design)  
Rationale : Courses previously offered as special topics courses under SYDE 599 have been given a regular calendar course code to help increase clarity for students when selecting required courses for specializations. Short title: Material Selection for Design

#### COURSE CHANGES (for approval)

#### Architecture - School of

##### Current Catalog Information

ARCH 110 (0.50) STU Visual and Digital Media 1

Introduction to the use of graphic media in architecture. Students will engage in exercises in drawing using various media, acquire digital skills, and develop fluency in diverse forms of architectural presentation. [Offered: F]

No Special Consent Required

Requisites : Prereq: Architecture students only

##### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

##### Current Catalog Information

ARCH 113 (0.50) LAB, LEC Visual and Digital Media 2

Introduction to computing techniques in architecture. Students will be instructed in the conceptual foundations for computer use in architecture, graphic applications for the computer and skills for two-dimensional drawing, three-dimensional modelling and graphic techniques for visualization and portfolio development. Students will gain fluency in a range of software applications for the purposes of developing technical and visual proficiencies to be integrated into the design process. [Offered: W]

No Special Consent Required

Requisites : Prereq: ARCH 110

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 120 (0.50) LEC An Introduction to Architectural Ideas and Communications

This course offers a broad introduction to the evolution of ideas, principles and vocabulary of architecture over time, establishing the concept that architecture conveys meaning through its own expressive language. It will familiarize students with the primary concepts of architecture; develop an awareness of the influences of architectural form; and introduce students to different modes of verbal and written communication, including the language of architectural criticism, analysis and interpretation. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Architecture students only

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 126 (0.50) LEC Environmental Building Design

An introduction to environmental design practices leading to low carbon design. Topics of discussion include passive heating and cooling, solar geometry, climate and meteorological influences, microclimate, site design, daylighting, active systems, embodied energy, sustainable rating systems, sustainable design philosophies such as cradle to cradle, biomimicry and design for disassembly. Energy-related issues will be addressed and energy-based software design programs will be introduced. Understanding the role of design in an energy efficient or passive solar building will be a central learning outcome. [Note: Field trip fee: \$15. Offered: W]

Department Consent Required

Requisites :

Prereq: Architecture students. Antireq: ARCH 226

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 142 (0.50) LEC Introduction to Cultural History

This course will introduce cultural history and the ethical dimension of the role architects play. Localizing the realities of modernity as an enduring cultural force and a global economy on one hand, with global threats to the future of humankind on the other. This course will explore the commonality of human experience, the interdependence of humans, and the natural environment. By considering narratives, artefacts, and buildings, this course will present how architecture and other cultural creations intersect with issues of race, gender, and identity, within a range of spiritual, social, political, and environmental contexts. Through orientation, disorientation, and reorientation, this course introduces human constructs and environmental conditions from a variety of perspectives such as location, foundation, habituation, accommodation, exile, and displacement. [Offered: F]

No Special Consent Required

Requisites : Prereq: Architecture students only

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 143 (1.00) LEC Settlements, Sanctuaries, and Cities

This course introduces buildings, cultural practices, and worldviews of nomadic and sedentary societies across a broad range of geographies and periods. Beginning with the earliest shrines and cities that appear in the Middle East, the Far East, and India, and exploring settlements in Africa, Asia, Europe, and the Americas up to the year 1000CE. This course examines the origins of sacred and civic architectures in the landscapes and environments in which they emerge, moving across continents to recognize patterns of life, concepts of order and conduct, symbols, rituals, and myths embodied in our building practices and settlement patterns. Analysis in this course foregrounds the relationships to the lands that inform cultures, the formation and movement of societies, their temporary and permanent constructions, looking at the ecological and social bearings of cities as spaces of power, sanctuary, and exchange. [Offered: W]

No Special Consent Required

Requisites : Prereq: ARCH 142

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 172 (0.50) LEC Building Construction 1

A focus on the construction of small-scale buildings will introduce the fundamentals of building construction demonstrating relationships between contemporary design and material selections. Design development practices will reference; regulatory frameworks, building science, soils, foundations, light wood construction, engineered wood, masonry (brick, concrete block, load bearing, veneer systems), shallow foundations, residential codes, barrier free design. [Note: Field trip fee: \$20.

Offered: F]

Department Consent Required

Requisites :

Prereq: Architecture students only

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 173 (0.50) LEC Building Construction 2

Focusing on the construction of medium-to large-scale buildings examines relationships between design development, and the building science, and construction practices of structural systems and enclosures. Case studies and projects will be used to investigate steel framing systems (traditional, long span, architectural exposed structural steel [AESS]); reinforced, precast, fibre reinforced and prestressed concrete construction; heavy timber construction (traditional, glulam, cross laminated timber [CLT]); deep foundations; building envelopes (curtain wall, window walls, glazing, insulation strategies, and roofing systems); fire protective design. [Offered: W]

No Special Consent Required

Requisites :

Prereq: ARCH 172

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 192 (1.50) STU Design Studio

Development of the means to appreciate the art and science of building; introduction to the study of theories of architecture; development of skills in graphic communication; introduction to a study of building elements; promotion of the application of theory in the practice of design. [Note: Passing grade is 60%. Field

trip (one week). Field trip cost \$300-\$450. Offered: F]

No Special Consent Required

Requisites :

Prereq: Architecture students only

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 193 ( 1.50 ) STU Design Studio

Further development of basic skills, and the application of theory and design in small scale architectural design projects. Introduction to issues of inhabitation, program, and context. [Note: Passing grade is 60%. Offered: W]

No Special Consent Required

Requisites :

Prereq: ARCH 192

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 212 ( 0.50 ) LEC Digital Fabrication

This course will introduce students to the tools, work-flows, and culture surrounding computer-aided design/computer-aided manufacturing (CAD/CAM) and its creative applications within architecture. Students will learn how to work with CAD/CAM technologies such as laser cutters, three-dimensional (3D) printers and computer numerical control (CNC) routers while expanding their knowledge of two- and three-dimensional CAD geometries that inform the digital fabrication process.

[Offered: F]

No Special Consent Required

Requisites :

Prereq: ARCH 113

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 225 ( 0.50 ) LEC Theory and Design of the Contemporary Landscape

This course provides an historical overview of the ideas of nature and landscape in Western thought. 'Nature', 'Ecology', and 'Landscape' are treated as cultural



constructs, related to specific philosophical, technological, economic, political, and social issues. Many of these issues will be considered as the course of study traces the evolution and transformation of contemporary landscape. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Architecture. Antireq: ARCH 425

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 243 (0.50) LEC Indigenous Practices

This course will engage students in a range of topics that include historical, practical, or theoretical investigations centering indigenous topics and epistemologies. This can include indigenous architectures, spatial and land practices locally or globally, indigenous typologies and worldviews, traditional ecological knowledge, and practices of restoration. This course will also look at critical and decolonizing frameworks for research methods and creative practices in order to introduce other ways of knowing and engaging the world. [Offered: S, first offered Spring 2023]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Architecture

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 246 (1.00) LEC, TUT Cultural Encounters 600-1600

This course presents encounters across peoples, worldviews, belief systems, and empires, following the movement of ideas, practices, and objects to consider significant cultural transformations resulting from conflictual or peaceful interactions. From Indigenous civilizations and imperial dynasties, to sites of economic, political, and religious encounters such as the Silk Road or the Crusades. This course thematically presents creative works across all continents and includes proto-capitalist and proto-colonial phenomena. Representational, material, and spatial practices studied range from visual and oral discourses, drawing, mapping, printing, land markings, places of burials, worship, and teachings, as well as the organization of cities, landscapes, and territories, all studied as windows into ways of knowing, patterns of life and relationships to the land. [Offered: F]

No Special Consent Required

Requisites :

Prereq: ARCH 143

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 248 (1.00) LEC, TUT Cultural Encounters 1600-1914

This course critically examines the period from the 17th century to the first years of the 20th century, studying revolutions in science, agriculture, and industry, and considering the social, political, and economic changes engendered globally in their wake. Selected works from philosophy, literature, the arts, architecture, landscape, and city design reveal complex social and political upheavals. The increasing influence of technology, and the power struggles around access to and extraction of the globe's resources. Topics considered include the birth of industrial nations driven by Enlightenment reason, science and the emancipative promise of political liberty, as well as the fall of that early idealism with the realities of capitalism, colonialism, racism, and the destruction of the natural environment. Considering encounters between people, as well as between people and the earth, this course studies both the promises and shadows of the complex global society that emerges in this time. [Offered: S]

No Special Consent Required

Requisites :

Prereq: ARCH 246

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ARCH 260 (0.50) LEC, TUT Principles of Structures

Fundamental concepts of mechanics and structures, as related to architectural design, study of loading conditions, forces, moments, systems of forces, conditions of equilibrium for two- and three-dimensional structures, centre of gravity of loads and areas, bar forces in trusses, simple frame analysis, moment of inertia. Concepts of simple stress and strain; shear and bending moments in simple beams; shear and moment diagrams, qualitative deflected shapes, flexural and shearing stresses, deflection calculations; compression members; Euler's formula. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Architecture students. Antireq: ARCH 163

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students

consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 276 (0.50) LEC Timber: Design, Structure and Construction

Architectural case studies are used to examine conceptual development, structural design, building process, and the selection of structural timber systems. Topics such as flexural, compression and truss members, connections, and plywood construction are studied using calculations, design aids, rules of thumb, and the latest CSA design standards. [Offered: S]

No Special Consent Required

Requisites :

Prereq: One of ARCH 260, ARCH 262, CIVE 204 or 205

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 292 (1.50) STU Design Studio

The exploration of design as a thinking process through the medium of small scale design projects. The development and analysis of architectural propositions concerning personal space within the context of a larger community. [Note: Passing grade is 60%. Required two-day field trip, cost range \$150-\$200. Offered: F]

No Special Consent Required

Requisites :

Prereq: ARCH 193

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 293 (1.50) STU Design Studio

Design involving problems of human perception and dimension in more complex environments, and dealing with issues of public and private space. Development of skills in analysis and programming, and further exploration of questions of siting and context. [Note: Passing grade is 60%. Field trip (one week). Estimated field trip cost \$400-\$500. Offered: S]

No Special Consent Required

Requisites :

Prereq: ARCH 292

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding

department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 327 (0.50) LEC Architecture of the Urban Environment

An introduction to the structure and form of urban environments as understood through the urban architecture. The forces that determine the creation and development of urban places will be examined. Topics include the plan as a generative form, urban building types, urban morphology, and the shape of the public realm, infrastructure as both system and architectural object, nature and the park, and real estate and development controls. Of special interest will be analyses of the suburb, and urban master plans. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Architecture students or Honours Environment and Business students

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 342 (1.00) LEC, TUT Modernisms: Local and Global

This course examines the cultural, architectural, urban, and environmental history of those complex movements designated as "modernism". Through selected works, projects and texts, this course studies the changing social, industrial, aesthetic, and ecological ambitions of these movements, critically reviewing their development and examining forms of acceptance and resistance to the "modern project". Through the examination of selected Canadian and international artistic, cultural, architectural, and landscape works, this course questions the technological, political, and social ideologies that continue to inform our buildings and cities as well as our relation to the earth and environment. Using a thematic approach to address the complexity of modernization, modernism, and modernity, this course presents issues related to habitat, health, craft, economy, and labour; histories of displacement, global narratives, resistance movements, and processes of emancipation and decolonization.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: ARCH 248

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

requirements.

### Current Catalog Information

ARCH 362 (0.50) LEC, TUT Steel and Concrete: Design, Structure and Construction

Architectural case studies are used to examine conceptual development, structural design, building process, and the selection of structural steel and concrete systems.

Topics such as tension, flexural, and compression members; and connections are studied using calculations, design aids, rules of thumb, and the latest CSA design standards. [Offered: W]

No Special Consent Required

Requisites :

Prereq: ARCH 262 or (ARCH 260 and ARCH 276)

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 364 (0.50) LEC Building Science

The physio-technical factors that influence building design for performance, durability, efficiency, health, and sustainability will be explored. Common building design construction problems, their causes and solutions, will be examined with the aid of case studies. Using the principles of building science, good details of masonry, wood, steel, and glass will be developed. [Offered: W]

No Special Consent Required

Requisites :

Prereq: ARCH 173. Antireq: ARCH 264

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 392 (1.50) STU Design Studio

Development of design skills and theoretical knowledge through their application in projects involving various building types in urban situations. Emphasis is placed upon issues of materiality and technology in architectural design. [Note: Passing grade is 60%. Required four to five day field trip, cost \$400-\$500. Offered: W]

No Special Consent Required

Requisites :

Prereq: ARCH 293

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for

their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 393 (1.50) STU Option Design Studio

This design studio is subdivided into distinct studio sections, each of which provides a specific platform for advanced research and design presented within the context of a topic or set of issues to be explored in relation to a specific design project, program and site. These studios range in both scale and scope, traversing an array of academic investigations, design hypotheses, research agendas, interdisciplinary explorations, and pedagogical intentions. These topics foreground the disciplinary arenas within architecture in the areas of architectural theory, media, technology, urbanism, and landscape. [Note: Passing grade is 60%. Offered: F]  
No Special Consent Required

Requisites : Prereq: ARCH 392

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 442 (0.50) LEC Contemporary Architectural Theory

This course presents a thematically organized survey of contemporary architectural theory that focuses on the relationship between key theoretical texts and critical developments in contemporary architectural theory, practice, and their social and ecological contexts. This course is intended to be a forum for discussion of selected topics in contemporary culture, and to provide students with an advanced knowledge base in contemporary theory broadly, and architectural theory more specifically to ground other forms of advanced architectural research. Themes explored in the course may include ethics in architectural practice, gender and identity in architecture, race and spatial justice, climate, sustainability, and ecological care. [Offered: F]  
No Special Consent Required

Requisites : Prereq: ARCH 342

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 463 (0.50) LEC Integrated Environmental Systems

This course is focused on the integrated environmental systems of buildings with an aim to develop the knowledge and skills appropriate to architectural practice.

Subjects covered include environmental parameters, air and water systems, heating and cooling loads, energy conservation, ventilating and air conditioning systems, plumbing and waste systems, artificial source lighting and daylighting, acoustics, and fire protection criteria and systems, with reference to building codes and standards. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 4A Architecture. Coreq: ARCH 493. Antireq: ARCH 263

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 473 (0.50) LEC Technical Report

Students will investigate and report on technical issues as they relate to the development of the comprehensive building project in the parallel Design Studio.

Innovation and integration in architectural design will be stressed with respect to structure, building envelope, environmental systems, health and life safety, movement systems, site planning and the integration of information technology. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 4A Architecture. Coreq: ARCH 493

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 492 (1.50) STU Design Studio

The studio course is mounted in Rome, Italy, with the school's own faculty and premises, and offers a unique opportunity to undertake design studies in a truly rich architectural heritage. The main focus is the nature of the institution and its relationship to the city and its culture. Students participating in the Rome term are expected to defray the costs of travel, accommodation, and food. For students unable to study in Rome, an alternative studio is offered in Cambridge. It presents similar design projects and theoretical questions in a North American context. [Note: Passing grade is 60%. Offered: F]

No Special Consent Required

Requisites :

Prereq: ARCH 393

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for



their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ARCH 493 (1.50) STU Design Studio/Comprehensive Building Design

This studio represents a culmination of the pre-professional degree, through the integration and application of skills and knowledge to a complex building project.

Students will develop designs to a high level of detail. A concern for technical material, environmental, and legal aspects of architecture will support open speculation and innovative design. [Note: Passing grade is 60%. Offered: S]

No Special Consent Required

Requisites :

Prereq: ARCH 492

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

## Chemical Engineering

### Current Catalog Information

CHE 100 (0.50) LEC, TST, TUT Chemical Engineering Concepts 1

Introduction to basic methods and principles in chemical engineering. The fundamentals of engineering calculations (units and dimensions), behaviour of fluids, mass balances, processes, and process variables. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Chemical Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 102 (0.50) LEC, TST, TUT Chemistry for Engineers

Chemical principles with applications in engineering. Stoichiometric calculations, properties of gases, properties of liquids and solutions, gas phase chemical equilibrium, ionic equilibrium in aqueous solution, oxidation-reduction reactions, chemical kinetics. [Offered: F,W,S]

No Special Consent Required

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for



their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 120 (0.50) LAB, LEC Computer Literacy and Programming for Chemical Engineers

Using computers as problem-solving tools. Introduction to computer architecture and networking. Effective use of command line interfaces and graphical user interfaces. Word processing, spreadsheet, and presentation software. Introduction to programming and numerical computing using a high-level interpreted programming language. Programming fundamentals including flow charts, variables, design and use of functions, strings and text input/output, relational operators, conditionals, collections, loops. Numerical computing, plotting and file input/output. [Offered: F]  
No Special Consent Required

Requisites : Prereq: 1A Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 180 (0.50) LEC, SEM, STU Chemical Engineering Design Studio 1

Engineering as a profession. An introduction to the fundamentals of data analysis, investigation, design, and communication in chemical engineering. Introduction to chemical product and process design. Needs analysis and problem identification. Literature search and brainstorming. Design requirements, constraints, and criteria. Development and preliminary evaluation of alternative solutions using software tools. Process synthesis, block diagrams, process flow diagrams (PFD), and piping and instrumentation diagrams (P&ID). Introduction to computer-aided design (CAD). Safety and sustainability in design. Principles of green engineering. Occupational health and safety. Introduction to process safety and process hazard identification. Communication of technical information, written reports, and oral presentations. Teamwork. Professional development, résumé and interview skills, and e-portfolios. Students undertake a term-long design project under the supervision of the instructor. [Offered: F]

No Special Consent Required  
Requisites : Prereq: 1A Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 200 (0.50) LEC, TUT Equilibrium Stage Operations  
Equilibrium between phases; the equilibrium stage concept. Cascades of stages with and without reflux; group methods and stage-by-stage approaches; graphical solutions. Applications in the separation of components by distillation, absorption, stripping, extraction and leaching. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: 2A Chemical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 211 (0.50) LEC, TUT Fluid Mechanics  
Fundamentals of fluid flow. Conservation laws for mass, momentum and mechanical energy. Flow of fluids in conduits. Flow past immersed bodies. Flow through beds of solids, fluidization. Transportation and metering of fluids. Dimensional analysis. [Offered: F, S]  
No Special Consent Required  
Requisites : Prereq: 2B Chemical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 220 (0.50) LEC, TUT Process Data Analysis  
Introduction to statistical methods for analyzing and interpreting process data. Introduction to statistical ideas, probability theory, distribution theory, sampling theory, confidence intervals and significance tests. Introduction to regression analysis. Introduction to design of experiments and statistical quality control. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: 2A Chemical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 230 (0.50) LEC, TUT Physical Chemistry 1  
Thermodynamics: work and heat as forms of energy. First law, internal energy and enthalpy. Heats of chemical and physical changes. Cycles and the second law, entropy. Spontaneity and equilibrium, free energies. Systems of variable composition, chemical equilibrium. Phase equilibrium and the phase rule. Ideal solutions, colligative properties. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: 2A Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 231 (0.50) LEC, TUT Physical Chemistry 2  
Thermodynamics: ideal solutions; non-ideal solutions, non-electrolytic and electrolytic solutions, phase equilibrium and phase diagrams, reaction equilibrium. Surface phenomena: surface tension, capillarity, properties of small particles, adsorption. Chemical kinetics: rate laws, reaction rates, mechanisms, catalysis, heterogeneous reactions. [Offered: F, S]  
No Special Consent Required  
Requisites : Prereq: 2B Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 241 (0.50) LEC, TUT Materials Science and Engineering  
Fundamentals; atomic bonding, crystalline structure, crystal defects, non-crystalline materials; structure and properties of metals, ceramics, glasses, semi-conductors. Amorphous materials, polymers, composites. Processing and concepts of engineering design of materials. [Offered: F,S]  
No Special Consent Required  
Requisites : Prereq: 2B Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for

their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 290 (0.25) LAB Chemical Engineering Lab 1  
A selection of computer and laboratory exercises refreshing and reinforcing material covered in the previous term. Topics may include: basic microbiology and biotechnology, introductory physical chemistry, mass and energy balances. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: 2A Chemical Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 291 (0.25) LAB Chemical Engineering Lab 2  
A selection of computer and laboratory exercises refreshing and reinforcing material covered in the previous term. Topics may include: physical chemistry, design of experiments and statistics, and equilibrium stage operations. [Offered: F, S]  
No Special Consent Required  
Requisites : Prereq: 2B Chemical Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 312 (0.50) LEC, TUT Mathematics of Heat and Mass Transfer  
Fundamentals of mass transfer: species and mixture velocities, diffusive and convective fluxes, Fick's law and the diffusion coefficient. Vector form of the microscopic (differential) mass balance. Fundamentals of heat transfer: conduction, convection and radiation, Fourier's law and thermal conductivity. Vector form of the microscopic thermal energy balance for solids and incompressible fluids. Mass and heat transfer models leading to ordinary differential equation problems in Cartesian, cylindrical and spherical geometries; types of boundary conditions. Bessel functions. Analytical solution of linear partial differential equations: combination of variables, separation of variables and Sturm-Liouville theory, Laplace transform. Mass and heat transfer models leading to linear partial differential equations: 1D transient diffusion and conduction in Cartesian, cylindrical and spherical geometries; steady-state 2D conduction and diffusion. Heat-mass transfer analogies

and dimensionless numbers. [Offered: W,S]

No Special Consent Required

Requisites :

Prereq: 3A Chemical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 313 (0.50) LEC, TUT Applications of Heat and Mass Transfer

Convective heat transfer. Analysis of convective heat transfer in external flows using the boundary layer approach. Analysis of convective heat transfer in internal flows. Empirical correlations for convective heat transfer. Heat transfer with phase change: condensation and boiling. Heat exchanger design. Convective mass transfer. Empirical correlations for convective mass transfer. Mass transfer at fluid-fluid interfaces. Design of continuous differential contactors for absorption/stripping, distillation and liquid-liquid extraction. Analogy between heat, mass and momentum transfer. Dimensional analysis. Simultaneous heat and mass transfer operations.

[Offered: F,W]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Chemical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 314 (0.50) LEC, TUT Chemical Reaction Engineering

Review of stoichiometry and chemical kinetics. Homogeneous reactors: isothermal operation; batch; semi-batch; continuous tank; plug flow reactor design. Continuous stirred-tank reactors (CSTRs) in series; plug flow reactor with recycle. Multiple reactions in reactor networks. Temperature effects in adiabatic and non-isothermal reactors. Yield, selectivity and optimal operation of reactors. Heterogeneous catalysis and effectiveness factors in two-phase reactors. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: 3A Chemical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 322 (0.50) LEC, TUT Numerical Methods for Process Analysis and Design

Systems of linear and non-linear algebraic equations; polynomial and spline interpolation; numerical differentiation and integration; numerical solution of initial value and boundary value ordinary differential equation problems: accuracy and stability, step size control and stiffness; finite differences for the numerical solution of elliptic and parabolic partial differential equations: method of lines, explicit vs. implicit finite-difference methods; introduction to the finite element method (optional). [Offered: W,S]

No Special Consent Required

Requisites : Prereq: 3A Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 330 (0.50) LEC, TUT Chemical Engineering Thermodynamics

Review of fundamentals, including 2nd law and concepts of equilibrium, phase and reaction equilibria, fugacity, exergy. Thermodynamics applied to practical situations. Examples chosen from: fluid flow; power generation; refrigeration; air conditioning and water cooling; liquefaction of gases; equilibria in complex chemical reactions and separation processes; surface phenomena; electrochemical reactions; biological processes. [Offered: W, S]

No Special Consent Required

Requisites : Prereq: 3A Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 331 (0.50) LEC, TUT Electrochemical Engineering

Topics and applications of electrochemistry and electrochemical engineering. Industrial process examples. Environmental aspects. Ionic equilibria. Laws of electrolysis. Theory of electrolytes. Transport properties of electrolytes. Reversible cell potentials. Irreversible electrode processes. Thermodynamic and kinetic aspects of corrosion. Common examples of corrosion. Electrochemical energy conversion and storage. [Offered: F, W]

No Special Consent Required

Requisites :  
**Effective 01-SEP-2024**

Prereq: Level at least 3B Chemical Engineering

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 341 (0.50) LEC, TUT Introduction to Process Control

Laplace transform techniques. Proportional-integral-derivative control. Frequency response methods. Stability analysis. Controller tuning. Process control simulation and computer control systems. Process identification. [Offered: F, W]

No Special Consent Required

Requisites :  
**Effective 01-SEP-2024**

Prereq: Level at least 3B Chemical Engineering or Environmental Engineering

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 361 (0.50) LEC, TUT Bioprocess Engineering

Review of elementary aspects of microbiology, biochemistry, molecular biology, and genetic engineering. Introduction of biological systems for the production of commercial goods and services, e.g., foods, pharmaceuticals, chemicals, fuels, diagnostics, waste treatment, and biomaterials. Introduction to design of bioprocess systems, including biosafety and sustainability. Development of reaction kinetics associated with biological systems. Quantification of metabolism. Development of material balances for key constituents in bioreactors operated in different modes, e.g., batch, fed-batch, continuous stirred-tank reactor (CSTR), perfusion, recycle. Introduction to mass and heat transfer considerations for bioreactors. Dynamic simulation of cultures defined by ordinary differential equations. Introduction of downstream processes associated with biological systems and recovery of biological products. [Offered: F, W]

No Special Consent Required

Requisites :  
**Effective 01-SEP-2024**

Prereq: Level at least 3B Chemical Engineering or Environmental Engineering

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.



### Current Catalog Information

CHE 383 (0.25) LEC Chemical Engineering Design Workshop

An introduction to the engineering design process, including problem definition and needs analysis, critical analysis of problems, alternative solutions, process synthesis, design constraints, and safety and environmental protection in design.

This course also develops and enhances team work, project management and technical communication (written and oral). Students in teams work on open-ended problems and apply the formal methods of engineering design. At the conclusion of this course, each student team presents a pre-proposal of the design project that will become the subject of CHE 482 and CHE 483. [Offered: F, W]

No Special Consent Required

Requisites : Prereq: 3B Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 390 (0.50) LAB Chemical Engineering Lab 3

A selection of computer and laboratory exercises, and project-based investigations, refreshing and reinforcing material covered in the previous term. Topics may include fluid mechanics, physical chemistry and kinetics, materials properties, and testing.

[Offered: W, S]

No Special Consent Required

Requisites : Prereq: 3A Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 450 (0.13) PRJ Technical Work-term Report

An engineering report based upon a technical project, activity, or analysis carried out by the student, during the preceding work-term employment. Evaluation is based upon a level of written communication, technical proficiency, and engineering analysis appropriate to a graduating engineering student. [Offered: F, W]

No Special Consent Required

Requisites : Prereq: PD 11; Level at least 3B Chemical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding



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### Current Catalog Information

CHE 480 (0.50) LEC, TUT Process Analysis and Design  
Development and analysis of process flowsheets and chemical product design. Design and selection of common process equipment such as heat exchangers, pumps, piping, staged separations. Incorporation of pollution prevention and inherently safer design principles. Equipment and project cost estimation. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: 4A Chemical Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 482 (0.50) PRJ, SEM Group Design Project  
The first of two required courses for the Chemical Engineering capstone design project. Student design teams of three to five members work on design projects of industrial scope and importance under the mentorship of a faculty member. Students develop and communicate a feasible design project proposal and plan; generate feasible solutions that address the formulated problem; evaluate alternatives and identify preferred solution; address safety, regulatory, sustainability and professional ethics requirements, as appropriate; effectively manage design project technical and non-technical risks using project management tools and techniques; deliver a report and/or a presentation that summarizes the work completed; work effectively as a team member and/or team leader. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: 4A Chemical Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 483 (0.50) PRJ, SEM Group Design Project and Symposium  
Completion of the design project cycle started in CHE 482 and communication of the engineering design work. Submission of a written final report. Lecture-style technical presentation by group members. Poster-style technical presentation with

group members available to discuss the project. [Offered: W]

No Special Consent Required

Requisites :

Prereq: CHE 482; 4B Chemical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 490 (0.50) LAB Chemical Engineering Lab 4

A project-based experimental investigation of complex systems in main areas of application of chemical engineering. Topics selected from reaction engineering, separation processes, bioprocess engineering, electrochemical engineering, materials engineering and process control. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 4A Chemical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 491 (0.50) LAB Chemical Engineering Lab 5

Project-based experimental investigation of complex systems in main areas of application of chemical engineering. Topics selected from reaction engineering, separation processes, bioprocess engineering, electrochemical engineering, materials engineering and process control. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Chemical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CHE 561 (0.50) LEC Biomaterials and Biomedical Design

An overview of nanomedicine and nanotechnology-based biomedical devices. Strategies and technologies for designing, testing, and manufacturing biomaterials and tissue-engineering products. Biological and clinical applications. Manufacturing challenges and regulatory procedures for commercialization. [Offered: W]

No Special Consent Required

Requisites :

Cross-listed as:

Prereq: CHE 560. Antireq: BME Topic 1, Biocompatibility and Biomaterial  
NE 488

**Effective 02-SEP-2024**

Title Change:

Biomaterials and Tissue Engineering

Description Change:

The course provides an overview of the recent advances in medicine and nano-technologies for development of tissue engineering and regenerative medicine. Strategies and technologies for designing, testing, and manufacturing of biomaterials and tissue-engineering products will be introduced. The biological and clinical applications will be discussed. The unmet medical needs, challenges in manufacturing, regulatory approval and commercialization for tissue engineering applications will also be discussed.

Requisite Change :

Prereq: CHE 560.

New Cross Listing :

Antireq: BME 589 (Topic 4: Biomaterials & Biomedical Design)

Rationale :

NE 488 BME 561

A new BME cross-listing is being added to this course to replace a previous BME special topics offering. This will help increase clarity for students when selecting required courses for BME specializations. The title and description have also been updated to better represent what is currently taught in the course. Anti-requisites are updated to include the previous BME special topics course. All three areas are in agreement with the changes. Short title: Biomaterials & Tissue Eng

## Civil and Environmental Engineering

### Current Catalog Information

AE 100 (0.50 ) STU Concepts Studio

An introduction to the fundamental engineering methods, principles and skills, design and communication in architectural engineering. Techniques in analytical sketching, orthographic drawing, construction documentation, problem definition, and scaled model building will underlie the collaborative development of (a) small-scale design project(s). Students will become familiar with the language and anatomy of buildings, the studio environment and culture of peer evaluation and juried work critique, and the fundamental conventions of design. Introduction to report writing, documentation, and fundamental two-dimensional computer-aided design (2D CAD) software and tools.

[Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1A Architectural Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 101 (0.50) LEC, STU, TST History of the Built Environment

A complementary studies course that provides a broad history of technology as it relates to buildings, towers, bridges, etc. Social, cultural, and economic influences on technological products will be discussed while surveying icons of architectural engineering. [Offered: F]

No Special Consent Required

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 104 (0.25) LEC, TST, TUT Mechanics 1

Newtonian mechanics. Force systems; vectors, forces, and moments; equilibrium and free body diagrams. Mechanics of simple structures. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Architectural, Civil, Environmental, or Geological Engineering.  
Antireq: CIVE 104, PHYS 115

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 105 (0.75) LEC, TST, TUT Mechanics 2

Distributed forces, centroids, and moment of inertia. Introduction to foundations and fluid statics. Basic structural analysis. Plane trusses. Beam diagrams.

Stress-strain-temperature relationships. Behaviour of members in tension, compression, and bending. Thin-walled pressure vessels. Friction. [Offered: S]

No Special Consent Required

Requisites :

Prereq: AE 104; Level at least 1B Architectural, Civil, Environmental, or Geological Engineering. Antireq: CIVE 105

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 115 (0.25 ) LEC, TST, TUT Linear Algebra

Linear systems of equations, matrices, and determinants. Introduction to the eigenvalue problem. Applications. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Architectural, Civil, Environmental, or Geological Engineering.

Antireq: CIVE 115, MATH 114, 115, 125, 136, 146

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 121 (0.50 ) LAB, LEC, TST Computational Methods

Introduction to computer programming, examples of efficient numerical algorithms for basic scientific computations. Programming and problem-solving concepts introduced in the course will be incorporated into projects involving architectural engineering applications. The language of instruction will be Matlab. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Architectural, Civil, Environmental, or

Geological Engineering. Antireq: BME 121, CHE 121, CIVE 121, ECE 150, MTE 121/GENE 121, SYDE 121

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 125 (0.50 ) STU Structural Design Studio

Development of design and communication skills through application in projects involving various building or bridge types. The role of structure in the built environment is explored, including issues of materiality and technology. Exposure to three-dimensional (3D) modelling and model building. [Offered: S]

No Special Consent Required

Requisites :

Prereq: AE 100; Level at least 1B Architectural Engineering

### Effective 02-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

requirements.

### Current Catalog Information

AE 199 (0.00) SEM Seminar  
General seminar. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: Level at least 1B Architectural Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 200 (0.50) STU Enclosure Design Studio  
Development of design and communication expertise through studio projects involving various building enclosure types. Exposure to building enclosure materials, systems, applications, and methods of representation. Emphasis placed on critical evaluation, problem solving, and design synthesis. Introduction to industry standard three-dimensional computer-aided design (3D CAD) software. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: AE 125; Level at least 2A Architectural Engineering

#### Effective 02-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 204 (0.50) LEC, TST, TUT Solid Mechanics I  
Three-dimensional force systems, moments, couples, and resultants. Three-dimensional equilibrium problems. Shear stresses in beams. Plastic bending. Beam deflection. Torsion of shafts and thin-walled closed sections. Shear, bending moment, and deflection diagrams for beams. Compound stress and stress transformations. Design concepts. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: AE 105; Level at least 2A Architectural or Civil Engineering, or Level at least 2B Geological Engineering. Antireq: CIVE 204

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 205 (0.50) LEC, TST, TUT Solid Mechanics 2  
Frames, arches, and suspended structures. Stress and strain transformations. Strain energy. Energy methods. Virtual work. Buckling of columns. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: AE 204, 221; Level at least 2B Architectural or Civil Engineering, or Level at least 3A Geological Engineering. Antireq: CIVE 205

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 221 (0.50) LEC, TST, TUT Advanced Calculus  
Calculus of functions of several variables. Differentiation: partial derivatives of implicit and explicit functions, applications including optimizations. Integration: multiple integrals in various co-ordinate systems with applications; Vector calculus: vector fields, line integrals, surface integrals, and applications. Numerical integration and differentiation. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: MATH 118; Level at least 2A Architectural, Civil, or Geological Engineering. Antireq: CIVE 221, ENVE 221, MATH 217

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 223 (0.50) LEC, TST, TUT Differential Equations and Balance Laws  
An introduction to ordinary differential equations with applications to mass and energy balance problems in engineering. Standard methods of solution of first and second order linear equations with constant coefficients. Numerical methods for solving ordinary differential equations. Partial differential equations. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: AE 221; Level at least 2A Architectural, Environmental, or Geological Engineering. Antireq: CIVE 222, MATH 218

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for

their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 224 (0.50) LEC, TST, TUT Probability and Statistics

Role of probability in architectural engineering and decision-making under uncertainty. Basic probability concepts. Probability distributions. Functions of random variables. Data analysis. Confidence intervals and hypothesis testing. Introduction to regression analysis. Introduction to design of experiments and statistical quality control. [Offered: W]

No Special Consent Required

Requisites :

Prereq: MATH 116; Level at least 2A Architectural or Civil Engineering.

Antireq: CIVE 224, ENVE 224

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 225 (0.50) STU Environmental Building Systems Studio

Environmental performance of buildings studied via physical investigations, demonstrations, case studies, and design exercises with a focus on building mechanical and electrical systems and lighting. Embodied energy and life-cycle implications will be introduced. [Offered: F]

No Special Consent Required

Requisites :

Prereq: AE 200; Level at least 2B Architectural Engineering

### Effective 02-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 265 (0.50) LAB, LEC, TST, TUT Structure and Properties of Materials

A basic course in structure, behaviour, and uses of engineering materials. Topics include monotonic and cyclic stress-strain behaviour of metals, and the mechanical properties of irons, steels, copper, and aluminum. Structure and mechanical properties of wood, masonry, cements, concrete, polymers, and fiber-reinforced polymers. Fracture, fatigue, corrosion, decay, moisture, and radiation damage functions. [Note: Three lab sessions. Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Civil, Environmental, or Geological Engineering, or level at least 2B Architectural Engineering. Antireq: CIVE 265



**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 279 (0.50) LEC, TST, TUT Energy and the Environment

Fundamentals of thermodynamic analysis. Internal energy, enthalpy, and specific heats of solids, liquids, and gases. Energy transfer with heat, work, and mass flow. Energy balances for control-mass and control-volume systems. Heat engines, refrigerators, and heat pumps. Overview of selected renewable and non-renewable energy technologies, including photovoltaics. Environmental implications of energy use. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Architectural, Civil, Environmental, or Geological Engineering. Antireq: BME 384, CHE 330, MTE 309, ENVE 279, ME 250, SYDE 381

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 280 (0.50) LAB, LEC, TST, TUT Fluid Mechanics and Thermal Sciences

An introduction to fluid mechanics and thermal sciences. Aspects of heat transfer via conduction, convection, and radiation. Fluid properties. Fluid statics. Bernoulli equation. The momentum equation and applications. Laminar and turbulent flow. Dimensionless numbers. Closed conduit flow. Pipe network analysis. Steady flow in pipes. [Note: Four lab sessions. Offered: W]

No Special Consent Required

Requisites :

Prereq: CIVE 105, 221; Level at least 2A Architectural or Civil Engineering. Antireq: CIVE 280, ENVE 280

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 298 (0.00) SEM Seminar

General seminar. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Architectural Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 299 (0.00) SEM

Seminar

General seminar. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Architectural Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 300 (1.00) STU

Architectural Engineering Studio 1

Comprehensive mid-sized community building design project(s) in collaboration with the School of Architecture. Integration of structure, systems, and architecture explored with case studies. Preparation of construction drawings and specifications.

[Offered: S]

No Special Consent Required

Requisites :

Prereq: AE 225; Level at least 3A Architectural Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 303 (0.50) LEC, TST, TUT

Structural Analysis

Analysis of statically indeterminate structures using force and displacement methods.

Influence lines for determinate and indeterminate structures. Introduction to the matrix stiffness method. Computer applications using commercial structural analysis software. [Offered: S]

No Special Consent Required

Requisites :

Prereq: AE 205; Level at least 3A Architectural, Civil, or Geological Engineering. Antireq: CIVE 303

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 310 (0.75) LEC, TST, TUT Introduction to Structural Design

Introduction to structural systems. Systems for carrying gravity and lateral loads in buildings. Structural design concepts. Analysis and design of concrete beams and one-way slabs. Design of steel beams and tension members. Comparison of steel and concrete framing systems. [Offered: W]

No Special Consent Required

Requisites :

Prereq: AE 303; Level at least 3B Architectural, Civil, or Geological Engineering. Antireq: CIVE 310

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 325 (0.50) STU Architectural Engineering Studio 2

Comprehensive large multi-storey building design project(s) in collaboration with the School of Architecture. Integration of structure, systems, and architecture explored with case studies. Preparation of construction drawings and specifications. [Offered: W]

No Special Consent Required

Requisites :

Prereq: AE 300; Level at least 3B Architectural Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 353 (0.50) LEC, TST, TUT Soil Mechanics and Foundations

An introduction to soil mechanics principles including state of stress, ground water flow, consolidation and shear strength. An introduction to design of shallow and deep foundations. Earth pressure theories and design of retaining walls. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Architectural Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 377 (0.50) LEC, TUT Structural Timber Design

An introduction to the behaviour of wood as an engineering material and design of timber structures based on limit states design principles. Topics include materials behaviour, selection and design of structural timber members and systems, including beams, joists, columns, connections, shearwalls, and diaphragms. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Architectural Engineering or Architecture students

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

AE 392 (0.50) LEC, TST, TUT Economics and Life Cycle Cost Analysis

Project financing, life-cycle cost analysis, time value of money, sensitivity analyses, tax, financial implications of infrastructure projects, quantitative decision-making, financial aspects of a business plan. [Offered: S]

No Special Consent Required

Requisites :

Prereq: MATH 116; Level at least 3B Architectural Engineering, 2B Civil Engineering, 3A Environmental or Geological Engineering  
CIVE 392 ENVE 392 GEOE 392

Cross-listed as:

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

AE 398 (0.00) SEM Seminar

General seminar. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Architectural Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding

department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 399 (0.00) SEM Seminar  
General seminar. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: Level at least 3B Architectural Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 400 (0.50) PRJ Project Studio 1  
Students undertake a group architectural engineering design project over two terms of their program. The purpose of the project is to demonstrate students' abilities to practice in their chosen area of expertise, using knowledge gained from their academic and employment experiences. Projects integrate all relevant aspects (e.g., structure, constructability, mechanical, and enclosure) within appropriate defined social, economic, environmental, political, and technical constraints. Project management and sustainability considerations will be emphasized. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: AE 325; Level at least 4A Architectural Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 425 (0.50) PRJ Project Studio 2  
Completion of the detailed technical design for the project defined and initiated in AE 400. Complete oral presentation, written, and graphics deliverables. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: AE 400; 4B Architectural Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

requirements.

### Current Catalog Information

AE 491 (0.50) LEC, TST Engineering Law and Ethics  
Background (Charter of Rights and Freedoms), contracts, torts (negligent malpractice), forms of carrying on business, professional practice (Professional Engineers Act, joint practice rules, professional misconduct and sexual harassment), alternate dispute resolution, construction liens, intellectual property (patents, trade marks, copyrights and industrial designs), labour relations and employment law, environmental law. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: Level at least 4A Architectural Engineering. Antireq: CIVE 491

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 498 (0.00) SEM Seminar  
General seminar. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: Level at least 4A Architectural Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

AE 499 (0.00) SEM Seminar  
General seminar. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: 4B Architectural Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 100 (0.80) LAB, LEC, TST, TUT Civil Engineering Concepts  
An introduction to the fundamental methods, principles and skills of civil

engineering. Fundamentals of technical communication, the engineering design process and problem solving. Completion of a pre-design study and report for a civil engineering project. Independent and team work. Fundamentals of engineering computation: units, data collection, measurement, and error analysis. Field surveying (automatic level, engineer's transit, differential Global Positioning System (GPS), total station). Laboratory on engineering graphics auto-computer assisted diagnosis (AutoCAD) and computational software (Excel, Matlab). Aspects of the engineering profession (code of ethics, negligence, misconduct, role of the Professional Engineers Ontario (PEO), etc.), diversity in the workplace, and professional development. Preparation for the University of Waterloo co-operative education program (Co-operative Education and Career Action (CECA), résumé writing, job search and interview skills). [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Civil Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 104 (0.25 ) LEC, TST, TUT Mechanics 1

Newtonian mechanics. Force systems; vectors, forces and moments; equilibrium and free body diagrams. Mechanics of simple structures. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1A Civil, Environmental or Geological Engineering.

Antireq: PHYS 115

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 115 (0.25 ) LEC, TUT Linear Algebra

Linear systems of equations, matrices and determinants. Introduction to the eigenvalue problem. Applications. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1A Civil Engineering. Antireq: MATH 106, 114, 115, 136, 146

ENVE 115 GEOE 115

Cross-listed as:

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before

dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

CIVE 204 (0.50) LEC, TST, TUT Solid Mechanics 1

Three-dimensional force systems, moments, couples, and resultants. Three-dimensional equilibrium problems. Shear stresses in beams. Plastic bending. Beam deflection. Torsion of shafts and thin-walled closed sections. Shear, bending moment, and deflection diagrams for beams. Compound stress and stress transformations. Design concepts. [Offered: F]

No Special Consent Required

Requisites :

Prereq: CIVE 105; Level at least 2A Civil Engineering or 2B Geological Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 205 (0.50) LEC, TST, TUT Solid Mechanics 2

Frames, arches and suspended structures. Stress and strain transformations. Strain energy. Energy methods. Virtual work. Buckling of columns. [Offered: S]

No Special Consent Required

Requisites :

Prereq: CIVE 204, 221; 2B Civil Engineering or 3A Geological Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 221 (0.50) LEC, TST, TUT Advanced Calculus

Calculus of functions of several variables. Differentiation; partial derivatives of implicit and explicit functions, applications including optimizations. Integration; multiple integrals in various co-ordinate systems with applications. Vector calculus; vector fields, line integrals, surface integrals, and applications. Numerical integration and differentiation. [Offered: F]

No Special Consent Required

Requisites :

Prereq: MATH 118; Level at least 2A Civil Engineering. Antireq: MATH 217, ENVE 225  
GEOE 221

Cross-listed as:

### Effective 01-SEP-2024

Rationale :

Adding department drop consent to all offerings of this course. The Faculty



of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

CIVE 222 (0.50) LEC, TST, TUT Differential Equations

An introduction to linear and partial differential equations. Standard methods of solution, applications to physical and engineering problems, linear equations with constant coefficients, basic systems of differential equations, partial differential equations. Applications. [Offered: S]

No Special Consent Required

Requisites :

Prereq: CIVE 221; 2B Civil Engineering. Antireq: MATH 218, ENVE 223

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 224 (0.50) LEC, TST, TUT Probability and Statistics

Role of probability in engineering and decision-making under uncertainty. Data analysis. Basic probability concepts. Probability distributions. Functions of random variables. Estimation theory. Empirical determination of distribution models.

Regression analysis. Introduction to risk. [Offered: F]

No Special Consent Required

Requisites :

Prereq: MATH 116; Level at least 2A Civil Engineering. Antireq: CHE 220, ENVE 224, GEOE 224

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 230 (0.50) LEC, TST, TUT Engineering and Sustainable Development

This course introduces the concept of sustainability and how it applies to decision-making in civil engineering. The course begins by defining sustainability, both practically and technically, and describing the concepts of systems, and systems interactions. Quantitative methods and measures of effectiveness are derived and applied to components of sustainability; air quality, water quality, energy, transportation and solid waste. Economic concepts and their applicability to sustainability are described for both developed and developing countries. [Offered: S]

No Special Consent Required

Requisites : Prereq: CIVE 224 or GEOE 224; Level at least 2B Civil or 3A Geological Engineering. Coreq: CIVE 392 or GEOE 392

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 241 (0.50) LEC, TST, TUT Transport Principles and Applications

Application of scientific principles to the planning, design, maintenance and management of transportation systems. The basic principles of transportation engineering for contemporary urban transportation modes; auto, transit, cycling and walking, and intercity modes; rail and air. Transportation economics, environmental impacts, and demand estimation. [Offered: F]

No Special Consent Required

Requisites : Prereq: Level at least 2A Civil Engineering or (ENVE 224 or GEOE 224; Level at least 3B Environmental or Geological Engineering). Coreq: CIVE 224

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 265 (0.50) LAB, LEC, TST, TUT Structure and Properties of Materials

A basic course in structure, behaviour, and uses of engineering materials. Topics include monotonic and cyclic stress-strain behaviour of metals. Phase diagrams. Diffusion, nucleation and growth of grains. Metallurgy and mechanical properties of irons and steels. Structure and mechanical properties of wood, cements, and concrete. Fracture, fatigue, and corrosion. Three lab sessions. [Offered: F]

No Special Consent Required

Requisites : Prereq: 2A Civil Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 280 (0.50) LAB, LEC, TST, TUT Fluid Mechanics

An introduction to fluid mechanics. Fluid properties. Review of fluid statics.

Buoyancy. Bernoulli equation. The momentum equation and applications. Laminar and turbulent flow. Dimensionless numbers. Closed conduit flow including friction losses. Pipe network analysis. Pump systems. Four lab sessions. [Offered: S]  
No Special Consent Required

Requisites : Prereq: CIVE 105, 221; Level at least 2B Civil Engineering. Antireq: ENVE 280

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 298 (0.00) SEM Seminar  
General seminar. [Offered: F]  
No Special Consent Required

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 299 (0.00) SEM Seminar  
General seminar. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: 2B Civil Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 303 (0.50) LEC, TST, TUT Structural Analysis  
Analysis of statically indeterminate structures using force and displacement methods. Influence lines for indeterminate structures. Introduction to the matrix stiffness method. Computer applications using commercial structural analysis software. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: CIVE 205; Level at least 3A Civil or Geological Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding

department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 310 (0.75) LEC, TST, TUT Introduction to Structural Design

Introduction to structural systems. Systems for carrying gravity and lateral loads in buildings. Structural design concepts. Analysis and design of concrete beams, and one-way slabs. Design of steel beams and tension members. Comparison of steel and concrete framing systems. [Offered: F]

No Special Consent Required

Requisites :

Prereq: CIVE 205; Level at least 3B Civil or Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 332 (0.50) LEC, TST, TUT Civil Systems and Project Management

Introduction to conceptual planning, construction, management, optimization, and life-cycle performance assessment of civil engineering systems including capital projects. Fundamentals of decision theory including concepts of risk, uncertainty, utility, probability, value of information, and game theory. Tools for supporting decision-making process, including linear and integer programming, network models, optimization, and Monte Carlo simulation. Risk- and cost-benefit analysis of public projects and their impact on sustainability, and quality of life. [Offered: W]

No Special Consent Required

Requisites :

Prereq: (One of AE 221, CIVE221 or GEOE 221), (One of AE 223, CIVE 222 or GEOE 223), (One of AE 224, CIVE 224 or GEOE 224); Level at least 3A Architectural, Civil or Geological Engineering. Antireq: ENVE 335, MSCI 331, SYDE 411

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

CIVE 341 (0.50) LEC, TST, TUT Transportation Engineering Applications

Traffic engineering and travel forecasting. Evaluation, design and management of urban transport systems through advanced traffic control techniques. Quantitative methods for evaluating investments in transportation infrastructure or operational

changes. [Offered: W]  
No Special Consent Required  
Requisites :

Prereq: (CIVE 224 or ENVE 224); Level at least 3A Civil or 3B Environmental Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 353 (0.50) LAB, LEC, TST, TUT Geotechnical Engineering 1

An introduction to geologic processes. Subsurface exploration. Classification systems. Weight-volume relationships. Soil mechanics principles including state of stress, ground water flow, consolidation and shear strength. Four lab sessions.

[Offered as: CIVE 353 (W), GEOE 353 (S)]

No Special Consent Required

Requisites :

Prereq: CIVE 153 or (EARTH 121, 121L); (Level at least 3A Civil Engineering) or (Level at least 3A Earth Science/Hydrogeology Specialization)  
GEOE 353

Cross-listed as:

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

CIVE 375 (0.50) LAB, LEC, TST, TUT Environmental Engineering Principles

Water quality, air pollution, fate and transport of contaminants in natural and engineered systems, and pollution prevention. Solid and hazardous waste management.

Water and wastewater treatment systems and design principles. Four lab sessions.

[Offered: F]

No Special Consent Required

Requisites :

Prereq: CHE 102, (CIVE 280 or GEOE 280); Level at least 3A Civil or Geological Engineering. Antireq: ENVE 375

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements

**Current Catalog Information**

CIVE 382 (0.50) LAB, LEC, TST, TUT Hydrology and Open Channel Flow

Introduction to the water cycle, flood frequency analysis, design storms. Analysis of

hydrographs and rainfall-runoff response mechanisms in urban and natural systems. Mass continuity and water budgets at the watershed scale. Impact of land use change on hydrologic response. Quantification of open channel flow; subcritical and supercritical flow regimes. Dynamic forces on submerged structures and low/scour beneath bridges. [Offered as: CIVE 382 (W), ENVE 382 (F,W)]

No Special Consent Required

Requisites : Prereq: CIVE 105, 224, 280; Level at least 3A Civil Engineering

Cross-listed as: ENVE 382

**Effective 01-SEP-2024**

Rationale : Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

CIVE 392 (0.50) LEC, TST, TUT Economics and Life Cycle Cost Analysis

Project financing, life-cycle cost analysis, time value of money, sensitivity analyses, tax, financial implications of infrastructure projects, quantitative decision-making, financial aspects of a business plan. [Offered: S]

No Special Consent Required

Requisites : Prereq: MATH 116; Level at least 2B Civil Engineering. Antireq: MSCI 261, SYDE 262

Cross-listed as: ENVE 392 GEOE 392 AE 392

**Effective 01-SEP-2024**

Rationale : Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

CIVE 398 (0.00) SEM Seminar

General seminar. [Offered: W]

No Special Consent Required

Requisites : Prereq: 3A Civil Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 399 (0.00) SEM Seminar

General seminar. [Offered: F]

No Special Consent Required

Requisites : Prereq: 3B Civil Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 400 (0.50) LEC, PRJ Civil Engineering Design Project 1

Students must undertake an independent civil engineering design project during the last two terms of their plan. The purpose of the project is to demonstrate students' abilities to practise in a civil engineering capacity in their chosen area of expertise, using knowledge gained from their academic and employment experiences. The first part of the project (CIVE 400) will include problem identification, generation and selection of solutions, and time management. Incorporation of technical, ecological, social, political, and economic issues in the solution for the project will be required. A basic requirement of the proposed solution is that it must be compatible with the principles of sustainability. Requirements include proposal, progress report, oral presentation, and a final report containing recommendations for part two of the project, CIVE 401. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 4A Civil Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 401 (0.50) PRJ Civil Engineering Design Project 2

A continuation of CIVE 400. The final design of the major civil engineering project proposed in CIVE 400 will be undertaken. The purpose of this phase of the project is to carry out a detailed technical design of the solution proposed in CIVE 400.

Requirements of this part of the two-term project include a symposium presentation and a final report. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Civil Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 491 (0.50) LEC, TST Engineering Law and Ethics

Background (Charter of Rights and Freedoms), contracts, torts (negligent malpractice), forms of carrying on business, professional practice (professional engineers act, joint practice rules, professional misconduct and sexual harassment), alternate dispute resolution, construction liens, intellectual property (patents, trade marks, copyrights and industrial designs), labour relations and employment law, environmental law. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 4A Civil Engineering. Antireq: AFM 231/LS 283, BUS 231W, COMM 231, ENV5 201, GENE 411, ME 401

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 498 (0.00) SEM Seminar

General seminar. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 4A Civil Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

CIVE 499 (0.00) SEM Seminar

General seminar. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Civil Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

GEOE 100 (0.80) LAB, LEC, TST, TUT Environmental and Geological Engineering Concepts



An introduction to the fundamental methods, principles and skills of environmental and geological engineering. Fundamentals of technical communication, the engineering design process and problem solving. Completion of a pre-design study and report for an environmental engineering project. Independent and team work. Fundamentals of engineering computation units, data collection, measurement, and error analysis. Field surveying (automatic level, engineer's transit, differential global positioning system (GPS), total station). Laboratory on engineering graphics auto-computer assisted diagnosis (AutoCAD) and computational software (Excel, Matlab). Aspects of the engineering profession (code of ethics, negligence, misconduct, role of the Professional Engineers Ontario (PEO), etc.), diversity in the workplace, and professional development. Preparation for the University of Waterloo co-operative education program (Co-operative Education and Career Action (CECA), résumé writing, job search and interview skills). [Offered: F]

No Special Consent Required

Requisites : Prereq: 1A Geological Engineering

Cross-listed as: ENVE 100

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

GEOE 115 (0.25 ) LEC, TUT Linear Algebra

Linear systems of equations, matrices and determinants. Introduction to the eigenvalue problem. Applications. [Offered: F]

No Special Consent Required

Requisites : Prereq: Level at least 1A Geological Engineering. Antireq: MATH 106, 114, 115, 136, 146

Cross-listed as: CIVE 115 ENVE 115

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

GEOE 221 (0.50 ) LEC, TST, TUT Advanced Calculus

Calculus of functions of several variables. Differentiation; partial derivatives of implicit and explicit functions, applications including optimizations. Integration; multiple integrals in various co-ordinate systems with applications. Vector calculus; vector fields, line integrals, surface integrals, and applications. Numerical integration and differentiation. [Offered: F]

No Special Consent Required

Requisites : Prereq: MATH 118; Level at least 2A Geological Engineering. Antireq: MATH

Cross-listed as:  
**Effective 01-SEP-2024**

217, ENVE 225  
CIVE 221

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

GEOE 223 (0.50) LEC, TST, TUT Differential Equations and Balance Laws

An introduction to ordinary differential equations with applications to mass and energy balance problems in engineering. Standard methods of solution of first and second order linear equations with constant coefficients. Numerical methods for solving ordinary differential equations. Partial differential equations. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Geological Engineering. Antireq: CIVE 222, MATH 218

Cross-listed as:

ENVE 223

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

GEOE 224 (0.50) LEC, TST, TUT Probability and Statistics

Role of probability in engineering and decision-making under uncertainty. Basic probability concepts. Probability distributions. Functions of random variables. Data analysis. Confidence intervals and hypothesis testing. Introduction to regression analysis. Introduction to design of experiments and statistical quality control.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: MATH 116; Level at least 2A Geological Engineering. Antireq: CHE 220, CIVE 224

Cross-listed as:

ENVE 224

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

GEOE 280 (0.50) LAB, LEC, TST, TUT Fluid Mechanics

An introduction to fluid mechanics. Fluid properties. Review of fluid statics. Buoyancy. Bernoulli equation. The momentum equation and applications. Laminar and turbulent flow. Dimensionless numbers. Closed conduit flow including friction losses. Pipe network analysis including energy losses and efficiencies. Four lab sessions.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: CIVE 105; Level at least 2A Geological Engineering. Antireq: CIVE 280

ENVE 280

Cross-listed as:

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

GEOE 298 (0.00) SEM

Seminar

General seminar. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 299 (0.00) SEM

Seminar

General seminar. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 2B Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 353 (0.50) LAB, LEC, TST, TUT Geotechnical Engineering 1

An introduction to geologic processes. Subsurface exploration. Classification systems. Weight-volume relationships. Soil mechanics principles including state of stress, ground water flow, consolidation and shear strength. Four lab sessions.

[Offered as: CIVE 353 (W), GEOE 353 (S)]

No Special Consent Required

Requisites :

Prereq: GEOE 153 or ENVE 153 or (EARTH 121, 121L); (Level at least 3A Environmental or Geological Engineering) or (Level at least 3A Earth Science/Hydrogeology Specialization)

Cross-listed as:

CIVE 353

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

GEOE 391 (0.50) LEC, TST, TUT Law and Ethics for Environmental and Geological Engineers  
Philosophy of environmental controls; introduction to national and international regulatory structures relevant to industrial planning, emissions control, environmental impact assessment, occupational health; stance of government, industry and community pressure groups. Contract law. Professional ethics, including the social responsibility of engineers, conflicts of interest. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: 4B Geological Engineering  
Cross-listed as: ENVE 391

**Effective 01-SEP-2024**

Rationale : Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

GEOE 392 (0.50) LEC, TST, TUT Economics and Life Cycle Cost Analysis  
Project financing, life-cycle cost analysis, time value of money, sensitivity analyses, tax, financial implications of infrastructure projects, quantitative decision-making, financial aspects of a business plan. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: MATH 116; Level at least 3A Geological Engineering. Antireq: MSCI 261, SYDE 262  
Cross-listed as: CIVE 392 ENVE 392 AE 392

**Effective 01-SEP-2024**

Rationale : Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

**Current Catalog Information**

GEOE 398 (0.00) SEM Seminar  
General seminar. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: 3A Geological Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students

consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 399 (0.00) SEM Seminar  
General seminar. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: 3B Geological Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 400 (0.50) LEC, PRJ Geological Engineering Design Project 1  
Students undertake an independent geological engineering design project during the last two terms of their plan. The purpose of the project is to demonstrate students' abilities to practise in a geological engineering capacity in their chosen area of expertise, using knowledge gained from their academic and employment experiences. The first part of the project (GEOE 400) will include problem identification, generation and selection of solutions, and time management. Incorporation of technical, ecological, social, political, and economic issues in the solution for the project will be required. A basic requirement of the proposed solution is that it must be compatible with the principles of sustainability. Requirements include proposal, progress report, and a final report containing recommendations for part two of the project, GENE 401. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: 4A Geological Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 401 (0.50) PRJ Geological Engineering Design Project 2  
A continuation of GEOE 400. The final design of the major geological engineering project proposed in GEOE 400 will be undertaken. The purpose of this phase of the project is to carry out a detailed technical design of the solution proposed in GEOE 400. Requirements of this part of the two-term project include a symposium presentation and a final report. [Offered: W]  
No Special Consent Required

Requisites :  
**Effective 01-SEP-2024**

Prereq: 4B Geological Engineering

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 498 (0.00) SEM Seminar

General seminar. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 4A Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GEOE 499 (0.00) SEM Seminar

General seminar. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

## Electrical & Computer Engineering

### Current Catalog Information

ECE 105 (0.50) LAB, LEC, TUT Classical Mechanics

Forces in nature and Newton's laws, dynamics and circular motion, work, energy, and conservation of energy. Linear momentum and linear impulse, rotational dynamics.

Oscillations; simple harmonic motion. Wave motion; traveling waves and standing waves. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1A Computer Engineering or Electrical Engineering or Software Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding

department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 124 (0.50) LAB, LEC, TUT Digital Circuits and Systems

Number systems and Boolean arithmetic. Boolean algebra and simplification of Boolean functions. Combinational circuits. Sequential circuits; design and implementation. Hardware description languages. Timing analysis. Implementation technologies.

[Offered: W,S]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Computer Engineering, Electrical Engineering, Software Engineering or Computer Science/Digital Hardware Specialization

### Effective 02-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 140 (0.50) LAB, LEC, TUT Linear Circuits

Analysis of linear circuits. Voltage, current, resistance, capacitance, inductance, voltage source, current source, dependent sources, Ohm's Law, Kirchhoff's Laws, nodal analysis, mesh analysis, circuit transformations, operational amplifier circuits, time response, sinusoidal steady-state response. Preparing for, conducting, and reporting of laboratory experiments. [Offered: W,S]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Computer Engineering or Electrical Engineering or Software Engineering. Antireq: AE/CIVE/ENVE/GEOE 123, GENE 123, ME 123, MTE 120, NE 140

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 150 (0.50) LAB, LEC, TUT Fundamentals of Programming

Software design process in a high-level programming environment. Programming fundamentals, language syntax, simple data types, control constructs, functions, parameter passing, recursion, classes, arrays and lists, list traversals, introduction to searching and sorting algorithms, basic object-oriented design, polymorphism and inheritance, simple testing and debugging strategies, pointers and

references, basic memory management. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1A Computer Engineering or Electrical Engineering.  
Antireq: CIVE 121, MTE 121/GENE 121, NE 113, SYDE 121

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 190 (0.25 ) LEC Engineering Profession and Practice

Introduction to electrical and computer engineering with an emphasis on the profession of engineering, and engineering design. Topics include engineering design, safety, risk analysis, engineering data analysis, project management, sustainability, business, entrepreneurship, and intellectual property. Additional topics include co-op fundamentals for engineering students, professional development, and diversity training with a goal of understanding the roles and responsibilities of the professional engineer in society. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 1A Computer Engineering or Electrical Engineering.  
Antireq: ECE 100A

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 198 (0.25 ) LAB Project Studio

A design project integrating content from physics, math, and programming courses. Topics include engineering design process, problem definition, risk analysis, design specification, system modelling and analysis, engineering data analysis, project management, and prototyping. Students work in teams to build and test a prototype. Safety orientation training including WHMIS assessment, is included in this course. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level 1A Computer Engineering or Electrical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.



### Current Catalog Information

ECE 203 (0.50) LEC, TUT Probability Theory and Statistics 1

Ensemble model of randomness. Conditional probability, independence, and Bayes' theorem. Random variables, probability distribution functions. Expected values. Collections of random variables, joint and marginal probability distributions, and correlation. Introduction to random processes. [Offered: F, S]

No Special Consent Required

Requisites : Prereq: ECE 108, (ECE 205 or MATH 211), MATH 119; Level at least 2B Computer or Electrical Engineering. Antireq: ECE 306, 316

### Effective 02-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 204 (0.50) LAB, LEC, TUT Numerical Methods

Application of computational methods to engineering problems. Number systems, errors and error propagation. Roots of nonlinear equations. Introduction to numerical linear algebra. Interpolation and numerical integration. Introduction to numerical solutions of ordinary differential equations, optimization. Emphasis will be placed on algorithm development. [Offered: F, W]

No Special Consent Required

Requisites : Prereq: Level at least 2A Computer Engineering or Electrical Engineering. Antireq: AMATH 342, CS 370, 371, ECE 204A, 204B, MTE 204

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 222 (0.50) LAB, LEC, TUT Digital Computers

Computer organization. Memory units, control units, I/O operations. Assembly language programming, translation and loading. Arithmetic logic units. Computer case studies. [Offered: F, W]

No Special Consent Required

Requisites : Prereq: (One of BME 393, ECE 124, MTE 262, SYDE 192), (One of BME 121, CS 115, 135, 137, 145, ECE 150, MTE 121/GENE 121, MSC1 211, SYDE 121); Level at least 2A BASc/BSE or Computer Science/Digital Hardware Specialization

### Effective 02-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding

department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 231 (0.50) LAB, LEC, TUT Semiconductor Physics and Devices

Introduction to the physical principles and electrical behavior of semiconductor materials and devices; electronic band structure, charge carriers, doping, carrier transport, pn-junctions, metal-oxide-semiconductor capacitors, transistors, and bipolar junction devices. [Offered: F,S]

No Special Consent Required

Requisites : Prereq: ECE 106, 109; Level at least 2B Computer Engineering or Electrical Engineering. Antireq: NE 242

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 240 (0.50) LAB, LEC, TUT Electronic Circuits 1

Introduction to electronic signal processing; second-order circuits; operational amplifier circuits; diode device and circuits; metal-oxide-semiconductor (MOS) biasing networks; load-line analysis; diode and MOS small-signal equivalent circuits; single-stage small-signal MOS amplifiers; complementary metal-oxide-semiconductor (CMOS) logic circuits. [Offered: F, W]

No Special Consent Required

Requisites : Prereq: ECE 106, 140, MATH 119; Level at least 2A Computer Engineering or Electrical Engineering or Software Engineering. Coreq: (ECE 205 or MATH 211 or MATH 213)

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 252 (0.50) LAB, LEC, TUT Systems Programming and Concurrency

Processes and threads (pthreads); system calls; concurrency (semaphore, mutex, monitors, and barrier synchronization); user-level memory management. Performance and correctness of concurrent systems. Deadlock detection and recovery; file systems. [Offered: F, S]

No Special Consent Required

Requisites : Prereq: One of BME 122, ECE 250, MSCI 240, MTE 140, SYDE 223); Level at least 2B BAsC/BSE. Antireq: CS 343, 350, SE 350

**Effective 02-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 318 (0.50 ) LAB, LEC, TUT Communication Systems

Introduction to random processes, power spectral density. Thermal noise and the white noise model. Amplitude and angle modulation, generation and detection schemes. Sampling and reconstruction, quantization. Digital baseband transmission. Overview of digital passband communications. [Offered: W, S]

No Special Consent Required

Requisites : Prereq: ECE 203, 207, (ECE 205 or MATH 211); Level at least 3A Computer Engineering or Electrical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 327 (0.50 ) LAB, LEC, TST, TUT Digital Hardware Systems

Design and modelling of digital hardware systems using a hardware description language. Development process. Impact of implementation technologies. Performance analysis and optimization. Functional verification. Timing analysis. Power analysis and optimization. Faults and testability. Reliability and fault tolerance.[Offered: W, S]

No Special Consent Required

Requisites : Prereq: (ECE 222 or MTE 241); (ECE 124 or MTE 262) or (SYDE 192 and SYDE 192L); Level at least 3A BAsC/BSE or Computer Science/Digital Hardware Specialization

**Effective 02-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 340 (0.50 ) LAB, LEC, TUT Electronic Circuits 2

Electronic circuits and their limitations including, metal-oxide-semiconductor (MOS) and bipolar junction transistor (BJT) differential pairs, biasing, the cascode configuration and active loads. Differential and multistage amplifiers. Feedback, stability, and compensation. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Computer Engineering or Electrical Engineering.  
Antireq: ECE 242, NE 344

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 350 (0.50) LAB, LEC, TUT Real-Time Operating Systems  
Memory and virtual memory and caching; I/O devices, drivers, and permanent storage management; process scheduling; queue management in the kernel; real-time kernel development. Aspects of multi-core operating systems. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: ECE 252; Level at least 3A BAsC/BSE. Antireq: CS 350, SE 350

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 401 (0.00) SEM Information Session

Scheduled, non-credit session to provide information to electrical and computer engineering students. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 4A Computer Engineering or Electrical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 402 (0.00) SEM Information Session

Scheduled, non-credit session to provide information to electrical and computer engineering students. [Offered: W]

No Special Consent Required

Requisites :

**Effective 01-SEP-2024**

Rationale :

Prereq: Level at least 4B Computer Engineering or Electrical Engineering

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ECE 405A (0.50) LEC, TUT Quantum Information Processing Devices

This course introduces physical implementations of quantum computers with an emphasis on common and connecting themes. The course topics include the review of quantum mechanics, criteria to build quantum computers, quantum circuit models, and four quantum hardware platforms (nuclear magnetic resonance, optical photons, trapped ions, and superconducting systems) in terms of qubit definition, universal gate sets, initialization, measurement strategies, and decoherence processes.

No Special Consent Required

Requisites :

Prereq: One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, PHYS 234.

Antireq: PHYS 468

**Effective 02-SEP-2024**

Requisite Change :

Prereq: (One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, or PHYS 234) and Quantum Engineering Option or Quantum Engineering Specialization students.

Antireq: PHYS 468

Rationale :

The ECE 405 A/B/C/D courses are intended for Quantum Engineering Option and Quantum Engineering Specialization students. The Quantum Engineering Specialization was approved at the Nov. 2023 SUC meeting, and the Quantum Engineering Option is pending approval at the Feb. 2024 SUC meeting. Thus, these plans are being added as requisites for these courses.

### Current Catalog Information

ECE 405B (0.50) LAB, LEC, TUT Fundamentals of Experimental Quantum Information

This course introduces basic experimental tools and techniques on which the main quantum computing platforms are based. The course topics will be covered through lectures and through hands-on lab experiments and will include photon generation and detection; Rabi oscillations, coherence, and NMR; atom cooling and ion traps; low temperature physics; and Bell inequalities and two-qubit quantum tomography.

No Special Consent Required

Requisites :

Prereq: One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, PHYS 234.

Antireq: PHYS 468

**Effective 02-SEP-2024**

Requisite Change :

Prereq: (One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, or PHYS 234) and Quantum Engineering Option or Quantum Engineering Specialization students.

Rationale : Antireq: PHYS 468  
The ECE 405 A/B/C/D courses are intended for Quantum Engineering Option and Quantum Engineering Specialization students. The Quantum Engineering Specialization was approved at the Nov. 2023 SUC meeting, and the Quantum Engineering Option is pending approval at the Feb. 2024 SUC meeting. Thus, these plans are being added as prerequisites for these courses.

### Current Catalog Information

ECE 405C (0.50) LEC, TUT Programming of Quantum Computing Algorithms

The course will teach basic elements to create quantum circuits in quantum computers: qubits, single-qubit gates, two-qubit gates, quantum operators, and measurements. A quantum programming language (one of three: Qiskit, q#, Pennylane) is used to implement representative quantum circuits in quantum simulators or real quantum computers through a cloud service such as IBM Q experience or Microsoft Azure or Xanadu.

No Special Consent Required

Requisites : Prereq: One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, PHYS 234.  
Antireq: PHYS 468

### Effective 02-SEP-2024

Requisite Change : Prereq: (One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, or PHYS 234) and Quantum Engineering Option or Quantum Engineering Specialization students.  
Antireq: PHYS 468

Rationale : The ECE 405 A/B/C/D courses are intended for Quantum Engineering Option and Quantum Engineering Specialization students. The Quantum Engineering Specialization was approved at the Nov. 2023 SUC meeting, and the Quantum Engineering Option is pending approval at the Feb. 2024 SUC meeting. Thus, these plans are being added as prerequisites for these courses.

### Current Catalog Information

ECE 405D (0.50) LEC, TUT Superconducting Quantum Circuits

This course offers applications of superconductivity in quantum information devices and circuits at microwave frequencies. Introducing the basic physics of superconductivity, superconducting transmission lines and cavity resonators are presented as the elementary passive components in quantum circuits. Josephson junctions as an active element in superconducting electronics is introduced and it is shown how a qubit can be constructed based on various two-level system manipulated in Josephson junctions. Three superconducting qubit archetypes, i.e. charge, flux and phase, are introduced along with some hybrid qubits such as transmon and fluxonium. Single qubit operation and qubit coupling in the form of circuit cavity electrodynamics and their associated qubit readout are discussed. Some existing quantum computers such as IBM Q System One and Google Sycamore are briefly introduced.

No Special Consent Required

Requisites : Prereq: One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, PHYS 234.  
Antireq: PHYS 468

**Effective 02-SEP-2024**

Requisite Change :

Prereq: (One of AMATH 373, CHEM 356, ECE 305, NE 332, PHYS 233, or PHYS 234) and Quantum Engineering Option or Quantum Engineering Specialization students.

Antireq: PHYS 468

Rationale :

The ECE 405 A/B/C/D courses are intended for Quantum Engineering Option and Quantum Engineering Specialization students. The Quantum Engineering Specialization was approved at the Nov. 2023 SUC meeting, and the Quantum Engineering Option is pending approval at the Feb. 2024 SUC meeting. Thus, these plans are being added as requisites for these courses.

**Current Catalog Information**

ECE 498A (0.50) PRJ, SEM Engineering Design Project

Team-oriented design-project which comprises a significant design experience based on the knowledge and skills acquired by students in previous courses and on co-operative work terms. Development of the design specification and plan documents, followed by the initial design work. [Offered: F, W, S]

No Special Consent Required

Requisites :

Prereq: Level at least 4A Computer Engineering or Electrical Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ECE 498B (0.50) PRJ, SEM Engineering Design Project

Completion of the design cycle started in ECE 498A and communication of the engineering design work. Submission of a written final report. Lecture-style technical presentation by group members. Poster-style technical presentation with group members available to discuss the project. [Offered: F, W, S]

No Special Consent Required

Requisites :

Prereq: ECE 498A; Level at least 4B Computer Engineering or Electrical Engineering.

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Dean of Engineering**

**Current Catalog Information**



BME 101 (0.25) LEC, TUT Communications in Biomedical Engineering-Written and Oral

This course introduces first-year students to biomedical engineering with a focus on the engineering profession and technical communication skills. Through in-class and independent activities leading to formative and summative assessments, students will consider and reflect on communication intention, audience, content, medium, format, and tone to demonstrate and improve upon their listening, written and oral communication skills for academic, engineering, and professional context. [Offered: F]

No Special Consent Required

Requisites : Prereq: 1A Biomedical Engineering. Antireq: SYDE 101

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 101L (0.25) LAB, LEC Communications in Biomedical Engineering-Visualization

This laboratory course introduces students to visual communication methods relevant to engineering analysis and design. Through in-class and independent activities leading to formative and summative assessments, students will consider and reflect on communication intention, audience, content, medium, format, and level of detail to demonstrate and improve upon their skills in graphing, freehand sketching, technical drawing, and computer-aided design (CAD). [Offered: F]

No Special Consent Required

Requisites : Prereq: 1A Biomedical Engineering. Antireq: SYDE 101L

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 102 (0.00) SEM Seminar

Biomedical engineering first-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: W]

No Special Consent Required

Requisites : Prereq: 1B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students



consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 121 (0.50) LAB, LEC, TUT Digital Computation

The key skills necessary to develop software solutions to solve biomedical engineering problems. Topics include software development, software design, programming language syntax, object oriented programming, structured programming, arrays, matrices, pointers, and algorithm efficiency. The topics will be reinforced in the context of practical biomedical software systems such as physiological monitoring systems and clinical support systems. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Biomedical Engineering. Antireq: SYDE 121

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 122 (0.50) LEC, TUT Data Structures and Algorithms

Topics of structured software design, data structures, abstract data types, recursive algorithms, algorithm and data structure analysis and design from both computational and memory perspectives, lists, stacks, queues, trees, graphs, sorting and searching, hashing, and problem-solving strategies. Embedded programming in health monitoring systems and healthcare management systems. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Biomedical Engineering. Antireq: SYDE 223

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 161 (0.50) LEC, TUT Introduction to Biomedical Design

Topics related to biomedical design will be covered: multidisciplinary system design, design process, problem definition, life-cycle design, design specification, function analysis, design evaluation and decision-making, introduction to mechanical design, prototyping, experimentation, safety and responsibility in engineering design, design for society and environment, and design documentation. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Biomedical Engineering. Antireq: SYDE 161

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 162 (0.50) LEC, TUT Human Factors in the Design of Biomedical and Health Systems

Design of human-machine environments, designing for patient safety and reduce human error in decision-making, analytical methods of determining user needs, information processing and human sensory processes and consideration of these elements in the design of systems with humans, and consideration of human physical capabilities in ergonomic design. Topics will be reinforced in the context of the design of prosthetics or rehabilitation devices. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Biomedical Engineering. Antireq: SYDE 162

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 181 (0.50) LEC, TUT Physics 1: Statics

Introduction to the basic theory and principles of mechanics of static systems.

Topics covered include statics of particles, rigid bodies and force systems, equilibrium of rigid bodies, analysis of joints and frames, distributed forces, centroids and moments of inertia, and friction. Applications of mechanical principles to musculoskeletal systems will be presented. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Biomedical Engineering. Antireq: SYDE 181

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 182 (0.50) LEC, TUT Physics 2: Dynamics

The science of motion is taught with initial focus on particles, and then progressing to planar rigid body systems. Concepts such as inertia, momentum, work, energy, Newton's laws, and contact dynamics are covered, with particular application to human

motions (e.g., walking, running, jumping, lifting, and throwing). [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Biomedical Engineering. Antireq: ME 212, SYDE 182

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 186 (0.50) LEC, TUT Chemistry Principles

The stoichiometry of compounds and chemical reactions. Periodicity and chemical bonding. Energy changes in chemical systems. Electronic structure of atoms and molecules, correlation with the chemical reactivity of common elements, inorganic and organic compounds. Discussion of the structure, nomenclature and reactions of important classes of organic compounds. Stereochemistry and its role in reaction mechanisms. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 201 (0.00) SEM Seminar

Biomedical engineering second-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 2A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 202 (0.00) SEM Seminar

Biomedical engineering second-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual

difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 2B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 213 (0.50 ) LEC, TUT Statistics and Experimental Design

Fundamentals of probability and statistics, and applications to biomedical engineering. Random variables and statistical distributions, statistical estimation, hypothesis testing, regression, and experiment design considerations. Applications to biomedical experiments, biomedical imaging data, and clinical trials. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Biomedical Engineering. Antireq: BIOL 361, CHE 220, CIVE 224, ENVE 224, KIN 222, MSC1 252, ME 202, MTE 201, NE 215, PSYCH 292, STAT 202, 206, 211, SYDE 212

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 252 (0.50 ) LEC, TUT Linear Systems and Signals

Models and analysis of linear systems in the context of measurement and processing of biosignals such as electroencephalography (EEG), electrocardiography (ECG), and electromyography (EMG). Discrete and continuous time systems, difference and differential equations, impulse and frequency response, transform domain techniques, transfer functions and frequency response, frequency domain analysis of linear systems, sampling theory, stability, and linear filters. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Biomedical Engineering. Antireq: SYDE 252

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 261 (0.50) LEC, TUT Prototyping, Simulation and Design  
Problem-solving approaches, agile design and development, rapid prototyping, revision control, design patterns, development cycles, and simulation. Topics will be reinforced in the context of biomedical engineering projects conducted in groups within a collaborative environment. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: Level at least 2B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 281 (0.50) LEC, TUT Mechanics of Deformable Solids  
Introduction to mechanical response of materials and stress-strain relationship. Behaviour of prismatic members in tension, compression, shear, bending, and torsion. Shear-force and bending-moment diagrams. Introduction to instability. Mechanical properties of biological tissues, and viscoelastic models. Applications to bone, cartilage, and biomedical implants. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: Level at least 2A Biomedical Engineering. Antireq: CIVE 204, ME 219, SYDE 286

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 281L (0.25) LAB Mechanics of Deformable Solids Laboratory  
Laboratory experiments for students taking BME 281. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: Level at least 2A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 282 (0.50) LEC, TUT Materials Science for Biomedical Engineers

Crystalline structure, crystal defects, non-crystalline materials, structure and properties of metals, ceramics, glasses, semi-conductors, polymers, and composites. Factors in materials design, material selection and processing in the context of biomedical devices and instruments will also be discussed. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Biomedical Engineering. Antireq: SYDE 285

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 284 (0.50) LEC, TUT Physiological and Biological Systems

The structure, functions, and properties of the major biological systems (musculoskeletal, nervous, cardiovascular) will be presented in relation to the design of biomedical devices (imaging, assistive, and diagnostic). Concepts in modeling biological systems will be introduced. Various aspects of pathology and how they influence medical device design will also be discussed. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Biomedical Engineering. Antireq: SYDE 384/584

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 284L (0.25) LAB Physiology and Anatomy Laboratory

Laboratory experiments for students taking BME 284. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 285 (0.50) LEC, TUT Engineering Biology

Introduction to basic concepts of biochemistry and cell biology. Overview of the chemistry of amino acids, carbohydrates, lipids and nucleic acid. Structure and

properties of proteins and enzymes. Elements of cell structure and diversity, and relationship of biochemistry with cell metabolism. A focus on biomedical engineering with relevant examples such as biomimetic engineering design, system biology, and tissue engineering. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 285L (0.25 ) LAB Engineering Biology Laboratory

Laboratory experiments for students taking BME 285. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 294 (0.50 ) LEC, TUT Circuits, Instrumentation, and Measurements

Basic concepts of hardware measurement systems pertaining to the measurement of biosignals: active and passive circuit elements, Kirchhoff's laws, mesh and nodal circuit analysis, principle of superposition, step responses of first and second order networks, sinusoidal steady state analysis, input-output relationships, transfer functions and frequency response of linear systems, operational amplifiers, analog signal detection, conditioning and conversion systems, transducers, difference and instrumentation amplifiers, A/D and D/A conversion. Examples will be presented in the form of physiological monitoring hardware for vital measurements such as electroencephalography (EEG), electrocardiography (ECG), and electromyography (EMG).

[Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Biomedical Engineering. Antireq: BME 392, SYDE 292

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 294L (0.25) LAB Circuits, Instrumentation, and Measurements Laboratory  
Laboratory experiments for students taking BME 294. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: Level at least 2B Biomedical Engineering. Antireq: BME 392L, SYDE 292L

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 301 (0.00) SEM Seminar  
Biomedical engineering third-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: 3A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 302 (0.00) SEM Seminar  
Biomedical engineering third-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: 3B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**



BME 355 (0.50) LEC, TUT Physiological Systems Modelling

Introduction to systems theory as a general modelling method, and applied to the skeletal, neuromuscular, central nervous, cardiovascular, and respiratory systems of the human body. Time-domain simulations, sensitivity analyses, and parameter identification, with the latter driven by experimental measurements of system performance. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 356 (0.50) LEC, TUT Control Systems

Classical and state space representations of control systems. Stability, controllability, observability, and sensitivity. Routh-Hurwitz and root-locus methods. Frequency domain behaviour, Bode plots, Nyquist stability criteria. Pole placement, PID, phase-lead and phase-lag controllers. Application to anatomical system models, including musculoskeletal and cardiovascular systems, and to physiological feedback systems. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Biomedical Engineering. Antireq: BME 353, SYDE 352

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 356L (0.25) LAB Control Systems Laboratory

Laboratory experiments for students taking BME 356. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Biomedical Engineering. Antireq: BME 353L, SYDE 352L

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 361 (0.50) LAB, LEC, TUT Biomedical Engineering Design

Design methods: problem definition, requirements analysis, criteria and generation of alternative solutions, feasibility analysis, and optimization. Product development.

Design survey of biomedical equipment and assistive technologies. A term-long design project in small groups. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Biomedical Engineering. Antireq: SYDE 361

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 362 (0.50) LAB, LEC Biomedical Engineering Design Workshop 1

Engineering design project course where students work in small groups applying the principles of engineering problem solving, systems analysis, simulation, optimization, and design to a biomedical engineering problem of their own choosing.

Lecture topics include project management, risk management, standards, regulatory clearance, and certification for biomedical devices. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Biomedical Engineering. Antireq: SYDE 362

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 364 (0.50) LEC, TUT Engineering Biomedical Economics

This course examines key economic issues in health care and biomedical industries.

Topics include the market for medical care, health insurance, various models of healthcare delivery and competition and the role of government in policy, financing and delivery of health care. This course will train students to use economic analysis to model and understand the complex interactions between health care delivery, insurance markets, health innovators, governments, and firms. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Biomedical Engineering. Antireq: SYDE 262

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students

consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 381 (0.50) LEC, TUT Biomedical Engineering Ethics

This course explores ethical issues in biomedical engineering practice, including professional ethics, medical ethics, the ethics of human and animal subject use in biomedical research, and the impact of biomedical engineering solutions on society and the environment. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 384 (0.50) LEC, TUT Biomedical Transport: Biofluids and Mass Transfer

Fundamental concepts in systems involving fluid flow. Basic treatment of statics, kinematics, and dynamics of fluids. Mass transfer, conservation of mass, momentum and energy for a control volume. Dimensional analysis and similarity. Discussion of flow in pipes and channels and brief introduction to boundary layers, lift and drag, ideal and compressible flow will be specifically covered in the context of the cardiovascular system (macrocirculation and microcirculation). [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Biomedical Engineering. Antireq: SYDE 381, 383

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 386 (0.50) LEC, TUT The Physics of Medical Imaging

The fundamental laws of electricity, magnetism, and optics will be taught through the introduction to basic concepts of medical imaging: radiation for imaging, x-ray, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound or sonography imaging, electric impedance tomography, confocal microscopy, fluoroscopy. Radionuclide imaging: Single photon emission computed tomography (SPECT), and positron emission computed tomography (PET). Emerging technologies: elastography, tHz imaging, molecular imaging will also be discussed. [Offered: F]

No Special Consent Required

Requisites :  
**Effective 01-SEP-2024**

Prereq: Level at least 3B Biomedical Engineering. Antireq: SYDE 283

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 393 (0.50) LEC, TUT Digital Systems

Digital technology, combinatorial logic, binary arithmetic, sequential circuits, digital design, and microcontrollers. Topics will be reinforced in the context of biomedical microcontrollers and sensors used in physiological monitoring and clinical support systems. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Biomedical Engineering. Antireq: BME 292, SYDE 192

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 393L (0.25) LAB Digital Systems Laboratory

Laboratory experiments for students taking BME 393, focusing on circuit construction, simulation, and design. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Biomedical Engineering. Antireq: BME 292L, SYDE 192L

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 400 (0.13) PRJ, SEM Symposium Poster

A work-term poster is composed and presented at the symposium. The poster and presentation provide an opportunity for students to effectively communicate and reflect on their engineering experience gained during their co-op work terms. In the poster and presentation, students draw connections between the theoretical aspects of engineering taught in the classroom and the practical applications of that theory in

the workplace. [Offered: F, first Offered: Fall 2025]. Note: this course is considered as DRNA

No Special Consent Required

Requisites : Prereq: PD11; Level at least 4A Biomedical Engineering. Antireq: WKRPT 400, 401

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 401 (0.00) SEM Seminar

Biomedical engineering fourth-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: F]

No Special Consent Required

Requisites : Prereq: 4A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 402 (0.00) SEM Seminar

Biomedical engineering fourth-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work, and engineering practice will be discussed. Non-credit course. [Offered: W]

No Special Consent Required

Requisites : Prereq: 4B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

BME 411 (0.50) LEC, TUT Optimization and Numerical Methods

Interpolation and curve fitting, root-finding methods, local and global optimization methods, constrained optimization, multiobjective and multidisciplinary design

optimization for biomedical applications. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 4A Biomedical Engineering. Antireq: SYDE 411

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 461 (0.50) LAB, LEC Biomedical Engineering Design Workshop 2

The first half of a two-term engineering design project continuing the biomedical design workshop sequence. A prototype and interim progress report are presented at the end of the first term. Lecture topics include safety and risk analysis of biomedical technologies. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 4A Biomedical Engineering. Antireq: SYDE 461

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

BME 462 (0.50) LAB, LEC Biomedical Engineering Design Workshop 3

The concluding half of the fourth-year Biomedical Engineering Design Workshop.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Biomedical Engineering. Antireq: SYDE 462

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

(0.00)

**Effective 02-SEP-2024**

Title Change:

Biomaterials and Tissue Engineering

Description Change:

The course provides an overview of the recent advances in medicine and nano-technologies for development of tissue engineering and regenerative

medicine. Strategies and technologies for designing, testing, and manufacturing of biomaterials and tissue-engineering products will be introduced. The biological and clinical applications will be discussed. The unmet medical needs, challenges in manufacturing, regulatory approval and commercialization for tissue engineering applications will also be discussed.

Requisite Change :

Prereq: Level at least 3A Biomedical Engineering students or SYDE584 or NE481

New Cross Listing :

Antireq: BME 589 (Topic 4: Biomaterials & Biomedical Design)  
CHE 561 NE 488

Rationale :

A new BME cross-listing is being added to this course to replace a previous BME special topics offering. This will help increase clarity for students when selecting required courses for BME specializations. The title and description have also been updated to better represent what is currently taught in the course. Anti-requisites are updated to include the previous BME special topics course. All three areas are in agreement with the changes. Short title: Biomaterials & Tissue Eng

### Current Catalog Information

ENVE 100 (0.80 ) LAB, LEC, TST, TUT Environmental and Geological Engineering Concepts

An introduction to the fundamental methods, principles and skills of environmental and geological engineering. Fundamentals of technical communication, the engineering design process and problem solving. Completion of a pre-design study and report for an environmental engineering project. Independent and team work. Fundamentals of engineering computation units, data collection, measurement, and error analysis. Field surveying (automatic level, engineer's transit, differential global positioning system (GPS), total station). Laboratory on engineering graphics auto-computer assisted diagnosis (AutoCAD) and computational software (Excel, Matlab). Aspects of the engineering profession (code of ethics, negligence, misconduct, role of the Professional Engineers Ontario (PEO), etc.), diversity in the workplace, and professional development. Preparation for the University of Waterloo co-operative education program (Co-operative Education and Career Action (CECA), résumé writing, job search and interview skills). [Offered: F]

No Special Consent Required

Requisites : Prereq: 1A Environmental Engineering

Cross-listed as: GEOE 100

### Effective 01-SEP-2024

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 115 (0.25 ) LEC, TUT Linear Algebra

Linear systems of equations, matrices and determinants. Introduction to the eigenvalue problem. Applications. [Offered: F]



No Special Consent Required

Requisites :

Prereq: Level at least 1A Environmental Engineering. Antireq: MATH 106, 114, 115, 136, 146

Cross-listed as:

CIVE 115 GEOE 115

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 223 (0.50) LEC, TST, TUT Differential Equations and Balance Laws

An introduction to ordinary differential equations with applications to mass and energy balance problems in engineering. Standard methods of solution of first and second order linear equations with constant coefficients. Numerical methods for solving ordinary differential equations. Partial differential equations. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Environmental Engineering. Antireq: CIVE 222, MATH 218

Cross-listed as:

GEOE 223

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 224 (0.50) LEC, TST, TUT Probability and Statistics

Role of probability in engineering and decision-making under uncertainty. Basic probability concepts. Probability distributions. Functions of random variables. Data analysis. Confidence intervals and hypothesis testing. Introduction to regression analysis. Introduction to design of experiments and statistical quality control. [Offered: W]

[Offered: W]

No Special Consent Required

Requisites :

Prereq: MATH 116; Level at least 2B Environmental Engineering. Antireq: CHE 220, CIVE 224

Cross-listed as:

GEOE 224

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 225 (0.75) LEC, TST, TUT Environmental Modelling

Modelling of environmental engineering processes via the solution of differential



equations. Mass transfer processes in continuum and discrete systems, with applications to natural and engineered systems. Reactor theory. Understanding initial and boundary conditions. Classical and numerical solution techniques for solving differential equations. Volume and surface integration. Reynolds transport theorem.

[Offered: F]

No Special Consent Required

Requisites :

Prereq: ENVE 115, 223; 2B Environmental Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 275 (0.50 ) LAB, LEC, TST, TUT Environmental Chemistry

Overview of risk, biosphere compartments and contaminant fate. Composition of water.

Electroneutrality and activity. Reactions and speciation including reaction kinetics, mass transfer, vapor pressure, equilibrium, and chemical thermodynamics. Equilibrium chemistry including Log-concentration diagrams, titration and buffering intensity, dissolution/precipitation, carbonate system, hardness, and complex formation.

Classification, nomenclature, physical/chemical parameters and partitioning of organic compounds. Basic redox chemistry including: half cell reactions, Faraday and Nernst equations, and pE-pH diagrams. Four labs. [Offered: W]

No Special Consent Required

Requisites :

Prereq: CHE 102; 2A Environmental Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 277 (0.50 ) LEC, TST, TUT Air Quality Engineering

Quantitative introduction to indoor and outdoor air pollution sources, and major processes including emission rates, atmospheric dispersion, chemistry, and deposition. Air quality standards and regulations. Basic atmospheric science and meteorology to support the fate and transport of air pollutants. Overview of control and treatment methods. Indoor air exposure estimates and the function of the HVAC components. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Civil, Environmental or Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students

consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 279 (0.50) LEC, TST, TUT Energy and the Environment

Conservation of energy, energy balances on closed systems. Steady-state and transient heat transfer via convection, radiation, and conduction. Mechanical and electrical work. Internal energy, enthalpy, and specific heats of solids, liquids and gases. Phase change in natural environmental systems; The basics of heat engines, refrigerators, and heat pumps. Function, evaluation, and design of energy resource technology: wind and hydroelectric turbines, photovoltaics, geothermal energy, biomass and biofuel, natural gas and petroleum extraction, and tidal energy. Renewable energy policy and implications. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Civil, Environmental, or Geological Engineering.

Antireq: CHE 330, ECE 309, ME 250, SYDE 381

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 280 (0.50) LAB, LEC, TST, TUT Fluid Mechanics

An introduction to fluid mechanics. Fluid properties. Review of fluid statics. Buoyancy. Bernoulli equation. The momentum equation and applications. Laminar and turbulent flow. Dimensionless numbers. Closed conduit flow including friction losses. Pipe network analysis including energy losses and efficiencies. Four lab sessions.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: CIVE 105; Level at least 2A Environmental Engineering. Antireq:

CIVE 280

GEOE 280

Cross-listed as:

### Effective 01-SEP-2024

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 298 (0.00) SEM Seminar

General Seminar. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 299 (0.00) SEM Seminar  
General Seminar. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: 2B Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 330 (0.50) LAB, LEC, TST, TUT Lab Analysis and Field Sampling Techniques  
An introduction to the fundamental concepts of physical and chemical measurement of the environment. Review of basic statistics, quality assurance and control, sources of error, seasonal effects, sample preservation. Practical and essential elements of water, soil and air sampling. Introduction to measurement techniques including: colorimetry, chromatography, spectroscopy, electrochemical probes, remote sensing. Design of monitoring strategies, and use of methods to assess validity of laboratory data. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: 3A Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 335 (0.50) LEC, TST, TUT Decision Making for Environmental Engineers  
Decision-making, optimization, and assessment of environmental and water resource systems, and the design process in environmental engineering. Multi-criteria decision-making methods for concept and embodiment engineering design phases. Risk-based system performance metrics and trend tests. Uncertainty estimation via First-Order Uncertainty Analysis and Monte Carlo Simulation. Formulation and solution of linear, integer, and nonlinear optimization models. Multi-objective optimization

methods. Sensitivity analysis for decision-making and descriptive (numerical) models.

[Offered: W]

No Special Consent Required

Requisites : Prereq: Level at least 3B Environmental Engineering. Antireq: CIVE 332, MSCI 331

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 375 (0.50 ) LAB, LEC, TST, TUT Physico-Chemical Processes

Fundamentals of coagulation, flocculation, clarification, sedimentation, filtration, adsorption, air stripping, membrane technologies, chemical reduction/oxidation, and disinfection processes with applications to natural and various engineered systems.

Quantitative analysis and design of processes and applications to the treatment of drinking water, wastewater, stormwater, groundwater and soils. [Offered: S]

No Special Consent Required

Requisites : Prereq: CHE 102, ENVE 280; 3A Environmental Engineering. Antireq: CIVE 375

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 376 (0.50 ) LAB, LEC, TST, TUT Biological Processes

Common microbial substrates and metabolisms in engineered and natural systems, kinetics of microbial growth, stoichiometry of nutrient uptake, continuous flow stirred tanks with/without recycle, aeration system design, applications to wastewater treatment, solid waste management, groundwater, and soil remediation.

[Offered: W]

No Special Consent Required

Requisites : Prereq: (Level at least 3B Chemical Engineering) or (CIVE 375; Level at least 4A Civil Engineering) or (ENVE 375; Level at least 3B Environmental Engineering)

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 382 (0.50) LAB, LEC, TST, TUT Hydrology and Open Channel Flow

Introduction to the water cycle, flood frequency analysis, design storms. Analysis of hydrographs and rainfall-runoff response mechanisms in urban and natural systems. Mass continuity and water budgets at the watershed scale. Impact of land use change on hydrologic response. Quantification of open channel flow; subcritical and supercritical flow regimes. Dynamic forces on submerged structures and low/scour beneath bridges. [Offered as: CIVE 382 (W), ENVE 382 (F,W)]

No Special Consent Required

Requisites :

Prereq: CIVE 105, (ENVE or GEOE 224), (ENVE or GEOE 280); Level at least 2B Environmental or 3B Geological Engineering  
CIVE 382

Cross-listed as:

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 383 (0.50) LAB, LEC, TST, TUT Advanced Hydrology and Hydraulics

Physical and mathematical models of hydrological processes at the landscape scale, and hydraulic phenomena in channels. Advanced models of evapotranspiration and snow energy balances. Hydrologic modelling: parameterization, boundary conditions, calibration. Simulation of energy losses, backwater effects, and gradually varying flow profiles in open channels. Sediment transport, scour, and erosion. [Offered: W]

No Special Consent Required

Requisites :

Prereq: CIVE 382 or ENVE 382; Level at least 3B Civil, Environmental, or Geological Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 391 (0.50) LEC, TST, TUT Law and Ethics for Environmental and Geological Engineers

Philosophy of environmental controls; introduction to national and international regulatory structures relevant to industrial planning, emissions control, environmental impact assessment, occupational health; stance of government, industry and community pressure groups. Contract law. Professional ethics, including the social responsibility of engineers, conflicts of interest. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 3B Environmental Engineering

Cross-listed as:  
**Effective 01-SEP-2024**

GEOE 391

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 392 (0.50) LEC, TST, TUT Economics and Life Cycle Cost Analysis

Project financing, life-cycle cost analysis, time value of money, sensitivity analyses, tax, financial implications of infrastructure projects, quantitative decision-making, financial aspects of a business plan. [Offered: S]

No Special Consent Required

Requisites :

Prereq: MATH 116; Level at least 3A Environmental Engineering. Antireq: MSCI 261, SYDE 262

Cross-listed as:  
**Effective 01-SEP-2024**

CIVE 392 GEOE 392 AE 392

Rationale :

Adding department drop consent to all offerings of this course. The Faculty of Engineering wants to ensure students consult with the department before dropping a course that is required for their program and help keep them on track for meeting program requirements.

### Current Catalog Information

ENVE 398 (0.00) SEM Seminar

General seminar. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 3A Environmental Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 399 (0.00) SEM Seminar

General seminar. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 3B Environmental Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 400 (0.50) LEC, PRJ Environmental Engineering Design Project 1

Students undertake an independent environmental engineering design project during the last two terms of their plan. The purpose of the project is to demonstrate students' abilities to practise in an environmental engineering capacity in their chosen area of expertise, using knowledge gained from their academic and employment experiences. The first part of the project (ENVE 400) will include problem identification, generation and selection of solutions, and time management. Incorporation of technical, ecological, social, political, and economic issues in the solution for the project will be required. A basic requirement of the proposed solution is that it must be compatible with the principles of sustainability. Requirements include proposal, progress report, and a final report containing recommendations for part two of the project, ENVE 401. [Offered: F]

No Special Consent Required

Requisites : Prereq: 4A Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 401 (0.50) PRJ Environmental Engineering Design Project 2

A continuation of ENVE 400. The final design of the major environmental engineering project proposed in ENVE 400 will be undertaken. The purpose of this phase of the project is to carry out a detailed technical design of the solution proposed in ENVE 400. Requirements of this part of the two-term project include a symposium presentation and a final report. [Offered: W]

No Special Consent Required

Requisites : Prereq: 4B Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ENVE 498 (0.00) SEM Seminar

General seminar. [Offered: F]

No Special Consent Required

Requisites : Prereq: 4A Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ENVE 499 (0.00) SEM Seminar  
General seminar. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: 4B Environmental Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

GENE 119 (0.00) SEM Problems Seminar  
Students may be assigned to a Problems Seminar by the Director or Associate Director of First-Year Engineering or Software Engineering according to their performance during the term. [Offered: F,W,S]  
Department Consent Required

**Effective 01-SEP-2024**

Title Change: First-Year Engineering Seminar  
Description Change: Seminar series focusing on topics relating to success in Waterloo Engineering.  
Consent Change: No Special Consent Required  
Requisite Change : Prereq: Level 1A BASc/BSE students  
Rationale : The new title/description for GENE 119 better represents the course to students. Department add consent is being removed and a prerequisite is added to make adding the course easier for eligible students and reduce administrative load. Short title: First-Year Engineering Seminar

### Current Catalog Information

GENE 123 (0.50) LAB, LEC, TUT Electrical Circuits and Instrumentation  
Charge, current and voltage. Voltage and current sources, resistors, capacitors and inductors. Ohm's Law, Kirchhoff's Laws, nodal analysis, Thevenin and Norton models, instrumentation amplifier circuits, time response, impedance. Function and characteristics of basic electrical transducers. Resolution, precision and accuracy. Basics of data acquisition. [Note: Normally labs are held alternate weeks. Offered: W,S]  
No Special Consent Required  
Requisites : Prereq: Level at least 1B Chemical, Civil, Environmental, Geological,



**Effective 01-SEP-2024**

Description Change:

Management or Mechanical Engineering

Charge, current, and voltage. Voltage and current sources, resistors, capacitors, and inductors. Ohm's Law, Kirchhoff's Laws, nodal analysis, Thevenin and Norton models, instrumentation amplifier circuits, time response, impedance. Function and characteristics of basic electrical transducers. Resolution, precision, and accuracy. Basics of data acquisition.

Requisite Change :

Prereq: Level at least 1B Management Engineering

Rationale :

GENE 123 prerequisites will be changed to align with current plans that include this course. Editorial change to description.

**Current Catalog Information**

GENE 199 (0.50 ) LAB, LEC, TUT Special Topics in First-Year Engineering

Various courses dealing with selected topics related to success in Waterloo Engineering. These courses will be offered as needed.

Department Consent Required

**Effective 01-SEP-2024**

Description Change:

Special topics of relevance to engineering students in first year. Not offered regularly; inquire at the Engineering Undergraduate Office for information about current and future offerings.

Consent Change:

No Special Consent Required

Requisite Change :

Prereq: Level 1A or 1B BASc/BSE students

Rationale :

The current descriptions and requisites for GENE special topics courses (GENE 199, GENE 299, GENE 399, GENE 499) are updated to better represent the courses to students.

**Current Catalog Information**

GENE 299 (0.50 ) LEC, TUT Special Topics in Second-Year Engineering

Various courses dealing with selected topics of particular interest to second year engineering students. These courses will be offered as resources are available and the material is needed.

Department Consent Required

**Effective 01-SEP-2024**

Description Change:

Special topics of relevance to engineering students in second year. Not offered regularly; inquire at the Engineering Undergraduate Office for information about current and future offerings.

Consent Change:

No Special Consent Required

Requisite Change :

Prereq: Level 2A or 2B BASc/BSE students

Rationale :

The current descriptions and requisites for GENE special topics courses are updated to better represent the courses to students.

**Current Catalog Information**

GENE 399 (0.50 ) LEC, TUT Special Topics in Third-Year Engineering

Various courses dealing with selected topics of particular interest to third year engineering students. These courses will be offered as resources are available and

the material is needed.

Department Consent Required

**Effective 01-SEP-2024**

Description Change:

Special topics of relevance to engineering students in third year. Not offered regularly; inquire at the Engineering Undergraduate Office for information about current and future offerings.

Consent Change:

No Special Consent Required

Requisite Change :

Prereq: Level 3A or 3B BASc/BSE students

Rationale :

The current descriptions and requisites for GENE special topics courses are updated to better represent the courses to students.

**Current Catalog Information**

GENE 499 (0.50) LEC, TUT Special Topics in Fourth-Year Engineering

Various courses dealing with selected topics of particular interest to fourth year engineering students. These courses will be offered as resources are available and the material is needed.

Department Consent Required

**Effective 01-SEP-2024**

Description Change:

Special topics of relevance to engineering students in fourth year. Not offered regularly; inquire at the Engineering Undergraduate Office for information about current and future offerings.

Consent Change:

No Special Consent Required

Requisite Change :

Prereq: Level 4A or 4B BASc/BSE students

Rationale :

The current descriptions and requisites for GENE special topics courses are updated to better represent the courses to students.

**Current Catalog Information**

NE 100 (0.50) LAB, LEC, TST, TUT Introduction to Nanotechnology Engineering

An introduction to nanotechnology engineering and its various applications from electronics to biology. Basic concepts related to nanomaterials and devices, fabrication approaches, and characterization methods. Introduction to engineering iterative design, computer aided design (CAD) and modelling. Application of CAD methods in relevant nanotechnology engineering problems. Engineering report preparation skills. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level 1A Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 109 (0.50) LEC, TUT Societal and Environmental Impacts of Nanotechnology

Nanotechnology in society; health and environmental sustainability; introduction to

environmental life cycle assessments; engineering ethics, policies, and regulations; Canadian legal system, tort, and intellectual property; examples of nanotechnology innovation and commercialization. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level 1A Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 110 (0.50) LEC Introduction to Nanomaterials Health Risks

Nanomaterial impacts on worker, consumer, and environmental health. Engineered nanomaterials and ultrafines. Chemical risk assessment. Nanomaterial exposure characterization. Introductory nanotoxicology. Environmental chemical impacts, transport, and bio-accumulation. Introduction to UN Sustainable Development Goals. Human nanomaterial health risks and benefits. Introductory epidemiology, including study design, strength of association, bias, confounding, and causal inference.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 111 (0.25) LEC, TST Introduction to Programming for Engineers

Introduction to programming and numerical computing using a high-level interpreted programming language. Programming fundamentals, computer architecture, design and use of functions, strings and text input/output, relational operators, conditionals, lists, loops, designing algorithms, numerical computing, plotting, and file input/output. [Note: This course includes online components. Offered: F]

No Special Consent Required

Requisites :

Prereq: Level 1A Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 112 (0.50) LEC, TST, TUT Linear Algebra for Nanotechnology Engineers  
Matrices, operations on matrices. Determinants. Adjoints and inverses. Solution of linear equations: elimination and iterative methods. Eigenvalues and eigenvectors with engineering applications. Complex numbers. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: 1A Nanotechnology Engineering. Antireq: MATH 114, 115, 106, 136, 146, SYDE 114

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 121 (0.50) LEC, TST, TUT Chemical Principles  
Chemical reactions. Mass and charge balance. Introduction to the first, second, and third laws of thermodynamics. Chemical equilibrium. Applications of chemical equilibrium principles to proton-transfer reactions. Electronic structure of atoms and molecules. Periodicity and chemical bonding. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: Level 1A Nanotechnology Engineering. Antireq: CHE 102, CHEM 120, 123

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 131 (0.50) LEC, TST, TUT Physics for Nanotechnology Engineering  
A first course in physics that introduces basic topics in classical mechanics, wave mechanics, and physical optics. [Offered: W]  
No Special Consent Required  
Requisites : Prereq: MATH 117; Level at least 1B Nanotechnology Engineering. Antireq: BME 182, CIVE 104, ECE 105, PHYS 111, 115, 121, SYDE 182

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 140 (0.50) LAB, LEC, TUT Linear Circuits

Charge, current, and voltage. Resistance, Ohm's Law, Kirchhoff's voltage, and current laws. Nodal, mesh analysis, and source transformation. Superposition, Thévenin, and Norton equivalents. Capacitance, inductance, electrical energy dissipation, and first-order transient response circuits. Phasors, impedances, and alternating current (AC) steady state analysis. Ideal operational amplifier circuits. Frequency filter types, and active filter circuits' configuration. Introduction to the fundamentals of electronic waste recycling. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Nanotechnology Engineering. Antireq: AE 123, (BME 294 and BME 294L), CIVE 123, ECE 140, ENVE 123, GENE 123, GEOE 123, ME 123, MTE 120, SYDE 292

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 215 (0.50) LEC, TST, TUT Probability and Statistics

Elementary probability theory. Random variables and distributions. Binomial, Poisson, and normal distributions. Elementary sampling. Statistical estimation. Tests of hypotheses and significance. Regression. Goodness-of-fit tests. [Offered: F]

No Special Consent Required

Requisites :

Prereq: MATH 119, NE 112; Level at least 2A Nanotechnology Engineering. Antireq: CHE 220, CIVE 224, ME 202, STAT 202, 206, 220, 230, SYDE 213

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 216 (0.50) LAB, LEC, TST, TUT Advanced Calculus and Numerical Methods 1

Ordinary differential equations with constant coefficients. Boundary value problems and applications to quantum mechanics. Laplace and Fourier transforms, Fourier series and applications. Numerical solution of ordinary differential equations. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2A Nanotechnology Engineering Antireq: AMATH 350, MATH 218, 228

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 217 (0.50) LAB, LEC, TST, TUT Advanced Calculus and Numerical Methods 2  
Gradient, Divergence and Curl: Applications. Line and Surface Integrals. Green's, Gauss', and Stokes' Theorems: Applications to electromagnetism and fluid mechanics. Numerical solution of partial differential equations. [Offered: S]  
No Special Consent Required  
Requisites : Prereq: Level at least 2B Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 220L (0.25) LAB Materials Science and Engineering Laboratory  
Labs following the NE 125 Introduction to Materials Science and Engineering course. This laboratory course introduces students to techniques for the characterization of various materials, such as metals, polymers, ceramics, and composites. Experimental exercises will study the physical properties and characteristics of materials, including mechanical, thermal, electrical, and structural/morphological properties at different length scales. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: NE 125; 2A Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 222 (0.50) LAB, LEC, TST, TUT Organic Chemistry for Nanotechnology Engineers  
Nomenclature, stereochemistry and reactions of important classes of organic compounds. Reaction mechanisms and energetics. Aromaticity and simple molecular orbital theory of conjugated systems. Applications to nanomaterials and/or devices. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: Level at least 2A Nanotechnology Engineering. Antireq: (CHEM 262

and 262L), 264, (CHEM 266 and 266L)

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 225 (0.50 ) LEC, TUT Structure and Properties of Nanomaterials

Electronic orbitals in atoms, molecules and the solid state. Structures and properties of covalent and ionic solid nanoparticles including their catalytic, electrochemical, electrical, optical and magnetic properties. Semiconductors and carbon/silicon-based nanoparticles. Examples discussed include carbon nanoparticles, dendrimers, micelles, and quantum dots. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 226 (0.50 ) LEC, TUT Characterization of Materials

Materials structure analysis. Materials composition and chemical bonding analysis.

In-situ analysis and monitoring of fabrication process parameters. Materials properties characterization. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 241 (0.50 ) LAB, LEC, TUT Electromagnetism

Coulomb's law, electric field and electric flux, Gauss's law, electric potential, potential and field, magnetic field, Ampere's law, solenoid, electromagnetic induction, magnetic flux, Lenz' law, Faraday's law, capacitors and capacitance, inductors and inductance, Maxwell's equations, electromagnetic fields and waves, polarization. [Offered: F]

No Special Consent Required

Requisites : Prereq: Level at least 2A Nanotechnology Engineering. Antireq: ECE 106, MTE 120, SYDE 283

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 242 (0.50) LAB, LEC, TUT Semiconductor Physics and Devices

Introduction to the physical principles and electrical behaviour of semiconductor materials and devices: electronic band structure, charge carriers, doping, carrier transport, pn-junctions, metal-oxide-semiconductor capacitors, transistors, and related optoelectronic devices (photodetectors, light emitting diodes, solar cells).

[Offered: S]

No Special Consent Required

Requisites : Prereq: Level at least 2B Nanotechnology Engineering. Antireq: ECE 231

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 281 (0.50) LEC, TUT Biology for Nanotechnology Engineers

Introduction to cell biology. Cell structure and components. Critical molecular processes of living organisms. Applications to nanobiotechnology. [Offered: S, first offered without lab spring 2026]

No Special Consent Required

Requisites : Prereq: Level at least 2A Nanotechnology Engineering. Antireq: BIOL 130, CHE 161, BME 285

**Effective 02-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 318 (0.50) LEC, TUT Continuum Mechanics for Nanotechnology Engineering

Tensor operations. Kinematics of a continuum: material and spatial frames, strain and displacement, conservation of mass. Stress, conservation of momentum, energy, and mass. Linear elastic solids: Hooke's Law, infinitesimal elasticity theory.



Introduction to Newtonian viscous fluids: hydrostatics, Navier-Stokes equations, flow regimes, and the Reynolds number. Engineering applications in anisotropy, heat transfer, and fluid mechanics will be discussed. [Offered: S]

No Special Consent Required

Requisites :

Prereq: NE 216, 217; 3A Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 320L (0.25 ) LAB Characterization of Materials Laboratory

Follow-up labs associated with the NE 226 (Characterization of Materials) course. The laboratory exercises focus upon the synthesis and characterization of nano-based materials. Specifically, the synthesis of carbon nanotubes, quantum dots, magnetic ceramics, or other common nanomaterials will be investigated, and sample preparations for various characterization tools will be carried out. Characterization techniques such as infrared and Raman spectroscopy, x-ray diffraction, scanning electron microscope (SEM), and magnetic inductive heating will be utilized. [Offered: S]

No Special Consent Required

Requisites :

Prereq: NE 226; 3A Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 330L (0.25 ) LAB Macromolecular Science Laboratory

Lab exercises exploring the synthesis and characterization of polymers, copolymers, and soft nanomaterial structures. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 332 (0.50 ) LEC, TUT Quantum Mechanics

Historical background; the differential equation approach to quantum mechanics;

treatments of solvable problems such as the particle-in-a-box, harmonic oscillator, rigid rotor, and the hydrogen atom; introduction to approximation methods for more complex systems; application to solid state problems, including band theory.

[Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Nanotechnology Engineering. Antireq: CHEM 356, ECE 405, PHYS 233, 234

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 333 (0.50) LEC, TUT Macromolecular Science

Basic definitions, polymer types and nomenclature, molecular weight averages and distributions, structure and properties. Chemical kinetics, step-growth and free-radical chain-growth polymerizations, polymer recycling and sustainable design.

[Offered: S]

No Special Consent Required

Requisites :

Prereq: NE 225; 3A Nanotechnology Engineering. Antireq: CHE 541, CHEM 370, MNS 322

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 334 (0.50) LEC, TUT Statistical Thermodynamics

Statistical mechanics vs. thermodynamics. Review of statistical concepts. Canonical and grand canonical ensembles. Entropy. General formulation of statistical thermodynamics. Fermi-Dirac, Bose-Einstein, and Boltzmann statistics. Quantum ideal gases. Specific heat of solids. Electrons in metals and semiconductors. Radiation: the photon gas. [Offered: F, first fall offering, Fall 2022]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Nanotechnology Engineering. Antireq: CHEM 400 (Topic: Statistical Mechanics), PHYS 359

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 336 (0.50) LAB, LEC, TUT Micro and Nanosystem Computer-aided Design

Modeling and simulation. Lumped versus distributed approaches. Review of differential-equation systems, constitutive relations, boundary conditions, and solvers for complex, coupled transport problems pertinent to micro and nanosystems. Coupling strategies. Numerical schemes for nonlinear systems. Basic modeling and simulation of micro and nanosystems, and fluidic systems. Relevant nanotechnology applications: optical, thermal, mechanical, and fluidic microstructures, and nanoscale devices. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Nanotechnology Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 343 (0.50) LEC, TUT Microfabrication and Thin-film Technology

Key processes for electronic device fabrication. Single crystal growth. Substrate preparation. Homoepitaxy, heteroepitaxy, and molecular-beam epitaxy. Ion implantation. Oxidation and diffusion. Physical and chemical vapor deposition. Sputtering and evaporation. Etching. Micromachining. Spin coating and printing. Photolithography. Effects of device scaling on chip performance. Process integration. Yield and reliability. [Offered: S]

No Special Consent Required

Requisites :

Prereq: NE 121, 125, 242; 3A Nanotechnology Engineering. Antireq: ECE 433

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

NE 352 (0.50) LEC Surfaces and Interfaces

Surfaces and interfaces in microelectronics and nanofabrication. Physicochemistry of interfaces. Capillary phenomena and molecular self-assembly. Structure and properties of clean and adsorbate covered surfaces (metals, semiconductors, oxides). Reactions at surfaces and catalysis. Surface electrochemistry, growth and diffusion, nanoscale structure formation/surface patterning, biological interfaces. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Nanotechnology Engineering. Antireq: CHEM 400

**Effective 01-SEP-2024**

Rationale :

(Topic: Surface Science and Nanotechnology)

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 409 (0.50) PRJ Nanosystems Design Project and Symposium

Completion and presentation of the design project from NE 307 and NE 408. Teams communicate their design in the form of a final report, a poster, and a seminar presentation. [Offered: W]

No Special Consent Required

Requisites :

Prereq: NE 408; 4B Nanotechnology Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

NE 488 (0.50) LEC Biomaterials and Biomedical Design

An overview of nanomedicine and nanotechnology-based biomedical devices. Strategies and technologies for designing, testing, and manufacturing biomaterials and tissue-engineering products. Biological and clinical applications. Manufacturing challenges and regulatory procedures for commercialization. [Offered: W]

No Special Consent Required

Requisites :

Prereq: NE 481. Level at least 3B Biomedical Engineering or Nanotechnology Engineering. Antireq: BME 489, Topic Biocompatibility and Biomaterial Engineering.

CHE 561

Cross-listed as:

**Effective 02-SEP-2024**

Title Change:

Biomaterials and Tissue Engineering

Description Change:

The course provides an overview of the recent advances in medicine and nano-technologies for development of tissue engineering and regenerative medicine. Strategies and technologies for designing, testing, and manufacturing of biomaterials and tissue-engineering products will be introduced. The biological and clinical applications will be discussed. The unmet medical needs, challenges in manufacturing, regulatory approval and commercialization for tissue engineering applications will also be discussed.

Requisite Change :

Prereq: NE 481. Level at least 3B Biomedical Engineering or Nanotechnology Engineering.

Antireq: BME 589 (Topic 4: Biomaterials & Biomedical Design)

New Cross Listing : CHE 561 BME 561  
Rationale : A new BME cross-listing is being added to this course to replace a previous BME special topics offering. This will help increase clarity for students when selecting required courses for BME specializations. The title and description have also been updated to better represent what is currently taught in the course. Anti-requisites are updated to include the previous BME special topics course. All three areas are in agreement with the changes. Short title: Biomaterials & Tissue Eng

## Mechanical and Mechatronics Engineering

### Current Catalog Information

ME 100 (0.75 ) LAB, LEC, TUT Introduction to Mechanical Engineering Practice 1

This course is focused on fundamental knowledge and skills essential for academic and professional development in mechanical engineering. It covers basic methods and principles used by mechanical engineers, e.g., fundamentals of technical communication, the design process and problem solving, measurements and data analysis, engineering professionalism, safety, and intellectual property. The fundamentals of engineering graphical communication using computer-aided design (CAD) and freehand sketching will be a significant component of this course. Written, graphical and oral communications are emphasized. Examples are drawn from Mechanical Engineering. [Offered: F]

No Special Consent Required

Requisites : Prereq: 1A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 200A (0.00 ) LEC Seminar

Discussion of the structure of and options within the mechanical engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: F,W]

No Special Consent Required

Requisites : Prereq: 2A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 200B (0.00) LEC Seminar  
Discussion of the structure of and options within the mechanical engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: F,S]  
No Special Consent Required  
Requisites : Prereq: 2B Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 201 (0.50) LAB, LEC, TUT Advanced Calculus  
A continuation of First Year calculus, focusing on calculus of scalar and vector functions of several variables. Both classical calculus techniques and the computer implementation of numerical methods are discussed. Partial differentiation, total derivatives, chain rule, transformation of variables, Taylor series. Applications include geometrical problems, error estimation, maxima and minima, least squares curve fits. Multiple integration in standard coordinate systems, Jacobians. Vector calculus, divergence, curl, Laplacian, and Stokes', Green's and Divergence theorems. Scalar flux transport, work and energy, conservative force fields. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: MATH 118; Level at least 2A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 202 (0.50) LEC, TUT Statistics for Engineers  
Frequency distributions; measures of central tendency; standard deviation and other measures of dispersion. Probability. Binomial, Poisson, normal distributions. Techniques of sampling and statistical estimation. Tests of hypotheses; significance. The t-test and chi-squared test. Curve fitting by least squares. Statistical process control. Correlation and regression. Experimental design. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: MATH 116; Level at least 2A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 203 (0.50) LEC, TUT Ordinary Differential Equations

Solution of ordinary differential equations. First and higher order differential equations. Nonlinear equations. Linear equations with constant and variable coefficients. Systems of linear equations. Applications involving simple dynamical systems and principles of mass, momentum and heat conservation will emphasize the role of ordinary differential equations in understanding the behaviour of physical systems. Introduction to the Laplace transform method for solving ordinary differential equations. [Offered: F, S]

No Special Consent Required

Requisites :

Prereq: ME 201, Level at least 2B Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 212 (0.50) LEC, TUT Dynamics

An introduction to the kinematics of particle and rigid body motion. Impulse-momentum equations. Work-energy methods and Euler's equations. Simple gyroscopes. Vibrations. [Offered: F, S]

No Special Consent Required

Requisites :

Prereq: PHYS 115, MATH 118; Level at least 2B Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 219 (0.50) LEC, TUT Mechanics of Deformable Solids 1

Concept of equilibrium, force analysis of structures and structural components, equilibrium of deformable bodies, stress and strain concepts, stress-strain relationships, stress analysis of prismatic members in axial, shearing, torsional and flexural deformations, shear force and bending moment diagrams. [Offered: F, W, S]

No Special Consent Required



Requisites : Prereq: PHYS 115; Level at least 2A Mechanical Engineering or 2B Management Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 220 (0.50) LEC, TUT Mechanics of Deformable Solids 2

A general treatment of the behaviour of structural components from the study of stress and strain in solids. Topics include superposition, energy theorems, theories of failure, elastic and inelastic analysis of symmetrical bending, torsion of circular members, columns and stability, and virtual work. [Offered: F, S]

No Special Consent Required

Requisites : Prereq: ME 219; Level at least 2B Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 230 (0.50) LAB, LEC, TUT Control of Properties of Materials

Phase equilibria, non-equilibrium behaviour, heat treatment of metals, diffusion, strengthening processes. Alloying, composite materials, cold and hot working. Failure of engineering materials; creep, fatigue, corrosion and other environmental degradation processes. Prevention of service failures. [Offered: F,W]

No Special Consent Required

Requisites : Prereq: ME 115; Level at least 2A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 250 (0.50) LEC, TUT Thermodynamics 1

The engineering science of energy. The scope and limitations of thermodynamics. Macroscopic approach to heat, work, energy and the First Law. Properties and state of simple substances. Control-mass and control-volume energy analysis. The Second Law of Thermodynamics, principle of increase of entropy, limiting cycle efficiencies,



criteria for equilibrium. [Offered: F, S]

No Special Consent Required

Requisites :

Prereq: MATH 118; Level at least 2B Mechanical Engineering or level at least 2A Management Engineering. Antireq: MTE 309, SYDE 381

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 262 (0.50) LAB, LEC, TUT Introduction to Microprocessors and Digital Logic

Number systems, logic gates, Boolean algebra. Karnaugh maps and combinational logic design. Sequential logic and state machines. Programmable Logic Controllers (PLCs) and PLC programming using ladder logic and statement list. Microcomputer structure and operation, I/O and interfacing. Assembly language programming. Laboratory work includes microcomputer and PLC programming. [Offered: F,S]

No Special Consent Required

Requisites :

Prereq: GENE 123; Level at least 2B Mechanical Engineering. Antireq: MTE 262

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 269 (0.50) LAB, LEC, TUT Electromechanical Devices and Power Processing

Review of circuit analysis. Basic electromagnetic theory. DC machines, synchronous generators, transformers, and induction motors. Introduction to typical speed and torque control techniques of machines using power electronic based devices. [Note:

Labs: Alternate Weeks. Offered: F, W]

No Special Consent Required

Requisites :

Prereq: GENE 123; Level at least 2A Mechanical Engineering or Mechatronics Option

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 300A (0.00) LEC Seminar

Discussion of the structure of and options within the mechanical engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: W,S]

No Special Consent Required

Requisites :

Prereq: 3A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 300B (0.00) LEC Seminar

Discussion of the structure of and options within the mechanical engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses.

[Offered: F,W]

No Special Consent Required

Requisites :

Prereq: 3B Mechanical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 303 (0.50) LEC, TUT Advanced Engineering Mathematics

A continuation of ME 201 and ME 203 in which both classical calculus techniques and the computer implementation of numerical methods are discussed. Partial differential equations of mathematical physics: wave, diffusion, Laplace, Poisson equations. Boundary and initial conditions. Separation of variables. Numerical methods for ordinary and partial differential equations. Applications will emphasize the role of ordinary and partial differential equations in understanding the behaviour of physical systems. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: ME 201, 203; Level at least 3A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

requirements.

### Current Catalog Information

ME 321 (0.50) LEC, TUT Dynamics of Machines and Mechanical Vibrations  
Principles of the geometry of motion, uniform and non-uniform motion, linkage, gears.  
Synthesis and analysis of mechanisms. Consideration of the static and dynamic forces  
in machines. Vibration analysis, response to shock, motion and force  
transmissibility, vibration isolation, and multi-DOF mechanical vibrations. [Offered:  
W,S]  
No Special Consent Required  
Requisites : Prereq: (ME 201 or MTE 202) and (ME 212 or SYDE 182); Level at least 3A  
Mechanical Engineering or Mechatronics Engineering

### Effective 02-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding  
department drop consent for all core engineering courses to ensure students  
consult with the department before dropping a course that is required for  
their program and help them stay on track with meeting program  
requirements.

### Current Catalog Information

ME 322 (0.50) LAB, LEC, TUT Mechanical Design 1  
Adequacy assessment and synthesis of machine elements with a focus on the design  
process. Static failure of ductile and brittle materials, fatigue analysis of  
structures. Topics include the design of welds, bolted connections, springs and  
shafts. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: ME 220, 321; Level at least 3B Mechanical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding  
department drop consent for all core engineering courses to ensure students  
consult with the department before dropping a course that is required for  
their program and help them stay on track with meeting program  
requirements.

### Current Catalog Information

ME 340 (0.50) LAB, LEC, TUT Manufacturing Processes  
The principles of manufacturing unit processes including casting, forming, machining  
and joining. Interactions between design, materials (metals, polymers, ceramics) and  
processes. Advantages and limitations, relative cost, and production rates of  
competitive processes. [Offered: W, S]  
No Special Consent Required  
Requisites : Prereq: ME 219, 230; Level at least 3A Mechanical Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding  
department drop consent for all core engineering courses to ensure students  
consult with the department before dropping a course that is required for

their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 351 (0.50 ) LAB, LEC, TUT Fluid Mechanics 1  
Physical properties of fluids and fundamental concepts in fluid mechanics. Hydrostatics. Conservation laws for mass, momentum and energy. Flow similarity and dimensional analysis as applied to engineering problems in fluid mechanics. Laminar and turbulent flow. Engineering applications such as flow measurement, flow in pipes and fluid forces on moving bodies. [Offered: F, W, S]  
No Special Consent Required  
Requisites : Antireq: MTE 352

#### Effective 02-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 353 (0.50 ) LAB, LEC, TUT Heat Transfer 1  
Introduction to heat transfer mechanisms. The formulation and solution of steady and transient heat conduction. Radiant heat transfer including exchange laws and view factors. Introductory convective heat transfer. [Offered: F, W]  
No Special Consent Required  
Requisites : Prereq: ME 250, 351; Level at least 3B Mechanical Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 354 (0.50 ) LAB, LEC, TUT Thermodynamics 2  
Emphasis on applications of thermodynamics to flow processes. Real fluids, evaluation of state functions of real fluids. Non-reacting mixtures, reacting mixtures, equilibrium considerations. [Offered: W, S]  
No Special Consent Required  
Requisites : Prereq: ME 250; Level at least 3A Mechanical Engineering

#### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 360 (0.50) LAB, LEC, TUT Introduction to Control Systems

Open loop and feedback control. Laws governing mechanical, electrical, fluid and thermal control components. Analogies. Analysis of some engineering control systems using block diagram algebra, transient and steady-state operation. Different modes of control. Review of Laplace Transform methods. Concepts of stability. Principles of analog computer simulation. Brief treatment of linear flow graphs and bondgraphs.

[Offered: F,W]

No Special Consent Required

Requisites :

Prereq: ME 203, 321; Level at least 3B Mechanical Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 362 (0.50) LAB, LEC, TUT Fluid Mechanics 2

Basic equations of two-dimensional flow, potential flow, exact viscous solutions.

Introduction to lubrication, boundary layers, turbulence, and compressible flow.

Turbomachinery fundamentals and applications. Selected advanced topics. [Offered: F,

W]

No Special Consent Required

Requisites :

Prereq: ME 351; Level at least 3B Mechanical Engineering or 4A Mechatronics Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

ME 380 (0.50) LEC, PRJ Mechanical Engineering Design Workshop

In this course, students study the design process, including needs analysis, problem definition; design criteria and critical parameter identification, generation of alternative solutions; conceptual design, detailed design, optimization; and implementation. Most of the term is devoted to a significant design project in which student groups work independently and competitively, applying the design process to a project goal set by the faculty co-ordinator. The design project typically includes construction of a prototype, and part of the course grade may depend on the performance of the prototype in a competitive test. In exceptional circumstances, the requirement for a prototype may be replaced by a computer simulation, or may be

waived. Other mechanical engineering faculty members, particularly those teaching 3B courses, are available to provide advice and supervision to ME 380 students.

[Offered: F,W]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Mechanical Engineering. Antireq: MTE 380

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 400A (0.00) LEC Seminar

Research frontiers in mechanical engineering, specific discussion of research done at Waterloo, seminars by members of research groups. [Offered: S, F]

No Special Consent Required

Requisites :

Prereq: 4A Mechanical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 400B (0.00) LEC Seminar

Research frontiers in mechanical engineering, specific discussion of research done at Waterloo, seminars by members of research groups. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Mechanical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 481 (0.50) PRJ Mechanical Engineering Design Project 1

The first of two required courses for the mechanical engineering capstone design project. This course is intended to enable students to engage in in-depth engineering design and decision-making using engineering science while encouraging creativity and resourcefulness, and addressing the criteria listed in the faculty of engineering design rubrics. Students will work in small groups on a design project of their own choosing, or as part of a major student team project. The goal is to develop a design

proposal, consisting of the needs analysis, design specifications and project plan, followed by the initial and detailed design work. [Offered: F,S]

No Special Consent Required

Requisites : Prereq: ME 380; Level at least 4A Mechanical Engineering students only.  
Antireq: MTE 481

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

ME 482 (0.50) PRJ Mechanical Engineering Design Project 2

A continuation of ME 481. The final design of the major mechanical engineering project proposed in ME 481 will be undertaken. The purpose of this phase of the project is to carry out a detailed technical design and proof of feasibility of the solution proposed in ME 481. [Offered: W]

No Special Consent Required

Requisites : Prereq: ME 380, 481; Level at least 4B Mechanical Engineering students only. Antireq: MTE 482

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 100 (0.75) LAB, LEC, TUT Mechatronics Engineering

An introduction to mechatronics engineering and the engineering profession. Topics include the design process, project planning, data presentation, measurements and error, control logic, sensors and actuators, and intellectual property. Engineering graphics fundamentals of multi-view, isometric, oblique, and perspective projections are also covered while developing skills in computer-aided drawing (CAD), freehand sketching, and the interpretation of technical drawings. Professional development including résumé skills, interview skills, and preparation for co-op terms. A mechatronic design project/competition with small groups supplements the lecture material. [Offered: F]

No Special Consent Required

Requisites : Prereq: 1A Mechatronics Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

requirements.

### Current Catalog Information

MTE 120 (0.75 ) LAB, LEC, TST, TUT Circuits

Basic electromagnetic theory; magnetic circuits; electric circuit elements; DC circuit analysis; first-order transient response; AC circuit analysis. [Offered: W,S]

No Special Consent Required

Requisites : Prereq: Level at least 1B Mechatronics Engineering. Antireq: ECE 140, GENE 123

### Effective 02-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 182 (0.50 ) LEC, TUT Dynamics

Kinematic of particles, rectilinear and curvilinear motion. Kinetics of particles.

Energy and momentum methods. Systems of particles. Kinematics and kinetics of rigid bodies; planar motion. [Offered: F, W]

No Special Consent Required

Requisites : Prereq: Level at least 2A Mechatronics Engineering. Antireq: BME 182, SYDE 182

### Effective 02-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 200A (0.00 ) SEM Seminar

Discussion of the structure of and options within the mechatronics engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: F,W]

No Special Consent Required

Requisites : Prereq: 2A Mechatronics Engineering

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.



### Current Catalog Information

MTE 200B (0.00) SEM Seminar

Discussion of the structure of and options within the mechatronics engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: F,S]

No Special Consent Required

Requisites : Prereq: 2B Mechatronics Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 201 (0.50) LAB, LEC, TUT Experimental Measurement and Statistical Analysis

Measurement errors, calculations with unknown quantities, and error propagation.

Sensitivity analysis. Techniques of sampling and statistical estimation. Introduction

to sensors and data acquisition tools. Frequency distributions. Probability.

Binomial, Poisson, normal distributions. Tests of hypotheses. Significance. The

t-test and chi-squared test. Curve fitting by least squares. Correlation and

regression. Design of experiments. [Offered: F,W]

No Special Consent Required

Requisites : Prereq: MATH 118; Level at least 2A Mechatronics Engineering. Antireq: CIVE 224, ECON 221, KIN 222, MSCI 252, ME 202, PSCI 314, PSYCH 291, PSYCH 292, REC 371, SOC/LS 280, STAT 202, 206, 211, 220, 221, 231, 241, SYDE 212

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 202 (0.50) LEC, TUT Ordinary Differential Equations

First Order Differential Equations; Direction Field; Separable Equations, Integrating

Factors and Simple Transformations; Applications; Second and Higher Order ODE's with

Constant Coefficients - Transient and Steady State Solutions; The Laplace Transform;

Systems of Equations - reduction to single equation; Matrix Differential Equations;

Introduction to Partial Differential Equations. [Offered: F,W]

No Special Consent Required

Requisites : Prereq: MATH 118; Level at least 2A Mechatronics Engineering. Antireq: ME 203

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 203 (0.50) LAB, LEC, TUT Advanced Calculus

Review of Vectors and Vector Operations; 3-D Analytic Geometry and Space Curves; Multivariable Calculus, including Partial Differentiation, Total Differential, Chain Rule, Directional Derivative, Gradient Operator, Maxima and Minima; Multiple Integrals - Surface Area, Volume and Moments of Inertia; Line and Surface Integrals; Vector Theorems; Complex Analysis including Limits, Analytic Functions, Complex Line Integral, Cauchy's Integral Formula; Fourier Series (real and complex) and Fourier Integrals. [Offered: F,S]

No Special Consent Required

Requisites :

Prereq: MATH 118; Level at least 2B Mechatronics Engineering. Antireq: ME 201

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 204 (0.50) LEC, TUT Numerical Methods

Number Systems and Machine Errors; Roots of Non-Linear Equations; Matrix Calculations; Eigenvalue and Eigenvector Calculations; Interpolation and Approximation; Numerical Integration and Solution of ODE's (linear and non-linear) and systems of ODEs; Calculation of Series; Solution Methods for PDE's; Use of numeric and symbolic computing tools. [Offered: F,S]

No Special Consent Required

Requisites :

Prereq: MTE 202; Level at least 2B Mechatronics Engineering.

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 219 (0.50) LEC, TUT Mechanics of Deformable Solids

Introduction to mechanical response of materials and stress-strain relationships.

Behaviour of prismatic members in tension, compression, shear, bending and torsion.  
Stress and strain transformations. Virtual work and energy methods. [Offered F,W]

No Special Consent Required

Requisites : Prereq: MTE 111, 119; Level at least 2A Mechatronics Engineering. Antireq:  
CIVE 204, ME 219, SYDE 286

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 220 (0.50) LAB, LEC, TUT Sensors and Instrumentation

Review of circuit theory; input-output relationships, transfer functions and frequency response of linear systems; operational amplifiers, operational amplifier circuits using negative or positive feedback; diodes, operational amplifier circuits using diodes; analog signal detection, conditioning and conversion systems; transducers and sensors, difference and instrumentation amplifiers, active filters.

[Offered: F,S]

No Special Consent Required

Requisites : Prereq: MTE 120, 201; Level at least 2B Mechatronics Engineering. Coreq:  
SYDE 252. Antireq: SYDE 292

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 241 (0.50) LAB, LEC, TUT Introduction to Computer Structures and Real-Time Systems

Introduction to computer organization, basic real-time concepts, process management, interprocess communication and synchronization, memory management, resource management, interrupt handling, concurrent programming, file systems. [Offered: F,S]

No Special Consent Required

Requisites : Prereq: MTE 121/GENE 121 and MTE 140; Level at least 2B Mechatronics Engineering students. Antireq: ECE 254

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 252 (0.50) LEC, TUT Linear Systems and Signals  
Models and analysis of linear systems. Discrete time systems, continuous time systems; difference and differential equations; impulse and frequency response. Complex frequency, functions of complex variable transform domain techniques: Z transforms; Fourier analysis, Laplace transform. Transfer functions and frequency response, frequency domain analysis of linear systems; sample theory, stability, and linear filters.  
No Special Consent Required  
Requisites : Prereq: Level at least 2B Mechatronics Engineering or 2B Mechanical Engineering. Antireq: BME 252, SYDE 252

**Effective 02-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 262 (0.50) LAB, LEC, TUT Introduction to Digital Logic  
Number systems, logic gates, Boolean algebra. Karnaugh maps, and combinational logic design. Implementation of combinational and sequential logic circuits on Field Programmable Gate Arrays (FPGA) boards. Sequential logic and state machines. Programmable Logic Controllers (PLCs) and PLC programming using ladder. Laboratory work includes FPGA and PLC programming. [Offered: F,W]  
No Special Consent Required  
Requisites : Prereq: GENE 123 or MTE 120; Level at least 2B Mechanical or 2A Mechatronics Engineering. Antireq: ECE 222, ME 262

**Effective 02-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 300A (0.00) SEM Seminar  
Discussion of the structure of and options within the mechatronics engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: W,S]  
No Special Consent Required  
Requisites : Prereq: 3A Mechatronics Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students

consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 300B (0.00) SEM Seminar

Discussion of the structure of and options within the mechatronics engineering curriculum; of the operation of department, faculty, university, technical societies; of student team and graduate school opportunities; of safety training; and of subject material in support of core courses. [Offered: F,W]

No Special Consent Required

Requisites : Prereq: 3B Mechatronics Engineering

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 320 (0.50) LAB, LEC, TUT Actuators and Power Electronics

Review of circuit analysis and basic electromagnetic theory. Power electronics: power electronics circuits, H bridges, PWM control, interfacing, power amplifiers. DC servo and stepper motors, AC synchronous and induction motors. Transformers. Introduction to typical speed and torque control techniques of motors. [Offered: W,S]

No Special Consent Required

Requisites : Prereq: MTE 120; Level at least 3A Mechatronics Engineering. Antireq: ME 269

### Effective 01-SEP-2024

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 321 (0.50) LEC, TUT Design and Dynamics of Machines

Principles of the geometry and motion in linkages and mechanisms. Computer-aided kinematic and kinetic analysis of mechanisms. Synthesis of mechanisms. Static failure and yield criteria in ductile and brittle materials. Fatigue failure criteria due to fluctuating stresses. Shaft design under static and fluctuating loads. Shaft components, including shoulders, keys and keyways. Deflections in shafts. [Offered: W, S]

No Special Consent Required

Requisites : Prereq: MTE 203, 219, SYDE 182; Level at least 3A Mechatronics Engineering. Antireq: ME 321

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 322 (0.50) LAB, LEC, TUT Electromechanical Machine Design

Integrated design of mechanical motion transmission systems: gearing, couplings, bearings, power screws, fasteners, and their integration; sensing and measurement of mechanical motion; specification and selection of motors and electromechanical actuators; analysis and design of controllers for motion transmission systems; case studies. [Offered: F,W]

No Special Consent Required

Requisites :

Prereq: MTE 220, 262, 320, 321; Level at least 3B Mechatronics Engineering.  
Antireq: ME 321

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 325 (0.50) LAB, LEC, TUT Microprocessor Systems and Interfacing for Mechatronics Engineering

Synchronization and data flow; interfacing to sensors and actuators; parallel, serial, and analog interfacing; buses; direct memory access (DMA); interfacing considerations; privacy and security considerations. [Offered: W,S]

No Special Consent Required

Requisites :

Prereq: ME 262 or MTE 262; Level at least 3A Mechatronics Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 351 (0.50) LEC, TUT Systems Models 1

Introduction to systems modelling and analysis. Graph theoretic models and formulation of system equations. State space formulation and solution. Time and frequency domain solution. Application to engineering systems. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Mechanical Engineering. Antireq: SYDE 351

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 352 (0.50 ) LAB, LEC, TUT Fluid Mechanics 1

Physical properties of fluids and fundamental concepts in fluid mechanics. Hydrostatics. Conservation laws for mass, momentum, and energy. Flow similarity and dimensional analysis as applied to engineering problems in fluid mechanics. Laminar and turbulent flow. Engineering applications such as flow measurement, flow in pipes, and fluid forces on moving bodies.

No Special Consent Required

Requisites :

Prereq: Level at least 3A Mechanical Engineering. Coreq: MTE 309. Antireq: ME 351

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 360 (0.50 ) LAB, LEC, TUT Automatic Control Systems

Feedback control design and analysis for linear dynamic systems with emphasis on mechanical engineering applications; transient and frequency response; stability; system performance; control modes; state space techniques; Introduction to digital control systems. [Offered: F,W]

No Special Consent Required

Requisites :

Prereq: MTE 320, SYDE 252, 351; Level at least 3B Mechatronics Engineering. Antireq: ECE 380, ME 360, SYDE 352

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

MTE 380 (0.50 ) LEC, PRJ Mechatronics Engineering Design Workshop

In this course, students study the design process, including needs analysis, problem definition; design criteria and critical parameter identification, generation of alternative solutions; conceptual design, detailed design, optimization; and

implementation. Most of the term is devoted to a significant design project in which student groups work independently and competitively, applying the design process to a project goal set by the faculty coordinator. The design project typically includes construction of an electro-mechanical prototype, and part of the course grade may depend on the performance of the prototype in a competitive test. In exceptional circumstances, the requirement for a prototype may be replaced by a computer simulation, or may be waived. [Offered: F,W]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Mechatronics Engineering. Antireq: ME 380

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 400A (0.00) SEM Seminar

Discussion of structure of mechatronics engineering curriculum, operation of department, faculty, university, technical societies. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 4A Mechatronics Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 400B (0.00) SEM Seminar

Discussion of structure of mechatronics engineering curriculum, operation of department, faculty, university, technical societies. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Mechatronics Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 481 (0.50) PRJ Mechatronics Engineering Design Project

This course is intended to reinforce the concepts learned in MTE 380 and to extend the significant design experience obtained. Students work individually or in small



groups applying the principles of engineering design and problem-solving to a design project of their own choosing. The project must incorporate all elements of Mechatronics, namely, mechanical design, electronics, computers and software. In exceptional circumstances, one or more elements may be exempted by the course instructor. The students are required to consider a need analysis, search for prior art and present alternate designs. The course ends with the selection of a final design. Projects are selected, approved, monitored, and marked by a course co-ordinator. [Offered: F]

No Special Consent Required

Requisites :

Prereq: MTE 380; Level at least 4A Mechatronics Engineering students only.

Antireq: ME 481

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 482 (0.50) PRJ Mechatronics Engineering Project

This course is an extension of MTE 481. Students work on prototyping the designs they proposed and finalized in MTE 481. The students either individually or in small groups demonstrate the working prototypes; make a poster presentation for the design competition; and pitch their product on a web site. The projects are monitored by the course instructor and evaluated by the instructor with feedback from an expert judging panel. [Offered: W]

No Special Consent Required

Requisites :

Prereq: MTE 380, 481; Level at least 4A Mechatronics Engineering students only. Antireq: ME 482

### Effective 01-SEP-2024

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

MTE 484 (0.50) LAB, LEC, TUT Control Applications

Dynamic system modelling: linear, nonlinear, state-space, sample data systems, computer simulation, system identification. Discrete system stability and dynamic performance. Nonlinear system analysis, limit cycles. Digital control system design: emulation methods, z-domain, frequency domain, pole placement. Implementation of digital controllers. Laboratory projects in computer control of mechatronic and other systems. [Offered: F]

No Special Consent Required

Requisites :

Prereq: (ECE 380; Level at least 4A Computer Engineering or Electrical

Engineering) or (MTE 360; Level at least 4A Mechatronics Engineering) or (ME360; Mechanical Eng/Mechtr. Option) or (SYDE 352; Systems Design/Mechtr. Option). Antireq: ECE 481, ECE 484

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Management Science and Engineering**

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MSE 100

Title Change:

Management Engineering Concepts

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MSE 100B

Title Change:

Seminar

Rationale :

The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MSE 121

Title Change:

Introduction to Computer Programming

Rationale :

The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 131  
Title Change: Work Design and Facilities Planning  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 200A  
Title Change: Seminar  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 200B  
Title Change: Seminar  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 211  
Title Change: Organizational Behaviour  
Requisite Change : Antireq: MSCI 211  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change. MSCI 211 (the previous course code) is being added as an anti-requisite so that students know it is the same iteration as the former course code, particularly since this is a popular course outside of Engineering.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 232  
Title Change: Modelling in Operations Research  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 240  
Title Change: Algorithms and Data Structures  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 245  
Title Change: Databases and Software Design  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MSE 251

Title Change:

Probability and Statistics 1

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MSE 253

Title Change:

Probability and Statistics 2

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

MSE 261

Title Change:

Engineering Economics: Financial Management for Engineers

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 263  
Title Change: Managerial Economics  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 271  
Title Change: Advanced Calculus and Numerical Methods  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 300A  
Title Change: Seminar  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 300B  
Title Change: Seminar  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 302  
Title Change: Engineering Design Methods  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for

their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 311  
Title Change: Organizational Design and Technology  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 331  
Title Change: Introduction to Optimization  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 332  
Title Change: Fundamentals of Optimization  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 333  
Title Change: Simulation Analysis and Design  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science &

Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 334  
Title Change: Operations Planning and Inventory Control  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 342  
Title Change: Principles of Software Engineering  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 343  
Title Change: Human-Computer Interaction  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 391



Title Change: Work-term Report  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 392  
Title Change: Work-term Report  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 400A  
Title Change: Seminar  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 400B  
Title Change: Seminar  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change:

Title Change:

Rationale :

MSE 401

Management Engineering Design Project 1

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

Title Change:

Rationale :

MSE 402

Management Engineering Design Project 2

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

Title Change:

Rationale :

MSE 411

Leadership and Influence

The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change:

Title Change:

Rationale :

MSE 422

Economic Impact of Technological Change and Entrepreneurship

The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 431  
Title Change: Stochastic Models and Methods  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 432  
Title Change: Production and Service Operations Management  
Requisite Change : Prereq: (One of AE 224, BME 213, CHE 220, CIVE 224, ECE 203, 306, ECON 221, ENVE 224, ME 202, MTE 201, NE 215, STAT 206, 211, 231, 241, SYDE 212); Not open to Management Engineering students.  
Antireq: MSE 334  
Rationale : ECON 221 is an introductory probability and statistics course, similar in content to the other listed prerequisites for MSE 432 Production and Service Operations Management, and thus should be included as a prerequisite to allow more students the opportunity to take the course. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 433  
Title Change: Applications of Management Engineering  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 434

Title Change: Supply Chain Management  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 435  
Title Change: Advanced Optimization Techniques  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 436  
Title Change: Decision Support Systems  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 442  
Title Change: Impact of Information Systems on Organizations and Society  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 446  
Title Change: Introduction to Machine Learning

Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 452  
Title Change: Decision Making Under Uncertainty  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 454  
Title Change: Technical Entrepreneurship  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 491  
Title Change: Work-term Report  
Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements. The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 531  
Title Change: Stochastic Processes and Decision Making  
Rationale : The department has changed its name to Management Science & Engineering and

the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 541  
Title Change: Search Engines  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 543  
Title Change: Analytics and User Experience  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 546  
Title Change: Advanced Machine Learning  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 551  
Title Change: Quality Management and Control  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**  
( 0.00 )

**Effective 02-SEP-2024**

Subject/Catalog Nbr Change: MSE 555  
Title Change: Scheduling: Theory and Practice  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 597  
Title Change: Complementary Studies Topics in Management Science and Engineering  
Description Change: A complementary studies course on advanced topics in Management Science and Engineering will be offered when resources are available. For current offerings, see the Course Selections Offerings List or the Schedule of Classes. [Offered: F,W,S]  
Rationale : The department has changed its name to Management Science and Engineering and would like to change any naming references in courses to the new department name. The title now reads "Complementary Studies Topics in Management Science and Engineering" instead of "Complementary Studies Topics in Management Sciences." The new subject code also reflects the change in department name. New short title: Mgmt Sci & Eng Comp Studies

**Current Catalog Information**

( 0.00 )

**Effective 01-SEP-2024**

Subject/Catalog Nbr Change: MSE 598  
Title Change: Special Topics in Management Engineering  
Rationale : The department has changed its name to Management Science & Engineering and the new subject code reflects this change.

**Systems Design Engineering**

**Current Catalog Information**

SYDE 101 ( 0.25 ) LEC, TUT Communications in Systems Design Engineering-Written and Oral

This course introduces first-year students to systems design engineering with a focus on the engineering profession, and technical communication skills. Through in-class and independent activities leading to formative and summative assessments, students will consider and reflect on communication intention, audience, content, medium, format, and tone to demonstrate and improve upon their listening, written and oral communication skills for academic, engineering, and professional context. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering. Antireq: BME 101

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 101L (0.25 ) LAB, LEC Communications in Systems Design Engineering-Visualization

This laboratory course introduces students to visual communication methods relevant to engineering analysis and design. Through in-class and independent activities leading to formative and summative assessments, students will consider and reflect on communication intention, audience, content, medium, format, and level of detail to demonstrate and improve upon their skills in graphing, freehand sketching, technical drawing, and computer-aided design (CAD). [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering. Antireq: BME 101L

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 102 (0.00 ) SEM Seminar

Systems design first-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work and engineering practice will be discussed. Non-credit course. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 1B Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 111 (0.50 ) LEC, TUT Calculus 1

Differential calculus: limits, continuity, derivatives, differentials, applications.

Sequences and series: convergence, power series, Taylor expansions. Simple numerical



methods. Introduction to integration, indefinite and definite integral, techniques of integration. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering or 1A Biomedical Engineering.

Antireq: MATH 116, 117, 127, 137, 147

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 112 (0.50 ) LEC, TUT Calculus 2

Integration: improper integrals and applications. Multi-variable calculus: partial, total, and directional derivative, gradient divergence, double and triple integrals,

Jacobian, solution techniques, applications. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: 1B Systems Design Engineering or 1B Biomedical Engineering.

Antireq: MATH 118, 119, 128, 138, 148

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 113 (0.25 ) LEC, TUT Elementary Engineering Mathematics

Functions: trigonometric, exponential, log, inverse functions. Mathematical notation and proof techniques. Metric spaces. Geometry and algebra: root-finding, vectors, coordinate systems, lines and planes, conic sections, complex numbers. Introduction to numerical computation: binary and floating point numbers and arithmetic, accuracy and sources of error. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering or 1A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 114 (0.25 ) LEC, TUT Matrices and Linear Systems

Matrix algebra, inverses, solution of linear systems, determinants, eigenvalues and

eigenvectors, lower-upper (LU) factorization. Numerical methods: sensitivity, condition number. [Offered: W, S]

No Special Consent Required

Requisites :

Prereq: 1B Systems Design Engineering or 1B Biomedical Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 121 (0.50 ) LAB, LEC, TUT Digital Computation

Computer systems, problem solving, data and programs, structured programming, arrays, matrices and pointers, correct and efficient algorithms, data structures. [Offered:

F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering. Antireq: BME 121, CHE 121, CIVE 121, ECE 150, GENE 121

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 161 (0.50 ) LEC, TUT Introduction to Design

Multidisciplinary system design, the design process, problem definition, life-cycle design, design specification, concept/design generation and evaluation, design for manufacturing and assembly, system modelling and analysis, introduction to mechanical design, prototyping, safety and responsibility in engineering design, design documentation. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering. Antireq: BME 161

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 162 (0.50 ) LEC, TUT Human Factors in Design

Design of human-machine environments, design to reduce human error. Analytical methods of determining user needs in systems with humans. Information processing and

human sensory processes and consideration of these elements in the design of systems with humans. Human physical capabilities and consideration of these in ergonomic design. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 1B Systems Design Engineering. Antireq: BME 162

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 181 (0.50) LEC, TUT Physics 1: Statics

Basic concepts of mechanics, vectors. Statics of particles. Rigid bodies and force systems, equilibrium of rigid bodies. Analysis of trusses and frames. Distributed forces, centroids and moments of inertia. Friction. Virtual work. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 1A Systems Design Engineering. Antireq: BME 181

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 182 (0.50) LEC, TUT Physics 2: Dynamics

Kinematics of particles, rectilinear and curvilinear motion. Kinetics of particles, application to space mechanics. Energy and momentum methods. Systems of particles. Kinematics and kinetics of rigid bodies; planar motion. [Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Systems Design Engineering. Antireq: BME 182, MTE 182

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 192 (0.50) LEC, TUT Digital Systems

Digital technology, combinatorial logic, binary arithmetic, synchronous sequential circuits, design methodology, algorithmic state machines, microcomputer interfacing. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 1B Systems Design Engineering. Antireq: BME 292/393

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 192L (0.25 ) LAB Digital Systems Laboratory

Laboratory experiments for students taking SYDE 192. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 1B Systems Design Engineering. Antireq: BME 292L/393L

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 201 (0.00 ) SEM Seminar

Systems design second-year students will meet a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work and engineering practice will be discussed.

Non-credit course. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 202 (0.00 ) SEM Seminar

Systems design second-year students will meet a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work and engineering practice will be discussed.

Non-credit course. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 2B Systems Design Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 211 (0.50) LEC, TUT Calculus 3

Vector differential calculus: divergence and curl, line and surface integrals, fundamental theorems, applications. First order ordinary differential equations: analytical techniques and applications. Second order linear ordinary differential equations: systems of equations and applications. Numerical methods for solving ordinary differential equations (ODEs). [Offered: F,W]

No Special Consent Required

Requisites :

Prereq: 2A Systems Designs Engineering or 2A Biomedical Engineering

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 212 (0.50) LEC, TUT Probability and Statistics

Elementary probability theory. Random variables and distributions. Binomial, Poisson, and normal distributions. Elementary sampling. Statistical estimation. Tests of hypotheses and significance. Regression. Goodness-of-fit tests. Analysis of experimental measurements. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Systems Design Engineering. Antireq: BME 213, CIVE 224, ECE 316, NE 115

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 223 (0.50) LAB, LEC, TUT Data Structures and Algorithms

Algorithms and Data Structures emphasizes the following topics: structured software design, data structures, abstract data types, recursive algorithms, algorithm analysis and design, sorting and searching, hashing, problem-solving strategies and NP-completeness. [Offered: W,S]

No Special Consent Required

Requisites :

Prereq: Level at least 1B Systems Design Engineering or Computer Engineering Option. Antireq: BME 122, CS 240, ECE 250, MTE 140

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 252 (0.50) LEC, TUT Linear Systems and Signals

Models and analysis of linear systems. Discrete time systems, continuous time systems; difference and differential equations; impulse and frequency response. Complex frequency, functions of complex variables, transform domain techniques: Z transforms; Fourier analysis, Laplace transform. Transfer functions and frequency response, frequency domain analysis of linear systems; sampling theory, stability, and linear filters. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Level at least 2B Systems Design Engineering or 2B Mechanical Engineering. Antireq: BME 252, MTE 252

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 261 (0.50) LEC, TUT Design, Systems, and Society

This course will help students understand how others think about technology, and then use this knowledge to make better choices when designing. This impact course focuses on identifying, understanding, and analyzing the interactions and impacts among technology, society and the environment for current and emerging technologies using theoretical and evidence-based analyses. Connections among systems of systems engineering, impact analyses, evidence-based analyses, needs assessment, the design process, advocacy, and professional engineering will be discussed and applied.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 262 (0.50) LEC, TUT Engineering Economics of Design

Topics include microeconomics, supply, demand and external costs in the context of systems design. Sustainability indicators, entrepreneurship, engineering economics, comparison of alternatives, project schedules and developing a business plan. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 2B Systems Design Engineering. Antireq: BME 364, MSCI 261

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 263 (0.25) LAB, LEC Engineering Prototyping

This course addresses the practical aspects of design and technical communication. By using a series of workshops culminating in a comprehensive final project, students gain the hands-on experience necessary for prototyping and design validation. Topics include generating technical specifications, material selection, fastener basics, motor selection, electronic switching, reading data sheets and schematics, and advanced microcontroller implementation. [Note: the lecture and laboratory components are offered alternate weeks. This course is graded as CR/NCR. Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 283 (0.50) LEC, TUT Physics 3: Electricity, Magnetism and Optics

Introduction to the fundamental laws of electricity, magnetism, and optics; electric fields, voltage, resistance, current, properties of conductors and semiconductors, capacitance, properties of dielectrics, magnetic fields, Faraday's Law and inductance, properties of magnetic materials; electromagnetic waves and the nature of light, geometrical optics; reflection and refraction, physical optics; interference and diffraction. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 2A Systems Design Engineering. Antireq: BME 386

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 285 (0.50) LEC, TUT Materials Chemistry

The course will present how the fundamentals of chemistry are applied to materials science and engineering. Concepts such as chemical bonding, crystal structure, phase diagram, redox reaction, and electrochemistry will be introduced in the context of materials science. Properties, processing and structure of metals, semiconductors, polymers, ceramic, nanomaterials and biomaterials will be presented. [Offered: W]

No Special Consent Required

Requisites : Prereq: 2A Systems Designs Engineering. Antireq: BME 282

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 286 (0.50) LEC, TUT Mechanics of Deformable Solids

Introduction to mechanical response of materials and stress-strain relationship. Behaviour of prismatic members in tension, compression, shear, bending and torsion. Shear-force and bending-moment diagrams. Introduction to instability. [Offered: F]

No Special Consent Required

Requisites : Prereq: Level at least 2A Systems Design Engineering. Antireq: BME 281, CIVE 204, ME 219

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 292 (0.50) LEC, TUT Circuits, Instrumentation, and Measurements

Active and passive circuit elements, Kirchhoff's laws, mesh and nodal circuit analysis, principle of superposition; step response of first and second order networks; sinusoidal steady state analysis using complex impedance phasors; input-output relationships, transfer functions and frequency response of linear systems; operational amplifiers, operational amplifier circuits using negative or positive feedback; diodes, operational amplifier circuits using diodes; analog signal



detection, conditioning and conversion systems; transducers, difference and instrumentation amplifiers, active filters, A/D and D/A conversion. [Offered: F]

No Special Consent Required

Requisites : Prereq: (2B Systems Design Engineering) or Mechatronics Option. Antireq: BME 392

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 292L (0.25 ) LAB Circuits, Instrumentation, and Measurements Laboratory

Laboratory experiments for students taking SYDE 292. [Offered: F]

No Special Consent Required

Requisites : Prereq: 2B Systems Design Engineering. Antireq: BME 392L

**Effective 01-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 300 (0.13 ) PRJ, SEM Work-term Symposium Poster

A work-term poster is composed and presented at the Work-term symposium. The poster and presentation provide an opportunity for students to effectively communicate and reflect on their engineering experience gained during their co-op work terms. In the poster and presentation, students draw connections between the theoretical aspects of engineering taught in the classroom and the practical applications of that theory in the workplace. [Offered: W, first Offered: Winter 2024]

No Special Consent Required

Requisites : Prereq: PD11; Level at least 3B Systems Design Engineering. Antireq: WKRPT 400, 401

**Effective 02-SEP-2024**

Rationale : Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 301 (0.00 ) SEM Seminar

Systems design third-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with

courses, interrelation of coursework, later work and engineering practice will be discussed. Non-credit course. [Offered: S]

No Special Consent Required

Requisites : Prereq: 3A Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 302 (0.00) SEM Seminar

Systems design third-year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, interrelation of coursework, later work and engineering practice will be discussed. Non-credit course. [Offered: W]

No Special Consent Required

Requisites : Prereq: 3B Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 312 (0.50) LEC, TUT Applied Linear Algebra

Vector spaces, linear independence, linear maps and matrix representations. Inner product spaces and orthogonality. Gram-Schmidt algorithm and orthogonal projection. Interpolation and curve-fitting. Eigenvalues and eigenvectors, diagonalization, singular value decomposition. Applications and numerical methods. [Offered: W]

No Special Consent Required

Requisites : Prereq: 3A Systems Design Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**Current Catalog Information**

SYDE 352 (0.50) LEC, TUT Introduction to Control Systems

Classical and state space representations of control systems. Stability, controllability, observability and sensitivity. Routh-Hurwitz and root-locus methods. Frequency domain behaviour, Bode plots, Nyquist stability criteria. Pole placement,

PID, phase-lead and phase-lag controllers.(labs alt. weeks) [Offered: W]

No Special Consent Required

Requisites :

Prereq: 3B Systems Design Engineering. Antireq: BME 353

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 352L (0.25 ) LAB Control Systems Laboratory

Laboratory experiments for students taking SYDE 352. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 3B Systems Design Engineering. Antireq: BME 353L

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 361 (0.50 ) LAB, LEC, TUT Systems Design Methods 1: Needs Analysis and Prototyping

The methodology of design, situation of concern; needs analysis and problem definition, engineering analysis and generation of alternative solutions, design prototyping, and design documentation. The lecture material is supplemented by a term-long design project done in small groups that develops hands-on experience with electromechanical prototyping. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 3A Systems Design Engineering. Antireq: BME 361

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 362 (0.50 ) LAB, LEC Systems Design Methods 2: Testing, Verification, and Validation

Engineering design project course where students work in small groups applying the principles of engineering problem solving and design, with a focus on testing and design evaluation, and an introduction to benchmark testing and applied design optimization. Student projects will provide hands-on experience with design verification, validation, and performance measurement and analysis using engineering tools. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 3B Systems Design Engineering. Antireq: BME 362

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 381 (0.50) LEC, TUT Thermodynamics

An introductory course in engineering thermodynamics structured for students in Systems Design. Classical thermodynamics is presented as the systematic study of energy; its use, degradation, and waste. Introduction to heat transfer by conduction, convection, and radiation. Applications focus on problems of energy and environment. The concepts of statistical thermodynamics are introduced. [Offered: S]

No Special Consent Required

Requisites :

Prereq: 3A Systems Design Engineering. Antireq: BME 384, MTE 309, ME 250

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 383 (0.50) LAB, LEC, TUT Fluid Mechanics

Fundamental concepts in systems involving fluid flow. Basic treatment of statics, kinematics and dynamics of fluids. Conservation of mass, momentum and energy for a control volume. Dimensional analysis and similarity. Flow in pipes and channels. Brief introduction to boundary layers, lift and drag, ideal and compressible flow. [Offered: S]

No Special Consent Required

Requisites :

Prereq: Level at least 3A Systems Design Engineering. Antireq: BME 384, ME 351

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 401 (0.00) SEM Seminar

Systems design fourth-year students will meet with a faculty member designated as

their class professor. Conceptual difficulties, the interrelation of course work and engineering practice will be discussed. Non-credit course. [Offered: F]

No Special Consent Required

Requisites : Prereq: 4A Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 402 (0.00) SEM Seminar

Systems design fourth-year students will meet with a faculty member designated as their class professor. Conceptual difficulties, the interrelation of course work and engineering practice will be discussed. Non-credit course. [Offered: W]

No Special Consent Required

Requisites : Prereq: 4B Systems Design Engineering

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 411 (0.50) LEC, TUT Optimization and Numerical Methods

Advanced methods for systems of linear equations. Root-finding methods. Linear programming, simplex and interior-point methods. Local and global optimization methods. Constrained optimization. Multiobjective and multidisciplinary design optimization.

No Special Consent Required

Requisites : Prereq: Level at least 3B Systems Design Engineering

**Effective 02-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 461 (0.50) LAB, LEC Systems Design Capstone Project 1

The first half of a two-term engineering design project continuing the systems design project sequence. Students work in small groups applying the principles of systems design engineering to a situation of concern of their own choosing. Students have individual project supervisors as well as an overall co-ordinator who provides the

framework for the term assessments. [Offered: F]

No Special Consent Required

Requisites :

Prereq: 4A Systems Design Engineering. Antireq: BME 461

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### Current Catalog Information

SYDE 462 (0.50) LAB, LEC Systems Design Capstone Project 2

The second half of a two-term engineering design project continuing the systems design project sequence. Students work in small groups applying the principles of systems design engineering to a situation of concern of their own choosing. Students have individual project supervisors as well as an overall co-ordinator who provides the framework for the term assessments. [Offered: W]

No Special Consent Required

Requisites :

Prereq: 4B Systems Design Engineering. Antireq: BME 462

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

### COURSE INACTIVATIONS (for approval)

#### Dean of Engineering

Effective 01-SEP-2024

GENE 191 (0.50)

Rationale :

Communication in the Engineering Profession

GENE 191 has not been offered for some time and is no longer in any plan; we have no plan to mount this course in future. This course is being replaced by UCR 191.

End of Report

**COURSE CHANGES** (for approval)

**Co-operative Education & Career Action**

**Current Catalog Information**

WKRPT 203 (0.25) PRJ Work-term Report

Students will complete a case study analysis of the firm in which they are employed. Work-term reports are required courses for the degree but their grades are not included in the average. However, failed work-term report evaluations may delay a student's progress as indicated in the Examinations and Promotions section of this calendar. Details regarding the evaluation of the work-term reports can be obtained from the student's program advisor.

[Note: This course is considered as DRNA]

No Special Consent Required

Requisites :

Prereq: Level at least 3B Architecture students

**Effective 01-SEP-2024**

Rationale :

Adding department drop consent. The Faculty of Engineering is adding department drop consent for all core engineering courses to ensure students consult with the department before dropping a course that is required for their program and help them stay on track with meeting program requirements.

**COURSE INACTIVATIONS** (for approval)

Effective 01-SEP-2024

WKRPT 101 (0.13)

Rationale :

Work-term Report

WKRPT 101, 201, 301, and 401 are work-report courses for Computer Engineering & Electrical Engineering students and the work report requirement has been removed from programs, therefore the courses are no longer necessary.

Effective 01-SEP-2024

WKRPT 201 (0.13)

Rationale :

Work-term Report

WKRPT 101, 201, 301, and 401 are work-report courses for Computer Engineering & Electrical Engineering students and the work report requirement has been removed from programs, therefore the courses are no longer necessary.

Effective 01-SEP-2024

WKRPT 301 (0.13)

Work-term Report

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Rationale :

WKRPT 101, 201, 301, and 401 are work-report courses for Computer Engineering & Electrical Engineering students and the work report requirement has been removed from programs, therefore the courses are no longer necessary.

Effective 01-SEP-2024  
WKRPT 401 (0.13 )

**Work-term Report**

Rationale :

WKRPT 101, 201, 301, and 401 are work-report courses for Computer Engineering & Electrical Engineering students and the work report requirement has been removed from programs, therefore the courses are no longer necessary.

End of Report



## 2. Academic Plan Changes (Minor Modifications)

## 2.1 School of Architecture

### Summary:

- a) Changing AIF Requirement to Questionnaire
- b) Removing Defined Elective List

### Background & Rationale:

- a) The School of Architecture wishes to change the admission requirement from the standard AIF form to a Questionnaire that is better able to provide us with an indication of the interest level of potential students to the architecture program. Our admissions committee has discussed this change at great length with the faculty at the school as well as their counterparts in Engineering.

The rationale for the change is that often the AIF paragraph written by the students did not directly address their interests in architecture if they were also applying to another program. As the personal (city, school, grades) information on the AIF has been stripped away most faculty saw the current format of the paragraph somewhat useless. With a higher than previous number of students selecting to do either a virtual or online interview, it is helpful to have a better understanding of their exposure to the area of study to make the interview more effective given the brief amount of time we have with each student.

- b) The current calendar list of electives reflects requirements that limited student elective choice that are being dropped in the 2024 version of the calendar. Students will no longer be required to limit their choices to a reduced number of courses based on separate listings of ARCH courses. The current lists also do not include all of our elective offerings, effectively telling the students that they do not qualify as ARCH electives, which in fact they do.

We would like the wording to change to reflect any ARCH electives. The precise wording to be developed in conjunction with our Quali corrections as they are provided for revisions.

The rationale for this change is a housekeeping motivated one that will make the formatting of the list match the requirements that have already gone through due process.

These changes should be effective for the 2024/25 calendar.

## Architecture Admissions

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### **The Admissions Process**

Students wishing to apply to the School of Architecture will be initially screened on the basis of grades received in their required courses. By this process, approximately 450 students will

be further considered for admission to the School of Architecture. These students are required to:

- Participate in an interview as part of the admissions process.
- Complete a test in the form of an English précis.
- Present a portfolio of creative work must at the time of the interview.

Admission to the School depends equally on success in the précis test and the results of the interview. ~~An Admissions Information Form is required.~~ **A completed questionnaire is required.**

With the high number of applications, students will normally need an overall average of 80%, a grade of at least 75% (usually 80%) in English, and at least low 70s in physics and the two required mathematics courses to be considered for an interview. If offered admission, a final grade of at least 70% (but 75% in English) in each required course is needed to maintain an offer of admission. It is recommended that students take art, history, and other creative courses. The [admission requirements](#) from other provinces and countries is available.

More information on the process, and portfolio requirements may be found on the [School of Architecture](#) website.

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## Honours Bachelor of Architectural Studies

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### Electives

~~BAS program elective courses are organized into two primary groups: Architecture Electives and Open Electives.~~

Students must complete a minimum of five elective courses (0.5 unit each) as follows:

- ~~Four Architecture Electives~~ **At least 4 ARCH Electives**
- ~~One Open Elective or Architecture Elective~~ **No more than one Open Elective**

### Architecture Electives

~~The Architecture elective requirement gives students breadth of study and opportunities for research at the upper levels of the pre-professional program in relation to four curricular areas:~~

~~Students must complete a minimum of four Architecture electives to meet graduation requirements.~~

- ~~ARCH 428 Rome and the Campagna (Rome)~~
- ~~ARCH 446 Italian Urban History (Rome)~~
- ~~ARCH 449 The Development of Modern Italian Architecture (Rome)~~
- ~~ARCH 510 Special Topics in Visual and Digital Media~~
- ~~ARCH 520 Special Topics in Urbanism and Landscape~~
- ~~ARCH 540 Special Topics in Architectural History and Theory~~
- ~~ARCH 570 Special Topics in Building Technology and Environment~~
- ~~ARCH 580 Special Topics in Race, Equity, and Environmental Justice~~

### **Open Elective**

**A maximum of one non-ARCH elective (0.50 unit) can be taken towards the five elective program requirement.** ~~A minimum of one elective (0.50 unit) from any discipline, any level, including architecture, must be completed to satisfy the open elective requirement. This course is nominally placed in the 4B term, but it can be taken in any term in the second to fourth years (2B, 3A, 3B, 4A, 4B) of the BAS program.~~

## 2.2 Biomedical Engineering

### Summary:

- a) Remove Cross-Listed Courses (ME 540, BIOL 487) from TE List and Specializations
- b) Add Courses to TE List
- c) Update Specialization Course Requirements

### Background & Rationale:

- a) With the new Quali calendar software cross-listed courses will show as separate lines which may be confusing to students and lead to the perception that there are more courses than actually offered. Department would like to encourage students to take the BMEXXX or SYDEXXX version of the course when possible for the BME plan and specializations.
- b) The TE list will be updated to include the new BME courses (BME 561, BME 552, BME 553, BME 564, BME 582), as well as courses that are required for specializations and are missing from the main list (MTE 545, NE 466, NE 481, NE 486, NE 487, SYDE 537, SYDE 577, SYDE 586).
- c) The new regular calendar courses being added to replace special topics courses with specific titles are required for BME specializations and thus the specializations will be updated with the new course codes.

## Biomedical Engineering

MARK-UP

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### **Technical Electives**

Each student in Biomedical Engineering must complete at least six approved technical electives (TEs) to meet graduation requirements. Students may arrange the sequencing of the technical elective courses to suit their plan (and any course prerequisites).

The Department of Systems Design Engineering offers a wide variety of technical elective courses in the third and fourth year. Biomedical Engineering students are encouraged to design their own elective package to develop expertise in their particular interest area. Approved technical elective courses are available from the Department of Systems Design Engineering (BME and SYDE TEs), from other Engineering departments, and from a wide list of technical courses in the faculties of Science and Mathematics. There are a variety of [technical electives with biomedical content](#), but students can also take technical electives on other topics. Only courses from Engineering and Computer Science will contribute towards CEAB hours in the categories of "Engineering Science" and "Engineering Design". Some examples are listed below.

- [BME 561 Biomaterials and Tissue Engineering](#)
- [BME 499](#) Elective Biomedical Research Project

- [BME 540/ME 540](#) Fundamentals in Neural and Rehabilitation Engineering
- [BME 544](#) Biomedical Measurement and Signal Processing
- [BME 550](#) Sports Engineering
- [BME 551](#) Biomechanics of Human Movement
- [BME 552 Computational Biomechanics](#)
- [BME 553 Introductory Mechanics of Biomedical and Biological Materials](#)
- [BME 564 Biocompatibility and Biomedical Design](#)
- [BME 581](#) Ultrasound in Medicine and Biology
- [BME 582 Biomedical Optics](#)
- [BME 587](#) Special Topics in Biomedical Signals
- [BME 588](#) Special Topics in Biomechanics
- [BME 589](#) Special Topics in Biomedical Devices
- [CIVE 460/ME 574](#) Engineering Biomechanics
- [ECE 224](#) Embedded Microprocessor Systems
- [ECE 252](#) Systems Programming and Concurrency
- [ECE 350](#) Real-Time Operating Systems
- [ECE 356](#) Database Systems
- [ECE 358](#) Computer Networks
- [ECE 406](#) Algorithm Design and Analysis
- [ECE 457B](#) Fundamentals of Computational Intelligence
- [ECE 459](#) Programming for Performance
- [ECE 484](#) Digital Control Applications
- [MSE 343](#) Human-Computer Interaction
- [MSE 432](#) Production and Service Operations Management
- [MSE 343](#) Human-Computer Interaction
- [MSCI 432](#) Production and Service Operations Management
- [MSE 446](#) Introduction to Machine Learning
- [MSE 555](#) Scheduling: Theory and Practice
- [MSE 446](#) Introduction to Machine Learning
- [MSE 555](#) Scheduling: Theory and Practice
- [ME 574/CIVE 460](#) Engineering Biomechanics
- [MTE 241](#) Introduction to Computer Structures and Real-Time Systems
- [MTE 325](#) Microprocessor Systems and Interfacing for Mechatronics Engineering
- [MTE 544](#) Autonomous Mobile Robots
- [MTE 545 Introduction to MEMS Fabrication](#)
- [NE 466 Tactile Sensors and Transducers](#)
- [NE 481 Nanomedicine and Nanobiotechnology](#)
- [NE 486 Biosensors](#)
- [NE 487 Microfluidic and Nanobiotechnological Systems](#)
- [SYDE 322](#) Software Design
- [SYDE 334](#) Applied Statistics
- [SYDE 522](#) Foundations of Artificial Intelligence
- [SYDE 531](#) Design Optimization Under Probabilistic Uncertainty
- [SYDE 532](#) Introduction to Complex Systems
- [SYDE 533](#) Conflict Resolution
- [SYDE 537 Artificial Life: Biology and Computation](#)
- [SYDE 542](#) Interface Design
- [SYDE 543](#) Cognitive Ergonomics
- [SYDE 548](#) User Centred Design Methods
- [SYDE 552/BIOE-487](#) Computational Neuroscience
- [SYDE 553](#) Advanced Dynamics
- [SYDE 556](#) Simulating Neurobiological Systems
- [SYDE 572](#) Introduction to Pattern Recognition

- [SYDE 575](#) Image Processing
- [SYDE 577 Deep Learning](#)
- ~~[SYDE 584](#) Physiological Systems and Biomedical Design~~
- [SYDE 586 Material Selection for Design](#)
- [SYDE 599](#) Special Topics in Systems Design Engineering

### ~~Biomedical Engineering~~

### ~~Civil Engineering~~

### ~~Electrical and Computer Engineering~~

### ~~Management Sciences~~

### ~~Mechanical Engineering~~

### ~~Mechatronics Engineering~~

### ~~Systems Design Engineering~~

### Specializations

Students may choose to take their technical electives from a more restricted list to receive the Biomaterials and Tissues Specialization, the Medical Artificial Intelligence Specialization, the Medical Devices Specialization, the Neural Engineering Specialization, or the Sports Engineering Specialization.

**Note:** It is the student's responsibility to ensure that their course selection meets the Biomedical Engineering requirements as well as the CEAB requirements, which include a minimum number of instruction hours in the various CEAB categories.

### Biomaterials and Tissues Specialization

The Biomaterials and Tissues Specialization consists of five courses, one required course and four elective courses. A minimum average of 60% in the five specialization courses and a grade of at least 50% in each of the courses is required. Students who satisfy the requirements for [Faculty Options, Specializations and Electives for Engineering Students](#) will have the appropriate designation shown on their diploma and transcript.

#### ~~Required course:~~

- ~~[BME 589](#) Special Topics in Biomedical Devices [Topic title: Biomaterials and Biomedical Design]~~

#### One course from the following list:

- [BME 561 Biomaterials and Tissue Engineering](#)
- [BME 564 Biocompatibility and Biomedical Design](#)

Two courses from the following list (biomaterial science and tissue mechanics):

- [BME 499](#) Elective Biomedical Research Project (requires approval from the co-ordinator of the Biomaterials and Tissues Specialization)
- ~~[BME 588](#) Special Topics in Biomechanics [Topic title: Introductory Mechanics of Biomedical and Biological Materials]~~
- ~~[BME 588](#) Special Topics in Biomechanics [Topic title: Computational Biomechanics]~~
- [BME 552](#) **Computational Biomechanics**
- [BME 553](#) **Introductory Mechanics of Biomedical and Biological Materials**
- [BME 589](#) Special Topics in Biomedical Devices (requires approval from the co-ordinator of the Biomaterials and Tissues Specialization)
- [NE 481](#) Nanomedicine and Nanobiotechnology

One course from the following list (material engineering):

- [CHE 541](#) Introduction to Polymer Science and Properties
- [ME 526](#) Fatigue and Fracture Analysis
- [ME 533](#) Non-metallic and Composite Materials
- [ME 559](#) Finite Element Methods
- [ME 598](#) Special Topics in Mechanical Engineering ~~[Topic title: Smart Materials and Active Structures]~~ **(requires approval from the co-ordinator of the Biomaterials and Tissues Specialization)**
- ~~[SYDE 599](#) Special Topics in Systems Design Engineering [Topic title: Material Selection for Design]~~
- [SYDE 586](#) **Material Selection for Design**

One course from the following list (biology and physiology):

- [BIOL 240](#) Fundamentals of Microbiology
- [BIOL 302](#) Functional Histology
- [BIOL 308](#) Principles of Molecular Biology
- [BIOL 355/GERON 355](#) Biology of Human Aging
- [BIOL 373](#) Principles of Human Physiology 2
- [BIOL 376](#) Cellular Neurophysiology
- [KIN 406](#) Physiology of Muscle Aging and Disease

### **Medical Artificial Intelligence Specialization**

The Medical Artificial Intelligence Specialization consists of five courses, three required courses and two elective courses. Students are also required to do either their capstone design project ([BME 461](#) or [GENE 403](#) or [SYDE 461](#) and [BME 462](#) or [GENE 404](#) or [SYDE 462](#)) or an elective research project ([BME 499](#)) with a focus on the use of artificial intelligence in healthcare. The project must be approved by the co-ordinator of the specialization. A minimum average of 60% in the specialization courses and a grade of at least 50% in each of the courses is required. Students who satisfy the requirements for [Faculty Options, Specializations and Electives for Engineering Students](#) will have the appropriate designation shown on their diploma and transcript.

Required courses:

- [BME 530](#) The Healthcare System
- [SYDE 572](#) Introduction to Pattern Recognition
- ~~[SYDE 599](#) Special Topics in Systems Design Engineering [Topic title: Deep Learning]~~



- **[SYDE 577 Deep Learning](#)**

One of the following, a capstone project or research project with a focus on medical artificial intelligence and approved by the specialization co-ordinator:

- [BME 461](#) Biomedical Engineering Design Workshop 2 and [BME 462](#) Biomedical Engineering Design Workshop 3
- [BME 499](#) Elective Biomedical Research Project
- [GENE 403](#) Interdisciplinary Design Project 1 and [GENE 404](#) Interdisciplinary Design Project 2
- [SYDE 461](#) Systems Design Capstone Project 1 and [SYDE 462](#) Systems Design Capstone Project 2

List 1: One course that provides a survey of artificial intelligence methods from the following list:

- [CS 486](#) Introduction to Artificial Intelligence
- [ECE 457B](#) Fundamentals of Computational Intelligence
- [SYDE 522](#) Foundations of Artificial intelligence

List 2: One additional course from the following list:

- [BME 499](#) Elective Biomedical Research Project (requires approval from the co-ordinator of the Medical Artificial Intelligence Specialization)
- [CS 485](#) Statistical and Computational Foundations of Machine Learning
- [ECE 457C](#) Reinforcement Learning
- [HLTH 230](#) Introduction to Health Informatics
- [MSE 446](#) Introduction to Machine Learning
- [STV 208](#) Artificial Intelligence and Society: Impact, Ethics, and Equity
- [SYDE 552](#)/[BIOL 487](#) Computational Neuroscience
- [SYDE 556](#) Simulating Neurobiological Systems

Alternatively, students can take zero courses from List 1 and two courses from List 2.

### **Medical Devices Specialization**

The Medical Devices Specialization consists of five technical elective courses. Students are also required to do either their capstone design project ([BME 461](#) or [GENE 403](#) or [SYDE 461](#) and [BME 462](#) or [GENE 404](#) or [SYDE 462](#)) or an elective research project ([BME 499](#)) with a focus on medical devices. The project must be approved by the specialization co-ordinator. A minimum average of 60% in the five specialization courses and a grade of at least 50% in each of the courses is required. Students who satisfy the requirements for [Faculty Options, Specializations and Electives for Engineering Students](#) will have the appropriate designation shown on their diploma and transcript.

One of the following, a capstone project or research project with a focus on biomedical devices and approved by the specialization co-ordinator:

- [BME 461](#) Biomedical Engineering Design Workshop 2 and [BME 462](#) Biomedical Engineering Design Workshop 3
- [BME 499](#) Elective Biomedical Research Project

- [GENE 403](#) Interdisciplinary Design Project 1 and [GENE 404](#) Interdisciplinary Design Project 2
- [SYDE 461](#) Systems Design Capstone Project 1 and [SYDE 462](#) Systems Design Capstone Project 2

One course from the following list (biocompatibility or clinical assessment of medical devices):

- [BME 540/ME 540](#) Fundamentals in Neural and Rehabilitation Engineering
- ~~[BME 589](#) Special Topics in Biomedical Devices [Topic title: Biomaterials and Biomedical Design]~~
- ~~[BME 589](#) Special Topics in Biomedical Devices (biocompatibility topic approved by the specialization co-ordinator)~~
- **[BME 564 Biocompatibility and Biomedical Design](#)**

Two courses from the following list (elements of biomedical devices):

- **[BME 582 Biomedical Optics](#)**
- ~~[BME 589](#) Special Topics in Biomedical Devices [Topic title: Biomedical Engineering Electronic Circuits]~~
- ~~[ME 598](#) Special Topics in Mechanical Engineering [Topic title: Smart Materials and Active Structures]~~
- [MTE 545](#) Introduction to MEMS Fabrication
- [NE 466](#) Tactile Sensors and Transducers
- [NE 486](#) Biosensors
- [NE 487](#) Microfluidic and Nanobiotechnological Systems

Two additional courses from either list above or among the following courses:

- ~~[BME 588](#) Special Topics in Biomechanics [Topic title: Introductory Mechanics of Biomedical and Biological Materials]~~
- ~~[SYDE 599](#) Special Topics in Systems Design Engineering [Topic title: Material Selection for Design]~~
- **[BME 553 Introductory Mechanics of Biomedical and Biological Materials](#)**
- **[BME 581 Ultrasound in Medicine and Biology](#)**
- **[SYDE 586 Material Selection for Design](#)**

### Neural Engineering Specialization

The Neural Engineering Specialization consists of five courses covering a wide range of neuroscience topics and computational applications in neuroscience. Students are also required to do either their capstone design project ([BME 461](#) or [GENE 403](#) or [SYDE 461](#) and [BME 462](#) or [GENE 404](#) or [SYDE 462](#)) or an elective research project ([BME 499](#)) with a focus on neuroscience applications. The project must be approved by the co-ordinator of the Neural Engineering Specialization. A minimum average of 60% in the five specialization courses and a grade of at least 50% in each of the courses is required. Students who satisfy the requirements for [Options, Specializations and Electives for Engineering Students](#) will have the appropriate designation shown on their diploma and transcript.

One course from the following list:

- ~~[SYDE 552](#)~~/~~[BIOL 487](#)~~ Computational Neuroscience

- [SYDE 556](#) Simulating Neurobiological Systems

One of the following, capstone project or research project with a focus on neural engineering and approved by the specialization co-ordinator:

- [BME 461](#) Biomedical Engineering Design Workshop 2 and [BME 462](#) Biomedical Engineering Design Workshop 3
- [BME 499](#) Elective Biomedical Research Project
- [GENE 403](#) Interdisciplinary Design Project 1 and [GENE 404](#) Interdisciplinary Design Project 2
- [SYDE 461](#) Systems Design Capstone Project 1 and [SYDE 462](#) Systems Design Capstone Project 2

Two courses from List 1: Anatomy and Physiology of the Nervous System:

- [BIOL 376](#) Cellular Neurophysiology
- [KIN 255](#) Fundamentals of Neuroscience
- [KIN 301](#) Human Anatomy of the Central Nervous System
- [KIN 416](#) Neuromuscular Integration
- [PHIL 256/PSYCH 256](#) Introduction to Cognitive Science
- [PSYCH 261](#) Physiological Psychology
- [PSYCH 307](#) Human Neuropsychology

One additional course from List 2: Computational Methods in Neuroscience:

- [AMATH 382/BIOL 382](#) Computational Modelling of Cellular Systems
- [AMATH 451](#) Introduction to Dynamical Systems
- [BME 499](#) Elective Biomedical Research Project (requires approval from the co-ordinator of the Neural Engineering Specialization)
- [BME 587](#) Special Topics in Biomedical Signals (requires approval from the co-ordinator of the Neural Engineering Specialization)
- [STAT 441](#) Statistical Learning - Classification
- [STAT 444](#) Statistical Learning - Advanced Regression
- [SYDE 522](#) Foundations of Artificial Intelligence
- [SYDE 552/BIOL 487](#) Computational Neuroscience
- [SYDE 556](#) Simulating Neurobiological Systems
- [SYDE 572](#) Introduction to Pattern Recognition

One additional course from either List 1 or List 2.

### **Notes**

- Some courses in List 1 ([PHIL 256/PSYCH 256](#)) can be counted towards Complementary Studies Requirements.
- Biomedical Engineering students may lack prerequisites for some of these courses and should ensure that they obtain the prerequisite courses prior to taking such courses. However, there are several courses in the list ([BIOL 376](#), [PHIL 256/PSYCH 256](#), [SYDE 522](#), [SYDE 552/BIOL 487](#), [SYDE 556](#), and [SYDE 572](#)) where students will have the appropriate prerequisites.

### **Sports Engineering Specialization**

The Sports Engineering Specialization consists of five courses, two specific required courses, plus three additional courses drawn from the provided list. Students are also required to do either their capstone design project ([BME 461](#) or [GENE 403](#) or [SYDE 461](#) and [BME 462](#) or [GENE 404](#) or [SYDE 462](#)) or an elective research project ([BME 499](#)) with a focus on a new sport equipment or training device. The project must be approved by the co-ordinator of the Sports Engineering Specialization. A minimum average of 60% in the five specialization courses and a grade of at least 50% in each of the courses is required. Students who satisfy the requirements for [Options, Specializations and Electives for Engineering Students](#) will have the appropriate designation shown on their diploma and transcript.

~~Required courses:~~ **Two courses from the following list:**

- [BME 550](#) Sports Engineering
- [BME 551](#) Biomechanics of Human Movement ~~or [BME 588](#) Special topics in Biomechanics (topic: Computational Biomechanics)~~
- **[BME 552](#) Computational Biomechanics**

One of the following, a capstone project or research project with a focus on sports engineering and approved by the specialization co-ordinator:

- [BME 461](#) Biomedical Engineering Design Workshop 2 and [BME 462](#) Biomedical Engineering Design Workshop 3
- [BME 499](#) Elective Biomedical Research Project
- [GENE 403](#) Interdisciplinary Design Project 1 and [GENE 404](#) Interdisciplinary Design Project 2
- [SYDE 461](#) Systems Design Capstone Project 1 and [SYDE 462](#) Systems Design Capstone Project 2

Any three additional courses from the following list must also be taken:

- [BME 499](#) Elective Biomedical Research Project (requires approval from the co-ordinator of the Sports Engineering Specialization)
- [BME 544](#) Biomedical Measurement and Signal Processing
- [BME 588](#) Special Topics in Biomechanics
- [CIVE 460/ME 574](#) Engineering Biomechanics
- [ECE 417](#) or [SYDE 575](#) Image Processing
- [KIN 340](#) Musculoskeletal Injuries in Sport and Activity
- [ME 362](#) Fluid Mechanics 2
- [ME 533](#) Non-metallic and Composite Materials
- [ME 559](#) Finite Element Methods
- [SYDE 553](#) Advanced Dynamics

## 2.3 Chemical Engineering

### Summary:

- a) Add GENE 403/404 as CHE 482/483 Alternative
- b) Remove Cross-Listed Courses (BIOL 349, NE 481 & NE 488) from Plan

### Background & Rationale:

- a) GENE 403/GENE 404 are already permitted as an alternative to CHE 482/CHE 483 when students choose to work with students from another program to complete an interdisciplinary capstone project. Some programs list these courses in the calendar, others do not. The Faculty of Engineering would like all programs to start listing these courses as alternatives for consistency across the faculty.
- b) Cross-listed courses (BIOL 349, NE 481 & NE 488) will be removed from the technical electives list under the chemical engineering plan and the three chemical engineering specializations. With the new calendar software cross-listed courses appear as separate lines. This may be confusing to students who may not realize that these courses are cross-listed. We would also like to encourage students to take the CHE 5xx version of the course when possible since this increases their flexibility in choosing remaining technical electives. Note: Students are required to take 4 approved technical electives of which 2 are CHE5xx courses.

## Chemical Engineering

MARK UP

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### **Term 4A (Fall)**

- [CHE 480](#) Process Analysis and Design
- [CHE 482](#) Group Design Project or [GENE 403 Interdisciplinary Design Project 1](#)
- [CHE 490](#) Chemical Engineering Lab 4
- [CHE 450](#) Technical Work-term Report
- Three Technical Electives or Complementary Studies Electives

### **Term 4B (Winter)**

- [CHE 483](#) Group Design Project and Symposium or [GENE 404 Interdisciplinary Design Project 2](#)
- [CHE 491](#) Chemical Engineering Lab 5
- Four Technical Electives or Complementary Studies Electives

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## Technical Electives

A total of four Technical Electives (TEs) courses must be taken, selected from the following lists. The lists are organized in three main thematic areas and students selecting all four TEs from the same list may choose to register for a specialization (further information below). Only one non-CHE course (i.e., from other departments) is permitted if [CHE 499](#) is chosen. Otherwise, students may select up to two non-CHE TEs. Non-CHE courses will likely require permission of the instructor and/or other prerequisites. Variations from this course selection list must be approved by the Department.

### **List 1 - Energy and Environmental Systems and Processes**

- [CHE 499](#) Elective Research Project
- [CHE 500](#) Special Topics in Chemical Engineering
- [CHE 514](#) Fundamentals of Petroleum Production
- [CHE 516](#) Energy Systems Engineering
- [CHE 520](#) Process Flowsheet Analysis
- [CHE 565](#)/~~[BIOL 349](#)~~ Synthetic Biology Project Design
- [CHE 571](#) Industrial Ecology
- [CHE 572](#) Air Pollution Control
- [CHE 574](#) Industrial Wastewater Pollution Control
- [EARTH 458](#) Physical Hydrogeology
- [EARTH 459](#) Chemical Hydrogeology
- [ENVE 376](#) Biological Processes
- [ENVE 573](#) Contaminant Transport
- [ENVE 577](#) Engineering for Solid Waste Management
- [ME 452](#) HVAC Load Analysis and Design Fundamentals
- [ME 459](#) Energy Conversion
- [ME 571](#) Air Pollution

### **List 2 - Materials and Manufacturing Processes**

- [CHE 499](#) Elective Research Project
- [CHE 500](#) Special Topics in Chemical Engineering
- [CHE 520](#) Process Flowsheet Analysis
- [CHE 541](#) Introduction to Polymer Science and Properties
- [CHE 543](#) Polymer Production: Polymer Reaction Engineering
- [CHE 560](#) Nanomedicine and Nanobiotechnology
- [CHE 561](#)/~~[NE 488](#)~~ Biomaterials and Biomedical Design
- [CHE 562](#) Advanced Bioprocess Engineering
- [CHE 564](#) Food Process Engineering
- [CHE 565](#)/~~[BIOL 349](#)~~ Synthetic Biology Project Design
- [CHE 571](#) Industrial Ecology
- [ME 435](#) Industrial Metallurgy
- [ME 531](#) Physical Metallurgy Applied to Manufacturing
- [ME 533](#) Non-metallic and Composite Materials
- [MSE 432](#) Production and Service Operations Management

- [MSE 551](#) Quality Management and Control
- [NE 352](#) Surfaces and Interfaces
- ~~[NE 481](#) Nanomedicine and Nanobiotechnology~~

**List 3 - Chemical Process Modelling, Optimization, and Control**

- [CHE 499](#) Elective Research Project
- [CHE 500](#) Special Topics in Chemical Engineering
- [CHE 520](#) Process Flowsheet Analysis
- [CHE 521](#) Process Optimization
- [CHE 522](#) Advanced Process Dynamics and Control
- [CHE 524](#) Process Control Laboratory
- [CHE 565](#)/~~[BIOL 349](#)~~ Synthetic Biology Project Design
- [EARTH 456](#) Numerical Methods in Hydrogeology
- [ME 362](#) Fluid Mechanics 2
- [ME 559](#) Finite Element Methods
- [ME 566](#) Computational Fluid Dynamics for Engineering Design
- [MSE 332](#) Deterministic Optimization Models and Methods
- [MSE 431](#) Stochastic Models and Methods
- [MSE 432](#) Production and Service Operations Management
- [MSE 551](#) Quality Management and Control
- [NE 451](#) Simulation Methods
- [SYDE 531](#) Design Optimization Under Probabilistic Uncertainty

Information for all undergraduate courses, including [Chemical Engineering](#), can be found in the Course Descriptions section of this Calendar.

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## 2.4 Mechanical Engineering

### Summary:

Update Technical Elective List

### Background & Rationale:

The non-ME/MTE courses being added to the list of TEs are pre-approved courses ME students can take to meet the TE requirement for their program. Having the courses added to the list on the calendar will be beneficial for increasing clarity for students when choosing courses, facilitating degree audit, and reducing record-keeping administrative effort. Lists will be split into ME/MTE electives and non-ME/MTE electives for clarity.

## Mechanical Engineering

MARK UP

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### **Technical Electives**

Seven technical electives (TEs) are required in addition to the core courses listed above to fulfil the requirements of the Mechanical Engineering curriculum. Lists of approved TEs are found below. A minimum of four of the seven TEs must be 400- or 500-level ME or MTE technical elective courses. A maximum of three TEs can be 400- or 500-level non-ME/MTE TEs from the list below or a graduate level course. Other non-ME/MTE TEs may be substituted with the approval of the Department of Mechanical and Mechatronics Engineering's associate chair.

Students who are contemplating graduate studies, ~~or who complete the majority of their TEs from one theme,~~ or who complete the Welding and Joining Specialization, can request permission to take a graduate-level course. It is recommended that students discuss their study plans with a faculty member.

~~A maximum of three TEs can be 400- or 500-level TEs from other University of Waterloo engineering plans or a graduate level course as discussed below. Students may require instructor and department permission to enrol in courses from another department. Technical electives may have prerequisites that have to be taken first. Some 400- and 500-level courses are not TEs but are CSEs. Courses listed as a CSE cannot be counted towards the TE requirement.~~

~~Mechanical Engineering technical electives are grouped into five different themes: Automation and Control, Fluid Mechanics, Machine Design and Solid Mechanics, Materials Engineering and Processing, and Thermal Engineering. It is possible to combine courses from different theme areas. Students are responsible for selecting their own combination of electives, in keeping with their ultimate career objective after graduation. To assist in ensuring that course selections satisfy all academic requirements, students are encouraged~~



~~to discuss and obtain approval from the Department of Mechanical and Mechatronics Engineering's undergraduate advisor and/or the associate chair.~~

#### List 1 – ME/MTE Technical Electives

- [ME 423 Mechanical Design 2](#)
- [ME 435 Industrial Metallurgy](#)
- [ME 436 Welding and Joining Processes](#)
- [ME 452 HVAC Load Analysis and Design Fundamentals](#)
- [ME 456 Heat Transfer 2](#)
- [ME 459 Energy Conversion](#)
- [ME 524 Advanced Dynamics and Vibrations](#)
- [ME 526 Fatigue and Fracture Analysis](#)
- [ME 531 Physical Metallurgy Applied to Manufacturing](#)
- [ME 533 Non-metallic and Composite Materials](#)
- [ME 535 Welding Metallurgy](#)
- [ME 538 Welding Design, Fabrication and Quality Control](#)
- [ME 540 Fundamentals in Neural and Rehabilitation Engineering](#)
- [ME 547 Robot Manipulators: Kinematics, Dynamics, Control](#)
- [ME 548 Numerical Control of Machine Tools 1](#)
- [ME 555 Computer-Aided Design](#)
- [ME 557 Combustion 1](#)
- [ME 559 Finite Element Methods](#)
- [ME 561 Fluid Power Control Systems](#)
- [ME 562 Experimental Methods in Fluids](#)
- [ME 563 Turbomachines](#)
- [ME 564 Aerodynamics](#)
- [ME 566 Computational Fluid Dynamics for Engineering Design](#)
- [ME 567 Fire Safety Engineering](#)
- [ME 571 Air Pollution](#)
- [ME 572/AE 572 Building Energy Analysis](#)
- [ME 573/AE 573 HVAC Systems, Equipment, and Energy Efficiency](#)
- [ME 574/CIVE 460 Engineering Biomechanics](#)
- [ME 595 Special Topics in Mechanical Engineering](#)
- [ME 596 Special Topics in Mechanical Engineering](#)
- [ME 597 Special Topics in Mechanical Engineering](#)
- [ME 598 Special Topics in Mechanical Engineering](#)
- [ME 599 Special Topics in Mechanical Engineering](#)
- [MTE 420 Power Electronics and Motor Drives](#)
- [MTE 421 Linear and Nonlinear Electronics](#)
- [MTE 460 Mechatronic System Integration](#)
- [MTE 544 Autonomous Mobile Robotics](#)
- [MTE 545 Introduction to MEMs Fabrication](#)
- [MTE 546 Multi-Sensor Data Fusion](#)

#### List 2 – Non-ME/MTE Technical Electives

- [ECE 305 Introduction to Quantum Mechanics](#)
- [ECE 406 Algorithm Design and Analysis](#)
- [ECE 457A Cooperative and Adaptive Algorithms](#)
- [ECE 457B Fundamentals of Computational Intelligence](#)
- [ECE 459 Programming for Performance](#)
- [ECE 481 Digital Control Systems](#)

- [ECE 484 Digital Control Applications](#)
- [ECE 486 Robot Dynamics and Control](#)
- [ECE 488 Multivariable Control Systems](#)
- [ECE 495 Autonomous Vehicles](#)
- [MSE 331 Introduction to Optimization](#)
- [MSE 431 Stochastic Models and Methods](#)
- [MSE 432 Production and Service Operations Management](#)
- [MSE 446 Introduction to Machine Learning](#)
- [MSE 452 Decision Making Under Uncertainty](#)
- [MSE 551 Quality Management and Control](#)
- [MSE 555 Scheduling: Theory and Practice](#)
- [SYDE 522 Foundations of Artificial Intelligence](#)
- [SYDE 532 Introduction to Complex Systems](#)
- [SYDE 543 Cognitive Ergonomics](#)
- [SYDE 548 User Centred Design Methods](#)
- [SYDE 553 Advanced Dynamics](#)
- [SYDE 572 Introduction to Pattern Recognition](#)
- [SYDE 584 Physiological Systems and Biomedical Design](#)

### ***Automation and Control***

- ~~ME 435 Industrial Metallurgy~~
- ~~ME 538 Welding Design, Fabrication and Quality Control~~
- ~~ME 540/BME 540 Fundamentals in Neural and Rehabilitation Engineering~~
- ~~ME 547 Robot Manipulators: Kinematics, Dynamics, Control~~
- ~~ME 548 Numerical Control of Machine Tools 1~~
- ~~ME 555 Computer Aided Design~~
- ~~ME 559 Finite Element Methods~~
- ~~ME 561 Fluid Power Control Systems~~
- ~~ME 597 Special Topics in Mechanical Engineering~~

### ***Fluid Mechanics***

- ~~ME 562 Experimental Methods in Fluids~~
- ~~ME 563 Turbomachines~~
- ~~ME 564 Aerodynamics~~
- ~~ME 566 Computational Fluid Dynamics for Engineering Design~~
- ~~ME 567 Fire Safety Engineering~~
- ~~ME 571 Air Pollution~~
- ~~ME 595 Special Topics in Mechanical Engineering~~

### ***Machine Design and Solid Mechanics***

- ~~ME 423 Mechanical Design 2~~
- ~~ME 435 Industrial Metallurgy~~
- ~~ME 524 Advanced Dynamics and Vibrations~~
- ~~ME 526 Fatigue and Fracture Analysis~~
- ~~ME 538 Welding Design, Fabrication and Quality Control~~
- ~~ME 555 Computer Aided Design~~
- ~~ME 559 Finite Element Methods~~
- ~~ME 574/CIVE 460 Engineering Biomechanics~~

- ~~ME 598 Special Topics in Mechanical Engineering~~

### ***Materials Engineering and Processing***

- ~~ME 435 Industrial Metallurgy~~
- ~~ME 436 Welding and Joining Processes~~
- ~~ME 526 Fatigue and Fracture Analysis~~
- ~~ME 531 Physical Metallurgy Applied to Manufacturing~~
- ~~ME 533 Non-metallic and Composite Materials~~
- ~~ME 535 Welding Metallurgy~~
- ~~ME 538 Welding Design, Fabrication and Quality Control~~
- ~~ME 596 Special Topics in Mechanical Engineering~~

### ***Thermal Engineering***

- ~~ME 452 HVAC Load Analysis and Design Fundamentals~~
- ~~ME 456 Heat Transfer 2~~
- ~~ME 459 Energy Conversion~~
- ~~ME 557 Combustion 1~~
- ~~ME 559 Finite Element Methods~~
- ~~ME 567 Fire Safety Engineering~~
- ~~ME 571 Air Pollution~~
- ~~ME 572/AE 572 Building Energy Analysis~~
- ~~ME 573/AE 573 HVAC Systems, Equipment, and Energy Efficiency~~
- ~~ME 599 Special Topics in Mechanical Engineering~~

■ ■ ■

## 2.5 Mechatronics Engineering

### Summary:

Adding courses (ECE 406, 423, 452, 455, 457A, 459, 493, 495) to the TE list

### Background & Rationale:

There are a noteworthy number of Mechatronics Engineering students taking ECE 406, ECE 423, ECE 452, ECE 455, ECE 457A, ECE 459, ECE 493, and ECE 495 on a regular basis and therefore the department would like to add these courses to the list of approved technical electives. This will provide students more options when selecting technical electives to meet program requirements. Additionally, editorial changes to the TE lists have been made to suit the new Quali calendar software and increase clarity.

## Mechatronics Engineering

MARK-UP

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### **Technical Electives**

The five technical electives (TEs) are to be chosen from the list below.

### **~~Courses Offered in the 4A (Fall) Term~~**

~~Choose two:~~

### Complete 5 of the following:

- [ECE 327](#) Digital Hardware Systems
- [ECE 358](#) Computer Networks
- [ECE 406 Algorithm Design and Analysis](#)
- [ECE 423 Embedded Computer Systems](#)
- [ECE 452 Software Design and Architectures](#)
- [ECE 455 Embedded Software](#)
- [ECE 457A Co-operative and Adaptive Algorithms](#)
- [ECE 457B](#) Fundamentals of Computational Intelligence
- [ECE 459 Programming for Performance](#)
- [ECE 488](#) Multivariable Control Systems
- [ECE 493 Special Topics in Electrical and Computer Engineering](#)
- [ECE 495 Autonomous Vehicles](#)
- [ME 362](#) Fluid Mechanics 2
- [ME 436](#) Welding and Joining Processes
- [ME 452](#) HVAC Load Analysis and Design Fundamentals
- [ME 459](#) Energy Conversion
- [ME 524](#) Advanced Dynamics and Vibrations or [SYDE 553](#) Advanced Dynamics

- [ME 547](#) Robotic Manipulators: Kinematics, Dynamics, Control or [ECE 486](#) Robotic Dynamics and Control
- [ME 548](#) Numerical Control of Machine Tools 1
- [ME 555](#) Computer-Aided Design
- [ME 559](#) Finite Element Methods
- [ME 561](#) Fluid Power Control Systems
- [ME 563](#) Turbomachines
- [ME 564](#) Aerodynamics
- [MTE 420](#) Power Electronics and Motor Drives or [ECE 463](#) Design & Applications of Power Electronic Converters (offered Spring)
- [MTE 421](#) Linear and Nonlinear Electronics
- [MTE 460](#) Mechatronic System Integration
- [MTE 544](#) Autonomous Mobile Robots
- [MTE 545](#) Introduction to MEMS Fabrication
- [MTE 546](#) Multi-sensor Data Fusion
- [SYDE 522](#) Foundations of Artificial Intelligence
- [SYDE 533](#) Conflict Resolution
- [SYDE 542](#) Interface Design
- [SYDE 544](#) Biomedical Measurement and Signal Processing
- [SYDE 543](#) Cognitive Ergonomics
- [SYDE 548](#) User Centred Design Methods
- [SYDE 556](#) Simulating Neurobiological Systems
- [SYDE 572](#) Introduction to Pattern Recognition
- [SYDE 575](#) Image Processing
- [SYDE 584](#) Physiological Systems and Biomedical Design

**Courses Offered in the 4B (Winter) Term**

Choose three:

## 2.6 Nanotechnology Engineering

### **Summary:**

- a) Add GENE 403/404 as NE 408/409 Alternative
- b) Remove CHE 561 from Technical Elective List
- c) Update Communication Requirement

### **Background & Rationale:**

- a) These courses are already permitted as an alternative to NE 408/NE 409 when students choose to work with students from another program to complete an interdisciplinary capstone project. Some programs list these courses in the calendar, others do not. The Faculty of Engineering would like all programs to start listing these courses as alternatives for consistency across the faculty. Department consent will be required for students to enroll in these courses.
- b) In Quali cross-listed courses appear as separate lines. CHE 561 is an anti-requisite and cross-listed with NE 488. By removing CHE 561 from the approved technical electives list, it will eliminate confusion from the students and prevent them from accidentally taking two courses that are identical. To avoid confusion for students and encourage them to take the NE version of the course (NE 488). The courses will remain cross-listed in the course description requirements.
- c) It is the current practice in the NE program to have the communication course that is required for the program to be taken only in in-person lectures. This change enables students to take the course online if circumstances are appropriate, which brings NE into alignment with most other programs.

## Nanotechnology Engineering

MARK-UP

■■■

### **Term 4A (Fall)**

- [NE 408](#) Nanosystems Design Project **or** [GENE 403 Interdisciplinary Design Project 1](#)
- [Complementary Studies Elective](#)
- Three Technical Electives
- Two senior laboratory course electives selected from:
  - [NE 454A](#) Nano-electronics Laboratory 1
  - [NE 454B](#) Nano-instrumentation Laboratory 1
  - [NE 454C](#) Nanobiosystems Laboratory 1
  - [NE 454D](#) Nanostructured Materials Laboratory 1

## Term 4B (Winter)

- [NE 409](#) Nanosystems Design Project and Symposium **or** [GENE 404 Interdisciplinary Design Project 2](#)
- [Complementary Studies Elective](#)
- Three Technical Electives
- Two senior laboratory course electives selected from:
  - [NE 455A](#) Nano-electronics Laboratory 2
  - [NE 455B](#) Nano-instrumentation Laboratory 2
  - [NE 455C](#) Nanobiosystems Laboratory 2
  - [NE 455D](#) Nanostructured Materials Laboratory 2

## Undergraduate Communication Requirement

Strong communication skills are essential to academic, professional, and personal success. To satisfy the Undergraduate Communication Requirement, Nanotechnology Engineering students must successfully complete a foundational course on communication. This course is scheduled into the 2A term, must be completed prior to enrolling in the 3A term, and can be selected from the following list below. ~~These courses cannot be taken online.~~

- [COMMST 100](#) Interpersonal Communication
- [COMMST 223](#) Public Speaking
- [EMLS 101R](#) Oral Communications for Academic Purposes
- [EMLS 102R](#) Clear Communication in English Writing
- [ENGL 109](#) Introduction to Academic Writing
- [ENGL 129R/EMLS 129R](#) Written Academic English

■ ■ ■

## Technical Electives

The Nanotechnology Engineering plan may be divided broadly into four areas of concentration, identified herein as micro and nano-instrumentation, nano-electronics, nanobiosystems, and nanomaterials. A set of eight technical elective course choices is provided in the curriculum to enable students to focus upon at least two of these areas of concentration. Students may choose up to four courses from outside the Nanotechnology Engineering plan to complement their studies. Approved technical electives are listed below. For a list of courses available in a specific term, consult the nanotechnology engineering undergraduate co-ordinator. The associate director (program) has the right, where the number of students enrolled in a course at the end of the Course Selection Period is 10 or less, to cancel the course.

**Note:** For [NE 453](#), more than one course may be offered simultaneously under this course number.

- [NE 335](#) Soft Nanomaterials
- [NE 344](#) Electronic Circuits
- [NE 345](#) Photonic Materials and Devices
- [NE 353](#) Nanoprobing and Lithography
- [NE 381](#) Introduction to Nanoscale Biosystems
- [NE 451](#) Simulation Methods
- [NE 452](#) Special Topics in Nanoscale Simulations
- [NE 453](#) Special Topics in Nanotechnology Engineering
- [NE 459](#) Nanotechnology Engineering Research Project
- [NE 461](#) Micro and Nano-instrumentation
- [NE 466](#) Tactile Sensors and Transducers
- [NE 471](#) Nano-electronics
- [NE 476](#) Organic Electronics
- [NE 481](#) Nanomedicine and Nanobiotechnology
- [NE 486](#) Biosensors
- [NE 487](#) Microfluidic and Nanobiotechnological Systems
- [NE 488](#)/~~[CHE 561](#)~~ Biomaterials and Biomedical Design
- [NE 491](#) Nanostructured Materials
- [NE 496](#) Nanomaterials for Electrochemical Energy Systems

■ ■ ■



## 2.7 Systems Design Engineering

### Summary

Remove Cross-Listed Course (BIOL 487) from Technical Elective List

### Background & Rationale:

With the new Quali calendar software cross-listed courses will show as separate lines which may be confusing to students and lead to the perception that there are more courses than actually offered. Thus, BIOL 487 which is cross-listed with SYDE 552 will be removed from the list of approved technical electives on the plan page. Department would like to encourage students to take the BMEXXX or SYDEXXX version of the course when possible.

## Systems Design Engineering

MARK-UP

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### **Technical Electives**

Students must complete a minimum of six department-approved technical electives (TEs) to meet graduation requirements. Students may arrange the sequencing of the technical elective courses to suit their plan (and any course prerequisites).

The Department of Systems Design Engineering offers a wide variety of technical elective courses in the third and fourth year. Students are encouraged to design their own elective package to develop expertise in their particular interest area (see the Technical Elective Package section below). Approved technical elective courses are available from Systems Design Engineering, from other Engineering departments, and from a wide list of technical courses in the faculties of Science and Mathematics. Only courses from Engineering and Computer Science will contribute towards CEAB hours in the categories of "Engineering Science" and "Engineering Design". Some examples are listed below.

### **Biomedical Engineering**

- [BME 499](#) Elective Biomedical Research Project
- [BME 544](#) Biomedical Measurement and Signal Processing
- [BME 550](#) Sports Engineering
- [BME 551](#) Biomechanics of Human Movement
- [BME 581](#) Ultrasound in Medicine and Biology
- [BME 587](#) Special Topics in Biomedical Signals
- [BME 588](#) Special Topics in Biomechanics
- [BME 589](#) Special Topics in Biomedical Devices

### **Civil Engineering**

- [CIVE 440/PLAN 478](#) Transit Planning and Operations
- [CIVE 460/ME 574](#) Engineering Biomechanics

### **Electrical and Computer Engineering**

- [ECE 254](#) Operating Systems and Systems Programming
- [ECE 356](#) Database Systems
- [ECE 358](#) Computer Networks
- [ECE 406](#) Algorithm Design and Analysis
- [ECE 457B](#) Fundamentals of Computational Intelligence
- [ECE 459](#) Programming for Performance
- [ECE 484](#) Digital Control Applications

### **Management Science and Engineering**

- [MSE 343](#) Human-Computer Interaction
- [MSE 432](#) Production and Service Operations Management
- [MSE 446](#) Introduction to Machine Learning
- [MSE 555](#) Scheduling: Theory and Practice

### **Mechanical Engineering**

- [ME 321](#) Kinematics and Dynamics of Machines
- [ME 574/CIVE 460](#) Engineering Biomechanics

### **Mechatronics Engineering**

- [MTE 241](#) Introduction to Computer Structures and Real-Time Systems
- [MTE 325](#) Microprocessor Systems and Interfacing for Mechatronics Engineering
- [MTE 544](#) Autonomous Mobile Robots

### **Systems Design Engineering**

- [SYDE 322](#) Software Design
- [SYDE 334](#) Applied Statistics
- [SYDE 522](#) Foundations of Artificial Intelligence
- [SYDE 531](#) Design Optimization Under Probabilistic Uncertainty
- [SYDE 532](#) Introduction to Complex Systems
- [SYDE 533](#) Conflict Resolution
- [SYDE 542](#) Interface Design
- [SYDE 543](#) Cognitive Ergonomics
- [SYDE 544](#) Biomedical Measurement and Signal Processing
- [SYDE 548](#) User Centred Design Methods
- [SYDE 552/BIOE-487](#) Computational Neuroscience
- [SYDE 553](#) Advanced Dynamics
- [SYDE 556](#) Simulating Neurobiological Systems
- [SYDE 572](#) Introduction to Pattern Recognition
- [SYDE 575](#) Image Processing
- [SYDE 584](#) Physiological Systems and Biomedical Design
- [SYDE 599](#) Special Topics in Systems Design Engineering

## 2.8 Computer Engineering Option

### Summary:

Include Pre-Approved List A CSE Courses

### Background & Rationale:

Both the Computer Engineering Option and Software Engineering Option currently state that students need to take “one course from List A Complementary Studies Course Lists for Engineering Students that considers application of computing technology, or an alternative approved by the option co-ordinator.” Providing a pre-approved list of courses to satisfy this requirement makes it easier for students to see examples of courses that meet the requirement and reduce the administrative load of approving courses. Additionally, editorial changes to the plan pages will be made to make the requirements of the options clearer to students. CS 136L was removed from the course list as passing the course was not a requirement of the option (See note under List 3 in option).

## Computer Engineering Option

MARK-UP

The Computer Engineering Option is available to all students in the Faculty of Engineering (including Architecture), except students in Computer Engineering. It requires a total of eight courses (**4.0 units**):

- Two of:
  - [ECE 320](#) Computer Architecture
  - [ECE 327](#) Digital Hardware Systems
  - [ECE 423](#) Embedded Computer Systems
  - [ECE 455](#) Embedded Software
- **One course from List 1, one course from List 2, one course from List 3 and the at least 3 courses from List 4.** ~~Five additional courses from the topics list below, one of which may be substituted with a course from the data structures and algorithms list.~~
- ~~One course from List A Complementary Studies Course Lists for Engineering Students that considers application of computing technology, or an alternative approved by the option co-ordinator.~~

The courses chosen to satisfy this Option must satisfy four additional constraints:

- ~~They must satisfy Canadian Engineering Accreditation Board (CEAB) requirements.~~
- ~~They must be approved by the option co-ordinator.~~
- Five of the courses must be considered elective (that is, not core requirements) in the student's academic plan. For the purposes of this Option, a course that a student could choose to graduate without will be considered elective.
- The student must have earned a minimum average of 75% in the selected courses in order to have earned the Option.

~~Students pursuing this Option are recommended to select courses in the areas of logic, digital hardware, operating systems, computing systems, databases, networks, and security and privacy.~~

Students may not declare this Option until they have completed ~~both an introductory programming course and a data structures and algorithms course~~ [a List 1 and List 2 course](#). Students must have a minimum average of 75% in these two courses in order to declare this Option.

The lists below are intended to be the same as for the [Computing Option](#) and the [Software Engineering Option](#). These lists are also intended to include courses that are normally part of the [Computing Minor](#) offered by the Cheriton School of Computer Science. Other courses from Computer Science may be used towards this Option with permission of the option co-ordinator. Students may declare at most one of the Computing Option, Computer Engineering Option, or Software Engineering Option. ~~Students may change which of the three Options they declare by contacting the option co-ordinator(s).~~

### **Introductory Programming [List 1](#)**

- [AE 121](#) Computational Methods
- [BME 121](#) Digital Computation
- [CHE 120](#) Computer Literacy and Programming for Chemical Engineers
- [CIVE 121/ENVE 121/GEOF 121](#) Computational Methods
- [CS 115](#) Introduction to Computer Science 1
- [CS 116](#) Introduction to Computer Science 2
- [CS 135](#) Designing Functional Programs
- [CS 137](#) Programming Principles
- [CS 145](#) Designing Functional Programs (Advanced Level)
- [ECE 150](#) Fundamentals of Programming
- [ME 101](#) Introduction to Mechanical Engineering Practice 2
- [MSCI 121](#) Introduction to Computer Programming
- [MTE 121](#) Digital Computation
- [NE 111](#) Introduction to Programming for Engineers
- [SYDE 121](#) Digital Computation

### **Data Structures and Algorithms [List 2](#)**

- [BME 122](#) Data Structures and Algorithms
- ~~CS 136~~ Elementary Algorithm Design and Data Abstraction ~~and CS 136L Tools and Techniques for Software Development (see Note)~~
- [CS 138](#) Introduction Data Abstraction and Implementation
- [CS 146](#) Elementary Algorithm Design and Data Abstraction (Advanced Level) ~~and CS 136L Tools and Techniques for Software Development (see Note)~~
- [CS 231](#) Algorithmic Problem Solving
- ~~CS 234 Data Types and Structures~~
- [ECE 250](#) Algorithms and Data Structures
- ~~ECE 406 Algorithm Design and Analysis~~
- [MSCI 240](#) Algorithms and Data Structures
- [MTE 140](#) Algorithms and Data Structures
- [SYDE 223](#) Data Structures and Algorithms

### List 3

- [STV 205: Cybernetics and Society](#)
- [STV 208: Artificial Intelligence and Society: Impact, Ethics, and Equity](#)
- [STV 210: The Computing Society](#)
- [STV 302: Information Technology and Society](#)
- [HIST 212: The Computing Society](#)
- [SOC 324: Digital Cultures](#)
- [MSCI 442: Impact of Information Systems on Organizations and Society](#)
- [CS 492: The Social Implications of Computing](#)

**Note:** Students who take [CS 136](#) or [CS 146](#) will also be required to enrol in [CS 136L](#) which is graded on a CR/NCR basis. However, passing [CS 136L](#) is not a requirement for the option and the course may be coded as [NRNA](#).

### ~~Topics List~~ List 4

The following list of topics are organized into specific areas for readability.

- [CS 234 Data Types and Structures](#)
- [ECE 406 Algorithm Design and Analysis](#)

### Logic

- [CS 245](#) Logic and Computation
- [ECE 208](#) Discrete Mathematics and Logic 2
- [SE 212](#) Logic and Computation

### Databases

- [CS 338](#) Computer Applications in Business: Databases
- [ECE 356](#) Database Systems
- [MSCI 245](#) Databases and Software Design

### Operating Systems

- [ECE 350](#) Real-Time Operating Systems
- [MTE 241](#) Introduction to Computer Structures and Real-Time Systems
- [SE 350](#) Operating Systems

### Computing Systems

- [ECE 252](#) Systems Programming and Concurrency
- [ECE 351](#) Compilers
- [ECE 454](#) Distributed Computing
- [ECE 455](#) Embedded Software
- [ECE 459](#) Programming for Performance

### Networks

- [ECE 358](#) Computer Networks

### Digital Hardware

- [BME 393](#) Digital Systems
- [CS 230](#) Introduction to Computers and Computer Systems
- [ECE 124](#) Digital Circuits and Systems
- [ECE 222](#) Digital Computers
- [ECE 224](#) Embedded Microprocessor Systems
- [ECE 320](#) Computer Architecture
- [ECE 327](#) Digital Hardware Systems
- [ECE 423](#) Embedded Computer Systems
- [ME 262](#) Introduction to Microprocessors and Digital Logic
- [MTE 262](#) Introduction to Microprocessors and Digital Logic
- [MTE 325](#) Microprocessor Systems and Interfacing for Mechatronics Engineering
- [SYDE 192](#) Digital Systems

### Software Engineering

- [CS 445/ECE 451](#) Software Requirements Specification and Analysis
- [CS 446/ECE 452](#) Software Design and Architectures
- [CS 447/ECE 453](#) Software Testing, Quality Assurance and Maintenance
- [MSCI 342](#) Principles of Software Engineering
- [SE 463](#) Software Requirements Specification and Analysis
- [SE 464](#) Software Design and Architectures
- [SE 465](#) Software Testing and Quality Assurance

### Human-Computer Interaction

- [MSCI 343](#) Human-Computer Interaction
- [MSCI 541](#) Search Engines
- [MSCI 543](#) Analytics and User Experience
- [SYDE 542](#) Interface Design
- [SYDE 543](#) Cognitive Ergonomics
- [SYDE 548](#) User Centred Design Methods

### Security and Privacy

- [ECE 409](#) Cryptography and System Security
- [ECE 458](#) Computer Security

### Pattern Analysis and Machine Intelligence

- [ECE 417](#) Image Processing
- [ECE 457A](#) Co-operative and Adaptive Algorithms
- [ECE 457B](#) Fundamentals of Computational Intelligence
- [ECE 457C](#) Reinforcement Learning
- [MSCI 436](#) Decision Support Systems
- [MSCI 446](#) Introduction to Machine Learning
- [MSCI 546](#) Advanced Machine Learning
- [MTE 544](#) Autonomous Mobile Robotics
- [MTE 546](#) Multi-Sensor Data Fusion

- [SYDE 522](#) Foundations of Artificial Intelligence
- [SYDE 552/BIOL 487](#) Computational Neuroscience
- [SYDE 556](#) Simulating Neurobiological Systems
- [SYDE 572](#) Introduction to Pattern Recognition
- [SYDE 575](#) Image Processing

### **Numerical Methods**

- [BME 411](#) Optimization and Numerical Methods
- [CHE 322](#) Numerical Methods for Process Analysis and Design
- [CIVE 422](#) Finite Element Analysis
- [EARTH 456](#) Numerical Methods in Hydrogeology
- [ECE 204](#) Numerical Methods
- [ECE 204A](#) Numerical Methods 1 and [ECE 204B](#) Numerical Methods 2
- [ENVE 225](#) Environmental Modelling
- [ME 559](#) Finite Element Methods
- [ME 566](#) Computational Fluid Dynamics for Engineering Design
- [MTE 204](#) Numerical Methods
- [NE 336](#) Micro and Nanosystem Computer-aided Design
- [SYDE 411](#) Optimization and Numerical Methods

Special topics courses as approved by the [option co-ordinator](#).

## 2.9 Software Engineering Option

### **Summary:**

Include Pre-Approved List A CSE Courses

### **Background & Rationale:**

Both the Computer Engineering Option and Software Engineering Option currently state that students need to take “one course from List A Complementary Studies Course Lists for Engineering Students that considers application of computing technology, or an alternative approved by the option co-ordinator.” Providing a pre-approved list of courses to satisfy this requirement makes it easier for students to see examples of courses that meet the requirement and reduce the administrative load of approving courses. Additionally, editorial changes to the plan pages will be made to make the requirements of the options clearer to students. CS 136L was removed from the course list as passing the course was not a requirement of the option (See note under List 3 in option).

## Software Engineering Option

MARK-UP

The Software Engineering Option is available to all students in the Faculty of Engineering (including Architecture), except students in Software Engineering. **It requires a total of eight courses (4.0 units).**

~~This Option is offered jointly by the Faculty of Engineering and the David R. Cheriton School of Computer Science in the Faculty of Mathematics.~~

~~For students in the Faculty of Engineering, this Option requires a total of eight courses.~~

- Three required courses:
  - [CS 445/ECE 451](#) or [SE 463](#) Software Requirements Specification and Analysis
  - [CS 446/ECE 452](#) or [SE 464](#) Software Design and Architectures
  - [CS 447/ECE 453](#) or [SE 465](#) Software Testing, Quality Assurance and Maintenance, or Software Testing and Quality Assurance
- **One course from List 1, one course from List 2, one course from List 3 and at least 2 courses from List 4.** ~~Four additional courses from the topics list below, one of which may be substituted with a course from the data structures and algorithms list.~~
- ~~One course from List A Complementary Studies Course Lists for Engineering that considers application of computing technology, or an alternative approved by the option co-ordinator.~~

The courses chosen to satisfy this Option must satisfy four additional constraints:

- ~~They must satisfy Canadian Engineering Accreditation Board (CEAB) requirements.~~
- ~~They must be approved by the option co-ordinator.~~



- Five of the courses must be considered elective (that is, not core requirements) in the student's academic plan. For the purposes of this Option, a course that a student could choose to graduate without will be considered elective.
- The student must have earned a minimum average of 75% in the selected courses in order to have earned the Option.

Students may not declare this Option until they have completed both ~~an introductory programming course and a data structures and algorithms course~~ [a List 1 and List 2](#) course. Students must have a minimum average of 75% in these two courses in order to declare this Option.

The lists below are intended to be the same as for the [Computing Option](#) and the [Computer Engineering Option](#). These lists are also intended to include courses that are normally part of the [Computing Minor](#) offered by the Cheriton School of Computer Science. Other courses from Computer Science may be used towards this Option with permission of the option co-ordinator. Students may declare at most one of the Computing Option, Computer Engineering Option, or Software Engineering Option. Students may change which of the three Options they declare by contacting the [option co-ordinator\(s\)](#).

### **Introductory Programming [List 1](#)**

- [AE 121](#) Computational Methods
- [BME 121](#) Digital Computation
- [CHE 120](#) Computer Literacy and Programming for Chemical Engineers
- [CIVE 121/ENVE 121/GEOE 121](#) Computational Methods
- [CS 115](#) Introduction to Computer Science 1
- [CS 116](#) Introduction to Computer Science 2
- [CS 135](#) Designing Functional Programs
- [CS 137](#) Programming Principles
- [CS 145](#) Designing Functional Programs (Advanced Level)
- [ECE 150](#) Fundamentals of Programming
- [ME 101](#) Introduction to Mechanical Engineering Practice 2
- [MSCI 121](#) Introduction to Computer Programming
- [MTE 121](#) Digital Computation
- [NE 111](#) Introduction to Programming for Engineers
- [SYDE 121](#) Digital Computation

### **~~Data Structures and Algorithms~~ [List 2](#)**

- [BME 122](#) Data Structures and Algorithms
- ~~[CS 136](#) Elementary Algorithm Design and Data Abstraction and [CS 136L](#) Tools and Techniques for Software Development (see Note)~~
- [CS 138](#) Introduction Data Abstraction and Implementation
- [CS 146](#) Elementary Algorithm Design and Data Abstraction (Advanced Level) ~~and [CS 136L](#) Tools and Techniques for Software Development (see Note)~~
- [CS 231](#) Algorithmic Problem Solving
- ~~[CS 234](#) Data Types and Structures~~
- [ECE 250](#) Algorithms and Data Structures
- ~~[ECE 406](#) Algorithm Design and Analysis~~
- [MSCI 240](#) Algorithms and Data Structures
- [MTE 140](#) Algorithms and Data Structures

- [SYDE 223](#) Data Structures and Algorithms

### **List 3**

- [STV 205: Cybernetics and Society](#)
- [STV 208: Artificial Intelligence and Society: Impact, Ethics, and Equity](#)
- [STV 210: The Computing Society](#)
- [STV 302: Information Technology and Society](#)
- [HIST 212: The Computing Society](#)
- [SOC 324: Digital Cultures](#)
- [MSCI 442: Impact of Information Systems on Organizations and Society](#)
- [CS 492: The Social Implications of Computing](#)

~~**Note:** Students who take [CS 136](#) or [CS 146](#) will also be required to enrol in [CS 136L](#) which is graded on a CR/NCR basis. However, passing [CS 136L](#) is not a requirement for the option and the course may be coded as [NRNA](#).~~

### ~~Topics List~~ **List 4**

The following list of topics are organized into specific areas for readability.

- [CS 234 Data Types and Structures](#)
- [ECE 406 Algorithm Design and Analysis](#)

#### **Logic**

- [CS 245](#) Logic and Computation
- [ECE 208](#) Discrete Mathematics and Logic 2
- [SE 212](#) Logic and Computation

#### **Databases**

- [CS 338](#) Computer Applications in Business: Databases
- [ECE 356](#) Database Systems
- [MSCI 245](#) Databases and Software Design

#### **Operating Systems**

- [ECE 350](#) Real-Time Operating Systems
- [MTE 241](#) Introduction to Computer Structures and Real-Time Systems
- [SE 350](#) Operating Systems

#### **Computing Systems**

- [ECE 252](#) Systems Programming and Concurrency
- [ECE 351](#) Compilers
- [ECE 454](#) Distributed Computing
- [ECE 455](#) Embedded Software
- [ECE 459](#) Programming for Performance

## Networks

- [ECE 358](#) Computer Networks

## Digital Hardware

- [BME 393](#) Digital Systems
- [CS 230](#) Introduction to Computers and Computer Systems
- [ECE 124](#) Digital Circuits and Systems
- [ECE 222](#) Digital Computers
- [ECE 224](#) Embedded Microprocessor Systems
- [ECE 320](#) Computer Architecture
- [ECE 327](#) Digital Hardware Systems
- [ECE 423](#) Embedded Computer Systems
- [ME 262](#) Introduction to Microprocessors and Digital Logic
- [MTE 262](#) Introduction to Microprocessors and Digital Logic
- [MTE 325](#) Microprocessor Systems and Interfacing for Mechatronics Engineering
- [SYDE 192](#) Digital Systems

## Software Engineering

- [CS 445/ECE 451](#) Software Requirements Specification and Analysis
- [CS 446/ECE 452](#) Software Design and Architectures
- [CS 447/ECE 453](#) Software Testing, Quality Assurance and Maintenance
- [MSCI 342](#) Principles of Software Engineering
- [SE 463](#) Software Requirements Specification and Analysis
- [SE 464](#) Software Design and Architectures
- [SE 465](#) Software Testing and Quality Assurance

## Human-Computer Interaction

- [MSCI 343](#) Human-Computer Interaction
- [MSCI 541](#) Search Engines
- [MSCI 543](#) Analytics and User Experience
- [SYDE 542](#) Interface Design
- [SYDE 543](#) Cognitive Ergonomics
- [SYDE 548](#) User Centred Design Methods

## Security and Privacy

- [ECE 409](#) Cryptography and System Security
- [ECE 458](#) Computer Security

## Pattern Analysis and Machine Intelligence

- [ECE 417](#) Image Processing
- [ECE 457A](#) Co-operative and Adaptive Algorithms
- [ECE 457B](#) Fundamentals of Computational Intelligence
- [ECE 457C](#) Reinforcement Learning
- [MSCI 436](#) Decision Support Systems
- [MSCI 446](#) Introduction to Machine Learning
- [MSCI 546](#) Advanced Machine Learning

- [MTE 544](#) Autonomous Mobile Robotics
- [MTE 546](#) Multi-Sensor Data Fusion
- [SYDE 522](#) Foundations of Artificial Intelligence
- [SYDE 552](#)/[BIOL 487](#) Computational Neuroscience
- [SYDE 556](#) Simulating Neurobiological Systems
- [SYDE 572](#) Introduction to Pattern Recognition
- [SYDE 575](#) Image Processing

### **Numerical Methods**

- [BME 411](#) Optimization and Numerical Methods
- [CHE 322](#) Numerical Methods for Process Analysis and Design
- [CIVE 422](#) Finite Element Analysis
- [EARTH 456](#) Numerical Methods in Hydrogeology
- [ECE 204](#) Numerical Methods
- [ECE 204A](#) Numerical Methods 1 and [ECE 204B](#) Numerical Methods 2
- [ENVE 225](#) Environmental Modelling
- [ME 559](#) Finite Element Methods
- [ME 566](#) Computational Fluid Dynamics for Engineering Design
- [MTE 204](#) Numerical Methods
- [NE 336](#) Micro and Nanosystem Computer-aided Design
- [SYDE 411](#) Optimization and Numerical Methods

Special topics courses as approved by the [option co-ordinator](#).

## 2.10 Management Sciences Option

### **Summary:**

Management Sciences Option Name Change

### **Background & Rationale:**

The department has changed its name to Management Science and Engineering. Thus, the “Management Sciences Option” will become the “Management Science Option” to reflect the change in department name. Students in the Management Sciences Option can change to the Management Science option if they change their requirement term.

### 3. Other Business

## 3.1 Drop Consent for Core Courses

### **Summary:**

Adding Department Drop Consent for Core Courses

### **Background & Rationale:**

Drop consent was previously coded in the background on Quest but did not appear on the course catalogue. Since it will now appear, there is a need to review and update as appropriate. It works in a similar way to ADD consent and can be set to one of: instructor, department, or none. Following consultation with departments (who determine what is appropriate for courses they teach), we have agreed on the following normal guidelines:

- ADD consent: typically none, but there are exceptions (the most appropriate way to control student ability to add courses is usually pre-reqs and/or course reserves).
- DROP consent for elective courses: typically none (students should usually be able to switch between electives themselves using the add/drop capacity of Quest).
- DROP consent for core courses: should generally be set to DEPARTMENT. Students are usually block enrolled into core courses. Setting of consistent DROP consent will hard-code a need to seek department permission before dropping. This will help students stay on track with meeting program requirements.
- Note: departments are encouraged to discontinue application of “NG” course grades, which achieve the same purpose but require manual intervention of advising/RO staff every term. NG grades may be useful if a course is core for one program but elective in another, since it can be applied at the student level.

The motion is to make set drop consent to department on courses that are core in engineering programs (if a course is core in one program but not in others then we may not be applying drop consent).

**For the following courses, the DROP consent is to be set to DEPARTMENT.**

#### **Architectural Engineering**

- AE 100 Concepts Studio
- AE 101 History of Built Environment
- AE 104 Mechanics 1
- AE 105 Mechanics 2
- AE 115 Linear Algebra
- AE 121 Computational Methods
- AE 125 Structural Design Studio
- AE 199 Seminar
- AE 200 Enclosure Design Studio
- AE 204 Solid Mechanics 1
- AE 205 Solid Mechanics 2

- AE 221 Advanced Calculus
- AE 223 Differential Equations and Balance Laws
- AE 224 Probability and Statistics
- AE 225 Environmental Building Systems Studio
- AE 265 Structure and Properties of Materials
- AE 279 Energy and the Environment
- AE 280 Fluid Mechanics and Thermal Sciences
- AE 298 Seminar
- AE 299 Seminar
- AE 300 Architectural Engineering Studio 1
- AE 303 Structural Analysis
- AE 310 Introduction to Structural Design
- AE 325 Architectural Engineering Studio 2
- AE 353 Soil Mechanics and Foundations
- AE 377 Structural Timber Design
- AE 392 Economics and Life Cycle Cost Analysis
- AE 398 Seminar
- AE 399 Seminar
- AE 400 Project Studio 1
- AE 425 Project Studio 2
- AE 491 Engineering Law and Ethics
- AE 498 Seminar
- AE 499 Seminar

### **Architectural Studies**

- ARCH 110 Visual and Digital Media 1
- ARCH 113 Visual and Digital Media 2
- ARCH 120 An Introduction to Architectural Ideas and Communications
- ARCH 126 Environmental Building Design
- ARCH 142 Introduction to Cultural History
- ARCH 143 Settlements, Sanctuaries, and Cities
- ARCH 172 Building Construction 1
- ARCH 173 Building Construction 2
- ARCH 192 Design Studio
- ARCH 193 Design Studio
- ARCH 212 Digital Fabrication
- ARCH 225 Theory and Design of the Contemporary Landscape
- ARCH 243 Indigenous Practices
- ARCH 246 Cultural Encounters 600-1600
- ARCH 248 Cultural Encounters 1600-1914
- ARCH 260 Principles of Structures
- ARCH 276 Timber: Design, Structure and Construction



- ARCH 292 Design Studio
- ARCH 293 Design Studio
- ARCH 327 Architecture of the Urban Environment
- ARCH 342 Modernisms: Local and Global
- ARCH 362 Steel and Concrete: Design, Structure and Construction
- ARCH 364 Building Science
- ARCH 392 Design Studio
- ARCH 393 Option Design Studio
- ARCH 442 Contemporary Architectural Theory
- ARCH 463 Integrated Environmental Systems
- ARCH 473 Technical Report
- ARCH 492 Design Studio
- ARCH 493 Design Studio/ Comprehensive Building Design

### **Biomedical Engineering**

- BME 101 Communications in Biomedical Engineering-Written and Oral
- BME 101L Communications in Biomedical Engineering-Visualization
- BME 102 Seminar
- BME 121 Digital Computation
- BME 122 Data Structures and Algorithms
- BME 161 Introduction to Biomedical Design
- BME 162 Human Factors in the Design of Biomedical and Health Systems
- BME 181 Physics 1: Statics
- BME 182 Physics 2: Dynamics
- BME 186 Chemistry Principles
- BME 201 Seminar
- BME 202 Seminar
- BME 213 Statistics and Experimental Design
- BME 252 Linear Systems and Signals
- BME 261 Prototyping, Simulation and Design
- BME 281 Mechanics of Deformable Solids
- BME 281L Mechanics of Deformable Solids Laboratory
- BME 282 Materials Science for Biomedical Engineers
- BME 284 Physiological and Biological Systems
- BME 284L Physiology and Anatomy Laboratory
- BME 285 Engineering Biology
- BME 285L Engineering Biology Laboratory
- BME 294 Circuits, Instrumentation, and Measurements
- BME 294L Circuits, Instrumentation, and Measurements Laboratory
- BME 301 Seminar
- BME 302 Seminar
- BME 355 Physiological Systems Modelling

- BME 356 Control Systems
- BME 356L Control Systems Laboratory
- BME 361 Biomedical Engineering Design
- BME 362 Biomedical Engineering Design Workshop 1
- BME 364 Engineering Biomedical Economics
- BME 381 Biomedical Engineering Ethics
- BME 384 Biomedical Transport: Biofluids and Mass Transfer
- BME 386 The Physics of Medical Imaging
- BME 393 Digital Systems
- BME 393L Digital Systems Laboratory
- BME 400 Work-term Symposium Poster
- BME 401 Seminar
- BME 402 Seminar
- BME 411 Optimization and Numerical Methods
- BME 461 Biomedical Engineering Design Workshop 2
- BME 462 Biomedical Engineering Design Workshop 3

### **Chemical Engineering**

- CHE 100 Chemical Engineering Concepts 1
- CHE 102 Chemistry for Engineers
- CHE 120 Computer Literacy and Programming for Chemical Engineers
- CHE 180 Chemical Engineering Design Studio 1
- CHE 200 Equilibrium Stage Operations
- CHE 211 Fluid Mechanics
- CHE 220 Process Data Analysis
- CHE 230 Physical Chemistry 1
- CHE 231 Physical Chemistry 2
- CHE 241 Materials Science and Engineering
- CHE 290 Chemical Engineering Lab 1
- CHE 291 Chemical Engineering Lab 2
- CHE 312 Mathematics of Heat and Mass Transfer
- CHE 313 Applications of Heat and Mass Transfer
- CHE 314 Chemical Reaction Engineering
- CHE 322 Numerical Methods for Process Analysis and Design
- CHE 330 Chemical Engineering Thermodynamics
- CHE 331 Electrochemical Engineering
- CHE 341 Introduction to Process Control
- CHE 361 Bioprocess Engineering
- CHE 383 Chemical Engineering Design Workshop
- CHE 390 Chemical Engineering Lab 3
- CHE 450 Technical Work-term Report
- CHE 480 Process Analysis and Design

- CHE 482 Group Design Project
- CHE 483 Group Design Project and Symposium
- CHE 490 Chemical Engineering Lab 4
- CHE 491 Chemical Engineering Lab 5

### **Civil Engineering**

- CIVE 100 Civil Engineering Concepts
- CIVE 104 Mechanics 1
- CIVE 115 Linear Algebra
- CIVE 204 Solid Mechanics 1
- CIVE 205 Solid Mechanics 2
- CIVE 221 Advanced Calculus
- CIVE 222 Differential Equations
- CIVE 224 Probability and Statistics
- CIVE 230 Engineering and Sustainable Development
- CIVE 241 Transport Principles and Applications
- CIVE 265 Structure and Properties of Materials
- CIVE 280 Fluid Mechanics
- CIVE 298 Seminar
- CIVE 299 Seminar
- CIVE 303 Structural Analysis
- CIVE 310 Introduction to Structural Design
- CIVE 332 Civil Systems and Project Management
- CIVE 341 Transportation Engineering Applications
- CIVE 353 Geotechnical Engineering 1
- CIVE 375 Environmental Engineering Principles
- CIVE 382 Hydrology and Open Channel Flow
- CIVE 392 Economics and Life Cycle Cost Analysis
- CIVE 398 Seminar
- CIVE 399 Seminar
- CIVE 400 Civil Engineering Design Project 1
- CIVE 401 Civil Engineering Design Project 2
- CIVE 491 Engineering Law and Ethics
- CIVE 498 Seminar
- CIVE 499 Seminar

### **Electrical & Computer Engineering**

- ECE 105 Classical Mechanics
- ECE 124 Digital Circuits and Systems
- ECE 140 Linear Circuits

- ECE 150 Fundamentals of Programming
- ECE 190 Engineering Profession and Practice
- ECE 198 Project Studio
- ECE 203 Probability Theory and Statistics 1
- ECE 204 Numerical Methods
- ECE 222 Digital Computers
- ECE 231 Semiconductor Physics and Devices
- ECE 240 Electronic Circuits 1
- ECE 252 Systems Programming and Concurrency
- ECE 318 Communication Systems
- ECE 327 Digital Hardware Systems
- ECE 340 Electronic Circuits 2
- ECE 350 Real-Time Operating Systems
- ECE 401 Information Session
- ECE 402 Information Session
- ECE 498A Engineering Design Project
- ECE 498B Engineering Design Project

### **Environmental Engineering**

- ENVE 100 Environmental and Geological Engineering Concepts
- ENVE 115 Linear Algebra
- ENVE 223 Differential Equations and Balance Laws
- ENVE 224 Probability and Statistics
- ENVE 225 Environmental Modelling
- ENVE 275 Environmental Chemistry
- ENVE 277 Air Quality Engineering
- ENVE 279 Energy and the Environment
- ENVE 280 Fluid Mechanics
- ENVE 298 Seminar
- ENVE 299 Seminar
- ENVE 330 Lab Analysis and Field Sampling Techniques
- ENVE 335 Decision Making for Environmental Engineers
- ENVE 375 Physico-Chemical Processes
- ENVE 376 Biological Processes
- ENVE 382 Hydrology and Open Channel Flow
- ENVE 383 Advanced Hydrology and Hydraulics
- ENVE 391 Law and Ethics for Environmental and Geological Engineers
- ENVE 392 Economics and Life Cycle Cost Analysis
- ENVE 398 Seminar
- ENVE 399 Seminar
- ENVE 400 Environmental Engineering Design Project 1
- ENVE 401 Environmental Engineering Design Project 2

- ENVE 498 Seminar
- ENVE 499 Seminar

### **Geological Engineering**

- GEOE 100 Environmental and Geological Engineering Concepts
- GEOE 115 Linear Algebra
- GEOE 221 Advanced Calculus
- GEOE 223 Differential Equations and Balance Laws
- GEOE 224 Probability and Statistics
- GEOE 280 Fluid Mechanics
- GEOE 298 Seminar
- GEOE 299 Seminar
- GEOE 353 Geotechnical Engineering 1
- GEOE 391 Law and Ethics for Environmental and Geological Engineers
- GEOE 392 Economics and Life Cycle Cost Analysis
- GEOE 398 Seminar
- GEOE 399 Seminar
- GEOE 400 Geological Engineering Design Project 1
- GEOE 401 Geological Engineering Design Project 2
- GEOE 498 Seminar
- GEOE 499 Seminar

### **Mechanical Engineering**

- ME 100 Introduction to Mechanical Engineering Practice 1
- ME 200A Seminar
- ME 200B Seminar
- ME 201 Advanced Calculus
- ME 202 Statistics for Engineers
- ME 203 Ordinary Differential Equations
- ME 212 Dynamics
- ME 219 Mechanics of Deformable Solids 1
- ME 220 Mechanics of Deformable Solids 2
- ME 230 Control of Properties of Materials
- ME 250 Thermodynamics 1
- ME 262 Introduction to Microprocessors and Digital Logic
- ME 269 Electromechanical Devices and Power Processing
- ME 300A Seminar
- ME 300B Seminar
- ME 303 Advanced Engineering Mathematics
- ME 321 Kinematics and Dynamics of Machines

- ME 322 Mechanical Design 1
- ME 340 Manufacturing Processes
- ME 351 Fluid Mechanics 1
- ME 353 Heat Transfer 1
- ME 354 Thermodynamics 2
- ME 360 Introduction to Control Systems
- ME 362 Fluid Mechanics 2
- ME 380 Mechanical Engineering Design Workshop
- ME 400A Seminar
- ME 400B Seminar
- ME 481 Mechanical Engineering Design Project 1
- ME 482 Mechanical Engineering Design Project 2

### **Management Science & Engineering**

- MSE 100 Management Engineering Concepts
- MSE 232 Modelling in Operations Research
- MSE 240 Algorithms and Data Structures
- MSE 245 Databases and Software Design
- MSE 251 Probability and Statistics 1
- MSE 253 Probability and Statistics 2
- MSE 261 Engineering Economics: Financial Management for Engineers
- MSE 302 Engineering Design Methods
- MSE 333 Simulation Analysis and Design
- MSE 334 Operations Planning and Inventory Control
- MSE 343 Human-Computer Interaction
- MSE 391 Work-term Report
- MSE 392 Work-term Report
- MSE 401 Management Engineering Design Project 1
- MSE 402 Management Engineering Design Project 2
- MSE 434 Supply Chain Management
- MSE 491 Work-term Report

### **Mechatronics Engineering**

- MTE 100 Mechatronics Engineering
- MTE 120 Circuits
- MTE 182 Physics 2: Dynamics
- MTE 200A Seminar
- MTE 200B Seminar
- MTE 201 Experimental Measurement and Statistical Analysis
- MTE 202 Ordinary Differential Equations

- MTE 203 Advanced Calculus
- MTE 204 Numerical Methods
- MTE 219 Mechanics of Deformable Solids
- MTE 220 Sensors and Instrumentation
- MTE 241 Introduction to Computer Structures and Real-Time Systems
- MTE 252: Linear Systems and Signals
- MTE 262 Introduction to Microprocessors and Digital Logic
- MTE 300A Seminar
- MTE 300B Seminar
- MTE 320 Actuators and Power Electronics
- MTE 321 Design and Dynamics of Machines
- MTE 322 Electromechanical Machine Design
- MTE 325 Microprocessor Systems and Interfacing for Mechatronics Engineering
- MTE 351 Systems Models 1
- MTE 352 Fluid Mechanics 1
- MTE 360 Automatic Control Systems
- MTE 380 Mechatronics Engineering Design Workshop
- MTE 400A Seminar
- MTE 400B Seminar
- MTE 481 Mechatronics Engineering Design Project
- MTE 482 Mechatronics Engineering Project
- MTE 484 Digital Control Applications

### **Nanotechnology Engineering**

- NE 100 Introduction to Nanotechnology Engineering
- NE 109 Societal and Environmental Impacts of Nanotechnology
- NE 110 Introduction to Nanomaterials Health Risks
- NE 111 Introduction to Programming for Engineers
- NE 112 Linear Algebra for Nanotechnology Engineers
- NE 121 Chemical Principles
- NE 131 Physics for Nanotechnology Engineering
- NE 140 Linear Circuits
- NE 215 Probability and Statistics
- NE 216 Advanced Calculus and Numerical Methods 1
- NE 217 Advanced Calculus and Numerical Methods 2
- NE 220L Materials Science and Engineering Laboratory
- NE 222 Organic Chemistry for Nanotechnology Engineers
- NE 225 Structure and Properties of Nanomaterials
- NE 226 Characterization of Materials
- NE 241 Electromagnetism
- NE 242 Semiconductor Physics and Devices
- NE 281 Biology for Nanotechnology Engineers

- NE 318 Continuum Mechanics for Nanotechnology Engineering
- NE 320L Characterization of Materials Laboratory
- NE 330L Macromolecular Science Laboratory
- NE 332 Quantum Mechanics
- NE 333 Macromolecular Science
- NE 334 Statistical Thermodynamics
- NE 336 Micro and Nanosystem Computer-aided Design
- NE 343 Microfabrication and Thin-film Technology
- NE 352 Surfaces and Interfaces
- NE 409 Nanosystems Design Project and Symposium

### **Systems Design Engineering**

- SYDE 101 Communications in Systems Design Engineering-Written and Oral
- SYDE 101L Communications in Systems Design Engineering-Visualization
- SYDE 102 Seminar
- SYDE 111 Calculus 1
- SYDE 112 Calculus 2
- SYDE 113 Elementary Engineering Mathematics
- SYDE 114 Matrices and Linear Systems
- SYDE 121 Digital Computation
- SYDE 161 Introduction to Design
- SYDE 162 Human Factors in Design
- SYDE 181 Physics 1: Statics
- SYDE 182 Physics 2: Dynamics
- SYDE 192 Digital Systems
- SYDE 192L Digital Systems Laboratory
- SYDE 201 Seminar
- SYDE 202 Seminar
- SYDE 211 Calculus 3
- SYDE 212 Probability and Statistics
- SYDE 223 Data Structures and Algorithms
- SYDE 252 Linear Systems and Signals
- SYDE 261 Design, Systems, and Society
- SYDE 262 Engineering Economics of Design
- SYDE 263 Engineering Prototyping
- SYDE 283 Physics 3: Electricity, Magnetism and Optics
- SYDE 285 Materials Chemistry
- SYDE 286 Mechanics of Deformable Solids
- SYDE 292 Circuits, Instrumentation, and Measurements
- SYDE 292L Circuits, Instrumentation, and Measurements Laboratory
- SYDE 300 Work-Term Poster Symposium
- SYDE 301 Seminar



- SYDE 302 Seminar
- SYDE 312 Applied Linear Algebra
- SYDE 351 Systems Models 1
- SYDE 352 Introduction to Control Systems
- SYDE 352L Control Systems Laboratory
- SYDE 361 Systems Design Methods 1: Needs Analysis and Prototyping
- SYDE 362 Systems Design Methods 2: Testing, Verification, and Validation
- SYDE 381 Thermodynamics
- SYDE 383 Fluid Mechanics
- SYDE 401 Seminar
- SYDE 402 Seminar
- SYDE 411 Optimization and Numerical Methods
- SYDE 461 Systems Design Capstone Project 1
- SYDE 462 Systems Design Capstone Project 2

#### **Work-term Report**

- WKRPT 203 Work-term Report

## 3.2 Complementary Studies Electives

### Summary:

Add Courses to CSE List

### Background & Rationale:

New courses (BET 210 Business Technology and Infrastructure, ARCH 510 Special Topics in Visual and Digital Media, ARCH 520 Special Topics in Urbanism and Landscape, ARCH 540 Special Topics in Architectural History and Theory, ARCH 580 Special Topics in Race, Equity, and Environmental Justice) are being added to Complementary Studies Elective (CSE) List C to provide students more options when selecting their CSE courses to suit their individual interests. The four ARCH courses added are expected to be of particular interest to Architectural Engineering students and are usually offered in person at the Cambridge campus.

## Complementary Studies Course Lists for Engineering

**MARK UP**

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### **List C - Humanities and Social Sciences (excluding courses concentrated on development of language or other skills)**

- Accounting and Financial Management: [AFM 131/ARBUS 101](#), [AFM 333/ARBUS 301](#)
- Anthropology: All [ANTH](#), except [ANTH 204](#), [ANTH 251](#), [ANTH 289](#), [ANTH 305](#), [ANTH 345](#), [ANTH 355](#), [ANTH 365](#), [ANTH 371](#), [ANTH 372](#), [ANTH 377](#), [ANTH 389](#), [ANTH 391](#), [ANTH 395](#), [ANTH 455](#), [ANTH 489](#), [ANTH 498](#), [ANTH 499A](#), [ANTH 499B](#)
- Applied Language Studies: All [APPLS](#)
- Architectural Engineering: [AE 101](#), [AE 491](#)
- Architectural Studies: [ARCH 510](#), [ARCH 520](#), [ARCH 540](#), [ARCH 580](#)
- Arts: [ARTS 122](#), [ARTS 450](#)
- Aviation: [AVIA 100](#)
- Biomedical Engineering: [BME 381](#), [BME 530](#)
- Black Studies: [BLKST 101](#), [BLKST 102/COMMST 112/THPERF 112/VCULT 112](#), [BLKST 103](#), [BLKST 201](#), [BLKST 202](#), [BLKST 203/ENGL 225](#), [BLKST 210/ENGL 326](#), [BLKST 224/COMMST 224/THPERF 224](#), [BLKST 230](#), [BLKST 240/ENGL 327](#), [BLKST 244/ENGL 328](#), [BLKST 302](#), [BLKST 304/PSCI 304](#), [BLKST 309](#), [BLKST 317/SPAN 317](#), [BLKST 330](#), [BLKST 410/ENGL 405](#), [BLKST 421](#)
- Business Entrepreneurship and Technology: [BET 100](#), [BET 210](#), [BET 300](#), [BET 320](#), [BET 340](#), [BET 350](#), [BET 400](#), [BET 411](#), [BET 420](#), [BET 430](#), [BET 450](#), [BET 460](#), [BET 470](#), [BET 580](#)

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# Appendix C: Faculty of Environment

Senate Undergrad Council

Faculty of Environment

February 5, 2024

All agenda items are pending faculty council approval (January 18, 2024)

## **Courses:** (attachment 1)

1. New
2. Revised
3. Inactivate

## **New Academic Plans/Programs (major):** N/A

## **Academic Plan changes (major):** N/A

## **Academic Plan changes (minor):**

4. Diploma in Ecological Restoration - (attachment 2)
5. Diploma in Environmental Assessment – (attachment 3)
6. Department of Geography and Environmental Management, Aviation Specialization (all plans except for Geography and Aviation) – (attachment 4)
7. Geography and Environmental Management, 3 yr General – (attachment 5)
8. Knowledge Integration Honours – (attachment 6)
9. Knowledge Integration Honours, Science, Technology, and Society Specialization – (attachment 7)
10. Knowledge Integration, Joint Honours – (attachment 8)
11. Parks Minor – (attachment 9)
12. Planning Honours – (attachment 10)
13. Planning Honours, Environmental Planning Specialization – (attachment 11)
14. Urban Studies Minor – (attachment 12)

## **Academic Plan inactivations (major):** N/A

## **Academic Regulation revisions:**

15. Business Option invalid combination with Sustainability and Financial Management – (attachment 13)

**Secretary Note:** As item 15 (attachment 13) is a regulation revision it is on the SUC Regular agenda. See item 6b on the SUC Agenda for the report.

**NEW COURSES** (for approval)

**Dean of Environment**

**Effective 01-SEP-2024**

ENVS 476A (0.50) FLD Field Studies in Environment

Detailed field analysis of a selected destination with one or more themes related to environmental studies. Field study will be one to two weeks duration. Offering dependent upon faculty availability and student enrolment. [Note: This course may have additional fees. See academic unit for details.]

Rationale : To enhance experiential learning within the faculty, the addition of a series of courses is needed for the scheduling of field trips. A trip duration of 7 to 10 days = 0.50 unit (ENVS 476A); 11-18 days = 1.0 unit (ENVS 476B); 19+ days = 1.50 units (ENVS 476C). Instructor consent required. Short title is: Field Studies in Environment

**Effective 01-SEP-2024**

ENVS 476B (1.00) FLD Field Studies in Environment

Detailed field analysis of a selected destination with one or more themes related to environmental studies. Field study will be two to three weeks duration. Offering dependent upon faculty availability and student enrolment. [Note: This course may have additional fees. See academic unit for details.]

Rationale : To enhance experiential learning within the faculty, the addition of a series of courses is needed for the scheduling of field trips. A trip duration of 7 to 10 days = 0.50 unit (ENVS 476A); 11-18 days = 1.0 unit (ENVS 476B); 19+ days = 1.50 units (ENVS 476C). Instructor consent required. Short title is: Field Studies in Environment

**Effective 01-SEP-2024**

ENVS 476C (1.50) FLD Field Studies in Environment

Detailed field analysis of a selected destination with one or more themes related to environmental studies. Field study will be three or more weeks duration. Offering dependent upon faculty availability and student enrolment. [Note: This course may have additional fees. See academic unit for details.]

Rationale : To enhance experiential learning within the faculty, the addition of a series of courses is needed for the scheduling of field trips. A trip duration of 7 to 10 days = 0.50 unit (ENVS 476A); 11-18 days = 1.0 unit (ENVS 476B); 19+ days = 1.50 units (ENVS 476C). Instructor consent required. Short title is: Field Studies in Environment

**Environment, Resources & Sustainability, School of**

**Effective 01-SEP-2024**

ERS 245 (0.50) LEC Interdisciplinary Perspectives on Biodiversity Conservation: Nature, People, and Policy

This course provides an overview of the interdisciplinary perspectives and approaches required to sustainably use and protect biodiversity from local to global scales. Diverse cases and examples are drawn from Canada and internationally to explore a range of conservation approaches, including Indigenous approaches to stewardship. A focus on key trends in biodiversity loss and recovery in Canada (and globally), including the role of climate change, will be combined with an understanding of biodiversity governance and the need to examine biodiversity conservation efforts in the context of resource extraction and sustainability debates.

Requisites : Prereq: Level at least 2A  
Rationale : Course added to reflect the curriculum review outcomes. This course will be developed by CEL and offered on-line only. Short title: Biodiversity Conservation

**Planning - School of**

**Effective 01-SEP-2024**

PLAN 240 (0.50) LEC Environmental Planning and Policy

This course explores environmental planning and policy in Canada and other contexts. Students will learn how environmental policies affect planning procedures, how planners engage with environmental policy, and how planners apply relevant planning tools in diverse policy contexts. Students will also develop skills in policy analysis, navigating regulatory landscapes, and environmental planning approaches.

Requisites : Prereq: One of BIOL 150, BIOL 250, ENVS 200; Level at least 2A. Antireq: PLAN 340  
Rationale : Modified due to curriculum updates. Both PLAN 240 and 340 need to be on the books for both students entering the plan in September 2024 and those already moving toward degree completion. PLAN 340 will be inactivated effective September 2026. Consultation with: KI. Affects Diploma in Environmental Assessment, Diploma in Ecological Restoration and Rehabilitation, and Parks Minor, all of which are included in this agenda. Short title: Env Planning & Policy

**Effective 01-SEP-2024**

PLAN 246 (0.50) LEC, TUT Tools for Public Participation

This course develops students' skills in the design and facilitation of public participation processes. It explores a range of community engagement tools that can be used in large and small group settings, as well as options for online engagement, focusing on how to make sensible choices between the different tools. The course also considers how planners can create inclusive public participation processes and

settings. Students will be introduced to the techniques for analyzing the community feedback received during an engagement process, with a specific focus on the methods of qualitative analysis.

Requisites : Prereq: Level at least 2A Planning. Antireq: PLAN 346  
Rationale : Modified due to curriculum updates. Both PLAN 246 and 346 need to be on the books for both students entering the plan in September 2024 and those already moving toward degree completion. PLAN 346 will be inactivated effective September 2026. Consultation with Knowledge Integration. Short title: Tools for Public Participation

## COURSE CHANGES (for approval)

### Dean of Environment

#### Current Catalog Information

ENVS 469 (0.50) LAB, LEC Landscape Ecology, Restoration and Rehabilitation

Survey of the major concepts and theories of landscape ecology. Application of these concepts to case studies in restoration and/or rehabilitation. Interaction with professionals from government, NGOs, or private industry on ecological issues will also be part of the course. The course includes a practical component on the planning of ecological restoration or rehabilitation projects. [Note: This course may have additional fees.]

No Special Consent Required

Requisites : Prereq: ERS 335; Level at least 4A

#### Effective 02-SEP-2024

Requisite Change : Prereq: Level at least 4A; WHMIS

Rationale : Removal of ERS 335 from the prerequisites, as instructor includes an introduction to landscape ecology theory in the course curriculum, which provides sufficient background for students to succeed. Addition of WHMIS to prereqs approved at SUC Nov 2023.

### Geography & Environmental Management

#### Current Catalog Information

GEOG 432 (0.50) LEC Health, Environment, and Planning

This course examines the relationship between the environment (built/physical, economic, social, political, and natural aspects) and population health. It focuses on conceptual and empirical links among current environment-health issues such as air quality, active transportation, injury prevention, climate change, and mental well-being. Emphasis is placed on the role of urban planners in collaboration with allied professionals (e.g., public health, engineering, law enforcement, architecture) in creating and maintaining healthy built environments to improve population health with a focus on key health issues.

No Special Consent Required

Requisites :

Prereq: One of PLAN 233, HLTH/GSJ 260, ERS 253, GEOG 325

Cross-listed as:

HLTH 420 PLAN 432

**Effective 01-SEP-2024**

Component Change:

LEC, TUT

Title Change:

Health and the Built Environment

Description Change:

This course will focus on current issues at the intersection of health, planning, and the built and natural environments. Students will learn the history and evolution of both public health and urban planning professions and academic disciplines and gain an appreciation of the theories and methods used in each. Students will also learn about specific health and planning issues (e.g., air pollution, physical activity, injury, mental health) as well as how better health and health equity can be built into future cities. Students will enhance interdisciplinary collaboration skills by working with classmates across faculties on multiple activities.

Rationale :

Course title and description updated to better align with the curriculum review outcomes. Tutorial added for scheduling flexibility. The Faculties of Health and Environment have approved these changes. Short title: Health & the Built Environment

**Knowledge Integration**

**Current Catalog Information**

INTEG 251 (0.50) LEC Creative Thinking

An introductory, integrative course in the history, psychology, value and practice of creativity across a variety of domains, from scientific research to the fine and performing arts. Students will learn to identify and explain key ideas and historical figures in the study and practice of creative thinking. They'll also learn to reliably generate novel ideas of value, both solo and collaboratively.

No Special Consent Required

Requisites :

Antireq: INTEG 275 Section 1 Taken Winter 2010, 2011, Spring 2011, 2012, Winter 2012

**Effective 01-SEP-2024**

Title Change:

Creativity and Innovation

Requisite Change :

Rationale :

These changes more accurately capture the course content and reflects the way the course is taught. Remove antireqs as an editorial change due to passage of time. Short title: Creativity & Innovation

**Planning - School of**

**Current Catalog Information**

PLAN 340 (0.50) LEC Canadian Environmental Policy and Politics

Consideration of the intersection between key ecological themes and recent policy developments. Investigation of current issues in environmental science and politics.

Development of critical skills for assessing, framing and conveying information essential to planning, managing and developing policy for environmental stewardship.

No Special Consent Required

Requisites :

Prereq: One of ENVS 200, BIOL 150, BIOL 251

**Effective 01-SEP-2024**

Requisite Change :

Prereq: One of BIOL 150, BIOL 251, ENVS 200. Antireq: PLAN 240

Rationale :

Modified due to curriculum updates. Both PLAN 240 and 340 need to be on the books for both students entering the plan in September 2024 and those already moving toward degree completion. PLAN 340 will be inactivated effective September 2026. Consultation with: KI. SDS will be consulted prior to the inactivation of PLAN 340. Affects Diploma in Environmental Assessment, Diploma in Ecological Restoration and Rehabilitation, and ECOL and Parks Minor.

**Current Catalog Information**

PLAN 346 (0.50) LEC, TUT Advanced Tools for Planning: Public Participation and Mediation

A number of approaches and techniques such as Public Participation, Alternative Dispute Resolution and Mediation are used extensively in modern planning. This course addresses these techniques and critically explores their background, rationale, application, and use in contemporary community planning within a modern democratic society.

No Special Consent Required

Requisites :

Prereq: Level at least 3B Planning students

**Effective 01-SEP-2024**

Requisite Change :

Prereq: Level at least 3B Planning. Antireq: PLAN 246

Rationale :

Modified due to curriculum updates. Both PLAN 246 and 346 need to be on the books for students entering the plan September 2024 and those already moving toward degree completion. PLAN 346 will be inactivated effective September 2026. Consultation with Knowledge Integration.

**Current Catalog Information**

PLAN 414 (0.50) LEC, SEM Heritage Planning Workshop

The role of cultural heritage in the community context is examined. Varying forms of heritage preservation, its function and organization are covered. This course may include a field component. [Note: Field trip fee will not exceed \$25+HST.]

No Special Consent Required

Requisites :

Prereq: Level at least 3A

Cross-listed as:

REC 425

**Effective 01-SEP-2024**

Component Change:

LEC, SEM, TUT

Title Change:

Heritage Conservation Planning

Description Change:

This course will examine the role of cultural heritage resources in urban and regional planning. Students will discuss different types of cultural heritage resources, including their identification, evaluation, promotion, protection, and role in community identity. Students will also consider the legislative and policy frameworks for heritage conservation and learn how



Rationale : to apply key tools for inventorying and evaluating cultural heritage resources. [Note: This course may have additional fees.]  
Course title and description updated to better align with the curriculum review outcomes. Tutorial added to provide scheduling flexibility. The Faculties of Health and Environment have approved these changes. Short title: Heritage Conservation

### Current Catalog Information

PLAN 432 (0.50) LEC Health, Environment, and Planning

This course examines the relationship between the environment (built/physical, economic, social, political, and natural aspects) and population health. It focuses on conceptual and empirical links among current environment-health issues such as air quality, active transportation, injury prevention, climate change, and mental well-being. Emphasis is placed on the role of urban planners in collaboration with allied professionals (e.g., public health, engineering, law enforcement, architecture) in creating and maintaining healthy built environments to improve population health with a focus on key health issues.

No Special Consent Required

Requisites : Prereq: One of PLAN 233, HLTH/GSJ 260, ERS 253, GEOG 325

Cross-listed as: HLTH 420 GEOG 432

### Effective 01-SEP-2024

Component Change: LEC, TUT  
Title Change: Health and the Built Environment  
Description Change:

This course will focus on current issues at the intersection of health, planning, and the built and natural environments. Students will learn the history and evolution of both public health and urban planning professions and academic disciplines and gain an appreciation of the theories and methods used in each. Students will also learn about specific health and planning issues (e.g., air pollution, physical activity, injury, mental health) as well as how better health and health equity can be built into future cities. Students will enhance interdisciplinary collaboration skills by working with classmates across faculties on multiple activities.

Rationale : Course title and description updated to better align with the curriculum review outcomes. Tutorial added for scheduling flexibility. The Faculties of Health and Environment have approved these changes. Short title: Health & the Built Environment

## Environment, Enterprise & Development - School of

### Current Catalog Information

ENBUS 202 (0.50) LEC Environmental Management Systems

The examination and evaluation of environmental management systems such as ISO 14001. Alternate EMS systems will be compared and reviewed to identify their respective strengths and weaknesses. Case studies will be used to illustrate the ideas presented.

No Special Consent Required

Requisites : Prereq: ENBUS 102; Accounting and Financial Management or Environment and Business students only

**Effective 01-SEP-2024**

Requisite Change : Prereq: ENBUS 102 or SFM 101; Accounting and Financial Management, Environment and Business, or Sustainability and Financial Management.  
Rationale : ENBUS 202 is a requirement for the Sustainability and Financial Management (SFM) plan. SFM students take SFM 101 which is a listed antireq to ENBUS 102. These changes allow SFM students to add this required course.

**Current Catalog Information**

ENBUS 309 (0.50) LEC, TUT Applied Social Marketing  
Social marketing uses social psychology and marketing concepts to promote behavioural change (e.g. anti-smoking campaigns, promotion of household energy conservation, and so on). This course will focus on developing an understanding of social marketing and behavioural change models. These concepts will be applied in the context of sustainability issues, using case studies to demonstrate successful (and not so successful) social marketing programs.

No Special Consent Required

Requisites : Prereq: Level at least 2A

**Effective 01-SEP-2024**

Title Change: Behaviour Change and Sustainability  
Description Change: Shifting behaviour and social norms is a key part of advancing sustainability. This course looks at how change happens - and why, in some cases, it doesn't. Students will explore concepts in social psychology, sociology, and marketing that activate people to engage in sustainable behaviours.

Rationale : The new title and description better reflect the course content. Short title: Behaviour Change & Sust

**Current Catalog Information**

ENBUS 408 (0.50) LEC Best Practices in Regulations  
Well-crafted environmental regulations, smart regulations, can not only protect the environment but also enhance business competitiveness. This course will discuss issues with regard to smart regulations from the viewpoint of various stakeholders, for example, governments, businesses, and customers.

No Special Consent Required

Requisites : Prereq: Level at least 3A

**Effective 01-SEP-2024**

Title Change: Policy Instruments for Sustainability  
Description Change: This course provides students with knowledge of the different regulatory approaches to managing environment and resources with a focus on the policy dimensions of regulatory instrument choice and design. The course examines market-based, regulatory, and behaviour change policy tools in relation to how they protect the environment but also address efficiency and social justice issues.

Rationale : The new title and description better reflect the course content. Short title: Policy Instruments for Sust

### Current Catalog Information

ENBUS 410 (0.50) LEC Engaging Stakeholders  
Business practices need to reflect responsibility not just to shareholders, customers and staff, but also towards the local community. This course discusses what this means for management, and the strategies and practices that are needed to express this responsibility successfully.  
No Special Consent Required  
Requisites :

Prereq: Level at least 3A; Accounting and Financial Management or Environment and Business students only

### Effective 01-SEP-2024

Requisite Change : Prereq: Level at least 3A; Accounting and Financial Management, Environment and Business, or Sustainability and Financial Management.

Rationale : ENBUS 410 is a requirement for the Sustainability and Financial Management plan.

### COURSE INACTIVATIONS (for approval)

#### Dean of Environment

Effective 01-SEP-2024  
ENVS 350 (0.50)

#### Complexity in Nature and Society

Rationale : There are no plans to teach this course in the future. To be removed from Diploma in Environmental Assessment (list D), which is included in this agenda. ENG has been contacted to remove from CSE list.

### Environment, Enterprise & Development - School of

Effective 01-SEP-2024  
INDEV 387 (0.50)

#### Global Cities in Global Development

Rationale : INDEV 387 will no longer be offered. This core course for the International Development honour plans, will be substituted with INDEV/PLAN 262. INDEV/PLAN 262 course content and learning outcomes are like those in INDEV 387, making this course a suitable substitute. Consultations with Knowledge Integration, the Global Experience Certificate team, Engineering, Social Innovation and Impact Minor (John Abraham), and the Associate Dean Undergrad Studies Faculty of Environment (Urban Studies minor) have occurred.

End of Report

Re: Diploma in Ecological Restoration and Rehabilitation: Revise

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Effective date: September 2024

Rationale: Reflect changes made by PLAN resulting from curriculum review (see attachment 1).

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

Consultations:

Within ENV: Planning

External to ENV: No consultations required.

**Revisions based on 2023/2024 Calendar**

Successful completion requires:

1. Six courses distributed as follows:

- [ERS 335](#)
- [ENVS 469](#)
- Four of:
  - [BIOL 351](#)
  - [BIOL 354](#)
  - [BIOL 457](#)
  - [BIOL 470](#)
  - [ENVS 300](#)
  - [ENVS 444](#)
  - [ERS 234](#)
  - [ERS 283](#) (1.0 unit)
  - [ERS 337](#)
  - [ERS 340](#) (1.5 units)
  - [ERS 341](#) (1.5 units)
  - [ERS 342](#) (1.0 unit)
  - [ERS 346](#)
  - [ERS 382](#) (1.0 unit)
  - [ERS 383/BIOL 383](#)
  - [ERS 446](#)
  - [ERS 484/GEOG 404](#)
  - [GEOG 368/PLAN 341](#)
  - [GEOG 381/PLAN 381](#)
  - [GEOG 387/PLAN 387](#)
  - [GEOG 405](#) (1.0 unit)
  - [GEOG 456](#) (1.0 unit)
  - **One of**
    - **PLAN 240**
    - [PLAN 340](#)

Re: Diploma in Environmental Assessment: Revise

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Effective date: September 2024

Rationale: Reflect changes made by PLAN resulting from curriculum review (see attachment 1) and inactivation of ENV5 350 (see attachment 1).

Consultations:

Within ENV: Planning

External to ENV: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on plan as approved at SUC November 21, 2023

List D - Courses that involve material useful for case application of environmental assessment and related approaches to planning analysis, and problem solving:

- [ENVE 577](#)
- ~~[ENVS 350](#)~~
- [ENVS 401](#)
- ERS 221
- [ERS 317](#)
- [ERS 361/GEOG 361](#)
- [ERS 404/PSCI 432](#)
- [ERS 462/GEOG 462/PSCI 488](#)
- [ERS 484/GEOG 404](#)
- [GEOG 456](#)
- [GEOG 368/PLAN 341](#)
- [GEOG 391](#)
- [GEOG 407](#)
- [GEOG 432/HLTH 420/PLAN 432](#)
- [GEOG 459](#)
- [PLAN 440](#)
- **One of:**
  - **PLAN 240**
  - [PLAN 340](#)

Re: Aviation Specialization: Revise

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Effective date: September 2024

Rationale: Transfer credits which are being granted for the AVIA specialization are skewing the unit count towards GEM degrees. Moving forward the 1.0 unit will be added as transcript text only instead of transfer credits. This change will affect the following degrees: Geography and Environmental Management Honours; Geography and Environmental Management General; Geography and Environmental Management Joint Honours; Climate and Environmental Change; Geomatics.

Consultations: Registrar's Office regarding the addition of transcript text. This process will be treated the same as other substitutions and petitions. No other consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

**Revisions based on 2023/2024 Calendar and formatting in the new Kuali system.**

Additional constraints:

Up to 1.0 unit may be ~~granted~~ **counted** towards the ~~3.0 units~~ **four of elective** requirement, ~~(not including the capstone course requirement)~~ based on prior successful completion of Professional Pilot Program courses, or if a student has held a Transport Canada Private Pilot Licence. The 1.0 unit ~~granted~~ **counted** towards the specialization **will be noted on the student's record as transcript text**, will not be used in ~~cumulative major and overall plan~~ average calculations, and will not count towards any other University of Waterloo ~~program requirement~~ **academic credential**, including overall units required ~~to graduate for a Bachelor's degree~~. Proof of Transport Canada Private Pilot Licence must be provided and approved by the [aviation program manager](#) prior to declaring this Specialization.

Re: Geography and Environmental Management, 3 year General: Revise

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Effective date: September 2024

Rationale: The GEM 3YR program is not a direct-entry program, meaning students typically transfer into this program in 3A or above, after failing to meet the average requirements in the Honours Geography and Environmental Management (GEM), Geomatics, and Geography and Aviation program – or other programs from across the Faculty. When GEOG 100 was removed as a degree requirement for this program (October 2022 meeting and effective September 2024), this should have been replaced with another requirement. Adding an ENVS unit requirement will both a) ensure students have a strong foundation in GEOG and ENVS courses, and b) help support students transferring into the General 3YR program from programs outside GEM, by ensuring that they have already completed 1.0 units of the degree requirements (as all other programs require at least 1.0 units of ENVS courses in first-year).

Consultations: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on plan as approved at SUC February 14, 2023

Successful completion requires:

1. 15.0 units distributed as follows:
  - One of:
    - EMLS 129R/ENGL 129R Written Academic English
    - ENGL 109 Introduction to Academic Writing
  - GEOG 101 Human Geographies: People, Space and Change
  - GEOG 102 Global Environmental Systems: Processes and Change
  - GEOG 181 Designing Effective Maps
  - Six of:
    - GEOG 202 Geography of the Global Economy
    - GEOG 203 Environment and Development in a Global Perspective
    - GEOG 205 Principles of Geomorphology
    - GEOG 207 Climate Change Fundamentals
    - GEOG 209 Hydroclimatology
    - GEOG 271 Earth from Space Using Remote Sensing
    - GEOG 281/PLAN 281 Introduction to Geographic Information Systems (GIS)
  - **1.0 units: ENVS Courses**
  - 1.5 units: GEOG courses
    - 0.5 unit: at or above 200-level
    - 1.0 unit: at or above 300-level
  - ~~8.5~~ **7.5** units: Elective

Re: Knowledge Integration Honours: Revise

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Effective date: September 2024

**Rationale:**

The following courses are being added because of successful course substitution requests and departmental review:

- ERS 225 for Ethics and Social Justice breadth

The following course is being removed because the lab component is being inactivated and the lecture course by itself does not fit our Natural/Physical Science breadth requirement:

- PHYS 256/256L.

The following courses are being replaced:

- “BIOL 309 with BIOL 335L” by “BIOL 235 with BIOL 335L”. BIOL will be replacing BIOL 309 (Analytical Methods in Molecular Biology) with a new 200-level course, BIOL 235 Foundations of Molecular Biology. The new 200-level course will provide hands-on lab experience and is a good fit with the paired course in the KI program, BIOL 335L Molecular Biology Techniques.

**Consultations:**

Units delivering Breadth courses	Consultative status
ERS	Dept. has <b>approved</b> that we would like to add ERS 225 to our Breadth list
BIOL	Dept. has <b>approved</b> the change of BIOL 309 to BIOL 235, to be taken with BIOL 335L

**Governance:**

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

**Revisions based on plan as approved at SUC Nov 21, 2023**

- 0.5 unit Ethics and Social Justice from:
  - ARBUS 202/PHIL 215
  - BLKST 201, BLKST 203/ENGL 225
  - **ERS 225**
  - GSJ 201, GSJ 205, GSJ 207, GSJ 304
  - INDEV 300/PHIL 227
  - LS 352/PHIL 328
  - PACS 311, PACS 314, PACS 315, PACS 332
  - PACS 316/PHIL 329
  - PHIL 221, PHIL 224, PHIL 226, PHIL 228, PHIL 319J, PHIL 320, PHIL 326J, PHIL 420
  - RS 283, RS 383
- 0.50 unit Conflict Management from:
  - COMMST 432
  - LS 271/PACS 202, LS 319/PACS 323



- PACS 201, PACS 313, PACS 327

### Revisions based on plan as approved at SUC February 14, 2023

- 1.0 unit Natural/Physical Sciences from:
  - ANTH 204, ANTH 355, ANTH 455
  - BIOL 110, BIOL 130 with BIOL 130L, BIOL 201, BIOL 211, BIOL 240 with BIOL 240L, BIOL 241, BIOL 266, BIOL 302, ~~BIOL 309~~ BIOL 235 with BIOL 335L, BIOL 310, BIOL 325, BIOL 354, BIOL 365, BIOL 370 with BIOL 477L, BIOL 371 with BIOL 477L, BIOL 373 with BIOL 373L, BIOL 376, BIOL 458, BIOL 469, BIOL 470
  - CHEM 120 with CHEM 120L, CHEM 123 with CHEM 123L
  - EARTH 121 with EARTH 121L, EARTH 122 with EARTH 122L, EARTH 123 with EARTH 223, EARTH 231, EARTH 235, EARTH 238, EARTH 260, EARTH 342
  - ENVS 200, ENVS 300, ENVS 444
  - GEOG 181, GEOG 205, GEOG 209, GEOG 271, GEOG 281/PLAN 281, GEOG 300, GEOG 303, GEOG 304, GEOG 310, GEOG 320, GEOG 371, GEOG 407, GEOG 408, GEOG 420, GEOG 428/PLAN 418
  - KIN 100 with KIN 100L, KIN 121 with KIN 121L, KIN 221 with KIN 221L, KIN 301
  - MSN 101
  - PHYS 111 with PHYS 111L, PHYS 112 with PHYS 112L, PHYS 121 with PHYS 121L, PHYS 122 with PHYS 122L, PHYS 175 with PHYS 175L, ~~PHYS 256 with PHYS 256L~~

Re: Knowledge Integration Honours, Science, Technology, and Society Specialization: Revise

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Effective date: September 2024

Rationale: Reflect changes to PLAN course offerings resulting from curriculum review (see attachment 1) and the inactivation of INDEV 387 (see attachment 1). Knowledge Integration has elected to remove PLAN 340 and PLAN 346 now, in anticipation of the inactivation of these courses effective September 2026.

Consultations:

Within ENV: SEED and Planning

External to ENV: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on plan as approved at SUC November 21, 2023

#### Science, Technology, and Society Specialization

- Three of the following courses, of which two (1.0 unit) must be at the 300- or 400-level. Courses must be chosen from at least two subject codes (i.e., ERS, PLAN, STV, etc.):
  - [ANTH 303](#) Anthropology of Digital Media
  - [ANTH 347](#) Medical Anthropology
  - [ANTH 430/SOC 431](#) Science as Practice and Culture
  - [ARTS 490](#) Fourth-Year Topics in Arts Disciplines (topic: The Socio-Cultural and Political Implications of Artificial Intelligence)
  - [ENGL 108D](#) Digital Lives
  - [ENGL 293](#) Introduction to Digital Media Studies
  - [ENVS 210](#) Future Studies
  - [ENVS 310](#) Future Cities: Integrating Future Thinking into Urban Decisions
  - [ERS 265](#) Water: Environmental History and Change
  - [ERS 316](#) Urban Water and Wastewater Systems: Integrated Planning and Management
  - ERS 361/GEOG 361 Food Systems and Sustainability
  - [ERS 372](#) First Nations and the Environment
  - [ERS 404/PSCI 432](#) Global Environmental Governance
  - [ERS 406](#) Paths to Sustainability
  - [ERS 422](#) Biosphere Reserves as Social-Ecological Systems
  - [ERS 454](#) Parks and Protected Areas: Issues and Trends
  - [ERS 462/GEOG 462/PSCI 488](#) Global Food and Agricultural Politics
  - [GEOG 203](#) Environment and Development in a Global Perspective
  - [GEOG 207](#) Climate Change Fundamentals
  - [GEOG 306](#) Human Dimensions of Natural Hazards
  - [GEOG 307](#) Societal Adaptation to Climate Change

- [GEOG 311](#) Economic Geography and Society
- [GEOG 426](#) Geographies of Development
- [GEOG 432/HLTH 420/PLAN 432](#) Health, Environment, and Planning
- [HIST 212/STV 210](#) The Computing Society
- [HIST 216](#) From Gutenberg to Zuckerberg: A (Long) History of the Internet
- ~~[INDEV 387](#) Global Cities in Global Development~~
- **[INDEV/PLAN 262](#) Introduction to Global Emerging Cities**
- [LS 413/SOC 413](#) Surveillance and Society
- [PACS 301](#) Special Topics in Peace and Conflict Studies 1
- [PACS 302](#) Special Topics in Peace and Conflict Studies 2
- [PHIL 208](#) Philosophy Through Science Fiction
- [PHIL 224](#) Environmental Ethics
- [PHIL 226](#) Biomedical Ethics
- [PHIL 252/SCI 252](#) Quantum Mechanics for Everyone
- [PHIL 256/PSYCH 256](#) Introduction to Cognitive Science
- [PHIL 259](#) Philosophy of Technology
- [PHIL 271](#) Special Topics
- PHIL 358 Topics in Philosophy of Science
- [PHIL 447/PSYCH 447](#) Seminar in Cognitive Science
- **PLAN 240 Environmental Planning and Policy**
- **PLAN 246 Tools for Public Participation**
- [PLAN 333](#) Neighbourhood and Community Planning
- ~~[PLAN 340](#) Canadian Environmental Policy and Politics~~
- ~~[PLAN 346](#) Advanced Tools for Planning: Public Participation and Mediation~~
- [PLAN 431](#) Issues in Housing
- [PLAN 433](#) Social Concepts in Planning
- [PLAN 440](#) Urban Services Planning
- RS 383 Justice, Peace, and Development
- [SOC 225](#) Games and Gamers
- [SOC 232](#) Technology and Social Change
- [SOC 248](#) Health, Illness, and Society
- [SOC 312](#) Sociology of Science
- STV courses

Re: Knowledge Integration Joint Honours: Revise

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Effective date: September 2024

Rationale: Students pursuing a KI Joint Honours degree complete the exact same requirements as students enrolled in the KI Honours plan. It is desired to allow these students the option of adding one or both specializations to the joint portion of their degree if they desire to do so.

Consultations: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

**Revisions based on 2023/2024 Calendar**

Knowledge Integration Specializations are available to students in Knowledge Integration Honours **and students who are completing a Knowledge Integration Joint Honours degree. Students can graduate with one of, or both, specializations.**

Re: Parks Minor: Revise

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Effective date: September 2024

Rationale: Reflect changes made by PLAN resulting from curriculum review (see attachment 1)

Consultations:

Within ENV: Planning

External to ENV: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on 2023/2024 Calendar

Successful completion requires:

1. Eight courses distributed as follows:

- [ENVS 444](#)
- [ERS 431](#)
- [ERS 454](#)
- One of:
  - **PLAN 240**
  - [PLAN 340](#)
- Four of:
  - [BIOL 312](#)
  - [BIOL 350](#)
  - [BIOL 351](#)
  - [BIOL 383/ERS 383](#)
  - [BIOL 450](#)
  - [BIOL 455](#)
  - [BIOL 456](#)
  - [BIOL 457](#)
  - [BIOL 458](#)
  - [BIOL 485](#)
  - [BIOL 489](#)
  - [ERS 234](#)
  - [ERS 283](#) (1.0 unit)
  - [ERS 321](#)
  - [ERS 337](#)
  - [ERS 340](#) (1.5 units)
  - [ERS 346](#)
  - [ERS 382](#) (1.0 unit)
  - [ERS 422](#)
  - [ERS 443](#) (1.0 unit)
  - [ERS 446](#)
  - [GEOG 368/PLAN 341](#)
  - [REC 230](#)

Re: Planning Honours: Revise

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Effective date: September 2024

Rationale: Changes reflect outcome of the Plan curriculum review. This change was not included with the SUC November 21, 2023 package, as the original plan was to renumber PLAN 346 to PLAN 246; however, upon review of the course curriculum schedule, there is a need for overlapping the offerings of these two courses to accommodate incoming students and those in the process of completing their degree. Hence, renumbering is not possible (see attachment 1).

Consultations: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on plan as approved at SUC November 21, 2023

Successful completion requires:

1. 20.0 units distributed as follows:

- ENVS 178 Environmental Applications of Data Management and Statistics
- ENVS 195 Introduction to Environmental Studies
- ENVS 200 Field Ecology
- ENVS 201 Introduction to Canadian Environmental Law
- ENVS 278 Applied Statistics for Environmental Research
- PLAN 100 Urbanization Today: Introduction to Cities and Regions
- PLAN 102 Professional Communication
- PLAN 103 Planning Governance and Administration
- PLAN 107 How Plans are Made: Processes, Stages, & Strategies
- PLAN 110 Visual Communication and Design for Planners
- PLAN 133 Planning for Equity, Justice, and the Public Interest
- PLAN 202 Transportation and Housing: A Systems Approach
- PLAN 205 Spatial and Demographic Analysis in Planning
- PLAN 210 Community Design Fundamentals
- **PLAN 246 Tools for Public Participation**
- PLAN 281 Introduction to Geographic Information Systems (GIS)
- PLAN 300 Planning Theory and Ethics
- PLAN 341 Ecology and Conservation for Planning
- ~~PLAN 346 Advanced Tools for Planning: Public Participation and Mediation~~
- PLAN 348 Planning to Confront Climate Change
- PLAN 375 Municipal Finance and Land Economics
- PLAN 401 Conflict, Negotiation, and Tribunals in Planning
- PLAN 405 Integrated Planning Project
- PLAN 452 Policy Analysis & Evaluation for Planners
- PLAN 471 Planning and Municipal Law

- Equity and Justice Breadth Requirement - One of:
    - **PLAN 441** Disabling Environments and Accessibility in Planning
    - **PLAN 442** Indigenous Peoples and Planning
    - **PLAN 443** Planning for Ethno-cultural Diversity and Difference
    - **PLAN 445** Gender and Queer Inclusive Planning
  - 0.5 unit: PLAN course elective at the 200-level
  - 2.0 units: PLAN course elective at the 300 or 400 level
  - 1.0 unit: Elective at the 100-level
  - 1.0 unit: Elective at the 200-level
  - 3.0 units: Elective at the 300 or 400-level
2. **Co-operative program requirements.**

Re: Planning Honours, Environmental Planning Specialization: Revise

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Effective date: September 2024

Rationale: Changes reflect outcome of the Plan curriculum review. This change was not included with the SUC November 21, 2023 package, as the original plan was to renumber PLAN 340 to PLAN 240; however, upon review of the course curriculum schedule, there is a need for overlapping the offerings of these two courses to accommodate incoming students and those in the process of completing their degree. Hence, renumbering is not possible (see attachment 1).

Consultations: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on plan as approved at SUC November 21, 2023

Successful completion requires:

1. 2.5 units distributed as follows:

- ~~○ PLAN 340 Canadian Environmental Policy and Politics~~
- **PLAN 240 Environmental Planning and Policy**
- **PLAN 451 Environmental Planning in Rural and Regional Systems**
- At least 1.5 units from (see additional conditions):
  - **PLAN 358 Planning Agricultural Systems**
  - **PLAN 414 Heritage Conservation Planning**
  - **PLAN 417 Aggregate Resources Planning, Development, and Management**
  - **PLAN 440 Urban Services**
  - **PLAN 453/GEOG 453 Urban Stormwater**
  - **PLAN 480 Planning Theory and Practice Abroad**
  - **PLAN 485 Projects, Problems, and Readings in Planning**
  - Up to 1.0 units from:
    - **ENVS 401 Canadian Law, Indigenous Peoples, and Natural Resource Development**
    - **ENVS 444 Ecosystem and Resource Management in Parks/Natural Areas**
    - **ENVS 469 Landscape Ecology, Restoration and Rehabilitation**
    - **ERS 316 Urban Water and Wastewater Systems: Integrated Planning and Management**
    - **ERS 372 First Nations and the Environment**



Re: Urban Studies Minor: Revise

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Effective date: September 2024

Rationale: INDEV 387 is being inactivated (see attachment 1). INDEV/PLAN 262 course content and learning outcomes are like those in INDEV 387, making this course more suitable as the core course for the Emerging Global Region theme, rather than core for all four themes. This change will lower the overall minor requirements by one course, to nine.

Consultations:

Within ENV: SEED and Planning

External to ENV: No consultations required.

Governance:

UGSC – December 8, 2023

FC – January 18, 2024

SUC – February 5, 2024

### Revisions based on plan as approved at SUC November 21, 2023

Successful completion requires:

1. ~~Ten~~ **Nine** courses distributed as follows:

- [ECON 101](#)
- [PLAN 100](#)
- [PLAN 233](#)
- ~~[INDEV 262/PLAN 262](#)~~
- One of:
  - [ENVS 195](#)
  - [GEOG 101](#)
- One of the following theme requirements:
  - Theme 1: Urban Economics/Finance
    - [ECON 201](#)
    - Four of:
      - One of:
        - [AE 392/CIVE 392/ENVE 392/GEOE 392](#)
        - [MSCI 261](#)
      - [ECON 241](#)
      - [ECON 351](#)
      - [ECON 361](#)
      - [ECON 437](#)
      - [ECON 441](#)
      - [ECON 451](#)
      - [ENBUS 204](#)
      - [ENBUS 405](#)
      - [ERS 320](#)
      - GEOG 302
      - [GEOG 311](#)

- [GEOG 319/PLAN 320](#)
  - [PLAN 103](#)
  - [PLAN 416](#)
  - [PLAN 483](#)
- Theme 2: Urban Activity and the Environment
  - [ENVS 200](#)
  - Four of:
    - [BIOL 225](#)
    - [BIOL 350](#)
    - [BIOL 455](#)
    - [BIOL 457](#)
    - [CIVE 440/PLAN 478](#)
    - [CIVE 484/PLAN 484](#)
    - [EARTH 270](#)
    - [EARTH 281](#)
    - [EARTH 358](#)
    - [ECON 255](#)
    - [ENVS 469](#)
    - [ERS 316](#)
    - [GEOG 306](#)
    - [GEOG 349/PLAN 349](#)
    - [GEOG 351](#)
    - [GEOG 368/PLAN 341](#)
    - [GEOG 453/PLAN 453](#)
    - [PLAN 416](#)
    - [PLAN 451](#)
    - [PLAN 483](#)
- Theme 3: Urban Societies
  - [ERS 253](#)
  - Four of:
    - [ANTH 272/INDG 272](#)
    - [EASIA 220R/HIST 231R](#)
    - [ECON 363](#)
    - [ECON 437](#)
    - [GEOG 325](#)
    - [GEOG 432/HLTH 420/PLAN 432](#)
    - [GEOG 450/PLAN 450](#)
    - [GSJ 302](#)
    - [HIST 260/MEDVL 260](#)
    - [HIST 374](#)
    - [INTEG 121](#)
    - [INTEG 221/PHIL 291](#)
    - [PACS 313](#)
    - [PLAN 333](#)
    - [PLAN 431](#)
    - [PLAN 433](#)
    - [REC 422](#)
    - [SDS 231R](#)
    - [SDS 312R/SWREN 312R](#)
    - [SDS 322R](#)

- [SOC 224R/SWREN 224R](#)
- [SOC 248](#)
- [SOC 369J](#)
- [SOCWK 222R/SWREN 222R](#)
- [STV 305](#)
- Theme 4: Emerging Global Urban Regions
  - ~~[INDEV 387](#)~~
  - **INDEV/PLAN 262**
  - Four of:
    - [ANTH 382/EASIA 382R](#)
    - [EASIA 277R/PSCI 277](#)
    - [EASIA 301R](#)
    - [ERS 404/PSCI 432](#)
    - [GEOG 202](#)
    - [GEOG 203](#)
    - [GEOG 215](#)
    - [GEOG 311](#)
    - [GEOG 411](#)
    - [GEOG 426](#)
    - [HIST 282](#)
    - [INDEV 404](#)
    - [PLAN 440](#)
    - [PSCI 252](#)
    - [PSCI 283](#)
    - [PSCI 358](#)
    - [PSCI 359](#)
    - [PSCI 405](#)
    - [SDS 388R](#)
    - [SOC 451](#)

# Appendix C: Faculty of Health

FACULTY OF HEALTH – UNDERGRADUATE REPORT (FUGS: November 2, 2023 & FC: November 24, 2023)

to

SENATE UNDERGRADUATE COUNCIL (February 5, 2024)

Faculty of Health undergraduate curricular changes for  
*for inclusion in the 2024/2025 Undergraduate Studies Academic Calendar*

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1. NEW COURSES – Undergraduate Catalog Report 7, 16 (23-JAN-2024)  
KIN
2. COURSE CHANGES – Undergraduate Catalog Report 7, 16 (23-JAN-2024)  
GERON  
HLTH  
KIN  
REC
3. ACADEMIC PLANS (MINOR MODIFICATIONS)
  - 3.1. Medical Physiology Minor
  - 3.2. Pre-Clinical Specialization

## Legend

Bold = new text added

Strikeout = text removed

## Undergraduate report approval process -

Admin Council (AC): October 11, 2023

Faculty Undergraduate Studies Committee (FUGS): November 2, 2023

Faculty Council (FC): November 24, 2023

Senate Undergraduate Council (SUC): February 5, 2024

Senate: March 4, 2024

**1. NEW COURSES** (for approval)

**Kinesiology and Health Sciences**

**Effective 01-SEP-2024**

**KIN 305** (0.50) LAB, LEC Human Anatomy of the Thorax, Abdomen, and Pelvis

A functionally oriented, regional approach, to the anatomy of the thorax, abdomen, and pelvis. Students will observe structures they have learned in lecture using pre-dissected human cadavers.

Requisites:

Prereq: KIN 100 and KIN 100L

Rationale:

To add a new course. In KIN 100 and KIN 100L, students learn the detailed anatomy of the limbs and trunk. The emphasis in those courses is on the musculoskeletal system. Pre-dissected human cadaver donors are available to teach additional body systems. This course will provide students another opportunity to be in the human anatomy lab and to learn about internal organs responsible for blood flow, respiration, digestion, and reproduction. This anatomical knowledge will help support and reinforce concepts taught throughout the Kinesiology program. Short title: Anatomy of Thorax & Abdomen

**2. COURSE CHANGES** (for approval)

**Current Catalog Information**

**Public Health Sciences - School of**

**Current Catalog Information**

**GERON 355** (0.50) LEC Biology of Human Aging

An overview of current aspects of the biology of human aging and the functional changes associated with both normal aging and pathological problems often present in the elderly. Biological theories of aging and normal age-related structural and physiological changes on all of the major body systems will be discussed. Extrinsic factors such as diet and exercise and their role on the aging process will be examined as well as various medical treatments. [Offered: W]

No Special Consent Required

Requisites: Prereq: BIOL 130

Cross-listed as: BIOL 355

**Effective 01-SEP-2024**

Requisite Change:

Prereq: BIOL 273

Rationale:

It was recognized that students would benefit with a stronger background in human physiology to describe and discuss physiological changes associated with aging. Therefore BIOL 273, Human Physiology 1, is added as a prerequisite for BIOL 355. Since BIOL 273 requires BIOL 130, the latter is removed as a prerequisite for BIOL 355. This course is cross-listed with GERON 355, and the Faculty of Health has been made aware of requisite changes on the BIOL of the cross-listing and approves the revision to GERON 355 as well.

### Current Catalog Information

#### **HLTH 420 (0.50) LEC** Health, Environment, and Planning

This course examines the relationship between the environment (built/physical, economic, social, political, and natural aspects) and population health. It focuses on conceptual and empirical links among current environment-health issues such as air quality, active transportation, injury prevention, climate change, and mental well-being. Emphasis is placed on the role of urban planners in collaboration with allied professionals (e.g., public health, engineering, law enforcement, architecture) in creating and maintaining healthy built environments to improve population health with a focus on key health issues.

No Special Consent Required

Requisites: Prereq: One of PLAN 233, HLTH/GSJ 260, ERS 253, GEOG 325

Cross-listed as: PLAN 432 GEOG 432

#### **Effective 01-SEP-2024**

Component Change: LEC, TUT

Title Change: Health and the Built Environment

Description Change: This course will focus on current issues at the intersection of health, planning, and the built and natural environments. Students will learn the history and evolution of both public health and urban planning professions and academic disciplines and gain an appreciation of the theories and methods used in each. Students will also learn about specific health and planning issues (e.g., air pollution, physical activity, injury, mental health) as well as how better health and health equity can be built into future cities. Students will enhance interdisciplinary collaboration skills by working with classmates across faculties on multiple activities.

Rationale: Course title and description updated to better align with the curriculum review outcomes. Tutorial added for scheduling flexibility. The Faculties of Health and Environment have approved these changes. Short title: Health & the Built Environment

### Current Catalog Information

#### **HLTH 442 (0.50) LEC** Epidemiology of Non-Communicable Diseases

This course builds upon the concepts learned in HLTH 333. The primary objective is to provide an understanding of the fundamental concepts, principles and applications of non-communicable disease epidemiology. The course emphasizes understanding of epidemiologic methods and identification of risk and protective factors.

No Special Consent Required

Requisites: Prereq: HLTH 333; HLTH 335 or STAT 316; Level at least 4A School of Public Health Sciences students

#### **Effective 01-SEP-2024**

Component Change: LAB, LEC

Description Change: This course builds upon the concepts learned in HLTH 333. The primary objective is to provide an understanding of the fundamental concepts, principles, and applications of non-communicable disease epidemiology. The course emphasizes the application of epidemiologic methods to identify risk and protective factors for chronic diseases.

Rationale: To revise the HLTH 442 course components and course description. A lab component is being added to HLTH 442 to allow for the option of scheduling of lab sections separately from the lectures. The labs will provide an opportunity for students to work on applied analyses of epidemiological data sets. The School of Public Health Sciences has made arrangements to support the addition of a lab for HLTH 442 including resources such as a higher TA ratio and access to statistical analysis software such as R or SAS. The course description is being revised to reflect the application of epidemiological methods, rather than just understanding.

## Kinesiology and Health Sciences

### Current Catalog Information

#### **KIN 312** (0.50) LEC Introduction to Neurological Disorders

An introduction to selected neurological disorders and their implications for physical activity. The neurological disorders examined include those which accompany neuromuscular and perceptual-motor impairment, intellectual disability, cardiovascular and respiratory disease.

No Special Consent Required

Requisites: Prereq: BIOL 273. Antireq: KIN 242

#### **Effective 01-SEP-2024**

Requisite Change:

Prereq: BIOL 273 or PSYCH 261. Antireq: KIN 242

Rationale:

To add a prerequisite. Given that the Neuroscience Minor will take effect on September 1, 2024, the addition of PSYCH 261 (Physiological Psychology) as a prerequisite will enhance the accessibility of KIN 312 to students outside of the Kinesiology program. PSYCH 261 is a suitable prerequisite for KIN 312 as it provides students with knowledge that is sufficient to prepare students for the content covered in KIN 312. The Department of Psychology was consulted and approved the use of PSYCH 261 as a prerequisite on July 24, 2023.

### Current Catalog Information

#### **KIN 357** (0.50) LEC Motor Learning and Neuroplasticity

This course will examine the neural control of movement and how experience shapes brain reorganization to support skilled motor ability. Evidence from behavioural and neuroimaging studies will be considered with an emphasis on leveraging principles of motor learning to skill acquisition and skilled performance in sport/occupational environments and the rehabilitation of movement disorders/injuries.

No Special Consent Required

Requisites: Prereq: KIN 255

#### **Effective 01-SEP-2024**

Requisite Change:

Prereq: KIN 255 or PSYCH 261

Rationale:

To add a prerequisite. Given that the Neuroscience Minor will take effect on September 1, 2024, the addition of PSYCH 261 (Physiological Psychology) as a prerequisite will enhance the accessibility of KIN 357 to students outside of the Kinesiology program. PSYCH 261 is a suitable prerequisite for KIN 357 as it provides students with knowledge that is sufficient to prepare students for the content covered in KIN 357. The Department of Psychology was consulted and approved the use of PSYCH 261 as a prerequisite on July 24, 2023.

### Current Catalog Information

#### **KIN 455** (0.50) LEC Brain and Behavioural Development

This course focuses on the neurobiological basis underlying brain and behaviour development from conception to adolescence. The emergence of neural functions and corresponding behaviours will be discussed in the context of a complex interaction between genes and environment. Topics include molecular/genetic perspectives, epigenetics, critical periods of cortical development, plasticity, sensorimotor and cognitive development. The course focuses on typical development, but conditions that induce abnormal brain development will be considered.

No Special Consent Required

Requisites: Prereq: KIN 255

#### **Effective 01-SEP-2024**

Requisite Change:

Prereq: KIN 255 or PSYCH 261

Rationale:

To add a prerequisite. The addition of PSYCH 261 (Physiological Psychology) as a prerequisite will enhance the accessibility of KIN 455 to students outside of the Kinesiology program. PSYCH 261 is a course in the Neuroscience Minor (effective September 1, 2024) and provides students with knowledge that is sufficient to prepare students for the content covered in KIN 455. The Department of Psychology was consulted and approved the use of PSYCH 261 as a prerequisite on July 24, 2023.

## Recreation & Leisure Studies

### Current Catalog Information

**REC 201 (0.50) LEC** Leisure and Social Justice

This course focuses on what social justice means in leisure studies and explores why social justice matters by introducing issues related to inclusivity, privilege, power, marginalization, and oppression. Areas of exploration may include but are not limited to age, class and poverty, (dis)ability, non-human interactions, race and ethnicity, sexual and gender identities, and status.

No Special Consent Required

Requisites: Prereq: REC 100, 101

### Effective 01-SEP-2024

Title Change: Introduction to Leisure, Equity, Diversity, and Inclusion for Just Communities

Description Change: This course focuses on how justice, equity, and liberation can be taken up within and promoted through recreation, leisure, and community. Emphasis is placed on just communities that put liberation of all peoples at the forefront of relations including self-care, community care, and environmental care. It explores why social justice matters by introducing issues related to inclusivity, privilege, power, marginalization, identities, and oppression. Topics for critique and resistance may include, but are not limited to gentrification, capitalism, settler colonialisms, environmental injustice, and other systemic barriers at play within our leisure lives and communities.

Requisite Change: Prereq: Level at least 2A

Rationale: To change course title, description, and prerequisites. The new course title and description more accurately reflects the content and focus of the course. The previous course prerequisites of REC 100, 101 are being removed to offer greater flexibility for enrolment of students across campus. REC 201 will be an elective in the Faculty of Arts, Social Innovation Impact Minor and this will allow students to enroll in the course. Additionally, the content of REC 100, 101 are no longer required as a prerequisite for REC 201 as the course is exploring introductory concepts which can be applied to all disciplines, not only the fields of Recreation and Leisure. The Department of Philosophy has been consulted and approved the revision. Short title: Leisure, Equity, & Diversity

### Current Catalog Information

**REC 218 (0.50) SEM** Social Entrepreneurship for Change

This course examines social entrepreneurship as a means for improving individual and community well-being. Focus will be placed on learning and implementing tools which businesses, citizens, and consumers can use to address social issues. Students will complete the course with an understanding of their personal responsibility and role as community/ global citizen which will aid them in their career development. Particular emphasis may be placed on the role of social entrepreneurship in addressing issues related to social justice, inclusion, and sustainable management practices.

No Special Consent Required

Requisites: Prereq: REC 100, REC 101; Level at least 2A Department of Recreation and Leisure Studies students

### Effective 01-SEP-2024

Description Change: This course examines social entrepreneurship as a means for improving individual and community well-being. Focus will be placed on learning and implementing tools which businesses, citizens, and consumers can use to address social issues. Students will complete the course with an understanding of their personal responsibilities and roles as community/global citizens providing opportunities for students to practice their leadership skills and support their career development. Emphasis may be placed on the role of social entrepreneurship in addressing issues related to social justice, inclusion, and sustainability practices.

Requisite Change: Prereq: Level at least 2A

Rationale: To revise the course prerequisites and course description. REC 218 is being included in a new minor offered by the Faculty of Arts, Social Innovation Impact Minor. The REC 100, REC 101 and Department of Recreation and Leisure Studies students only prerequisites are being revised to allow students from other faculties access to the course. The course description revision highlights the opportunity to develop leadership skills in the classroom.



**Current Catalog Information**

**REC 425** (0.50) LEC, SEM Heritage Planning Workshop

The role of cultural heritage in the community context is examined. Varying forms of heritage preservation, its function and organization are covered. This course may include a field component. [Note: Field trip fee will not exceed \$25+HST.]

No Special Consent Required

Requisites: Prereq: Level at least 3A

Cross-listed as: PLAN 414

**Effective 01-SEP-2024**

Component Change:

LEC, SEM, TUT

Title Change:

Heritage Conservation Planning

Description Change:

This course will examine the role of cultural heritage resources in urban and regional planning. Students will discuss different types of cultural heritage resources, including their identification, evaluation, promotion, protection, and role in community identity. Students will also consider the legislative and policy frameworks for heritage conservation and learn how to apply key tools for inventorying and evaluating cultural heritage resources. [Note: This course may have additional fees.]

Rationale:

Course title and description updated to better align with the curriculum review outcomes. Tutorial added to provide scheduling flexibility. The Faculties of Health and Environment have approved these changes. Short title: Heritage Conservation

End of Report

### 3. ACADEMIC PLANS (MINOR MODIFICATIONS)

#### 3.1. Medical Physiology Minor

Effective September 1, 2024

Background and rationale:

To revise the elective course lists. The addition of BIOL 472 (Cell Biology of Human Disease) and KIN 402 (Environmental Physiology) will add to the breadth of topics in the minor. In addition, these two courses will provide more flexibility/options to students looking to satisfy the plan requirements. The Associate Chairs Undergraduate Studies and Program Managers from the Departments of Biology and Kinesiology and Health Sciences discussed and agreed upon these revisions.

*Calendar Text:*

The Medical Physiology Minor is a shared minor between the Department of Biology and the Department of Kinesiology and Health Sciences.

Students enrolled in any degree program may pursue a minor designation in Medical Physiology.

Requirements

Successful completion of 5.0 units with a minimum cumulative minor average of 60%, from the requirements listed:

- Required courses (2.5 units):
  - BIOL 239, BIOL 373, KIN 308, KIN 404
  - One of GSJ 380/HLTH 380, PHIL 226, PHIL 319J, PHIL 321J
- Elective courses (2.5 units):
  - Select 1.0 unit from: KIN 301, KIN 310/GERON 310/HLTH 310, KIN 312, KIN 343, KIN 356, **KIN 402**, KIN 406, KIN 407, KIN 416, KIN 429
  - Select 1.0 unit from: BIOL 341, BIOL 354, BIOL 355/GERON 355, BIOL 376, BIOL 444, **BIOL 472**, BIOL 473, BIOL 476
  - Select 0.5 unit from: PSYCH 207, PSYCH 261, PSYCH 307, PSYCH 335

Notes

1. Courses obtained on a Letter of Permission or in transfer credit must be equivalent to courses listed in the course requirements.
2. Students in the Medical Physiology Minor are expected to have already taken BIOL 130, BIOL 273, and PSYCH 101/PSYCH 101R, which are prerequisites for one or more of the listed required courses.

#### 3.2. Pre-Clinical Specialization

Effective September 1, 2025

Background and rationale:

To revise the Pre-Clinical Specialization. The Department of Biology is inactivating and revising some courses that affect the Pre-Clinical Specialization. BIOL 309 (Analytical Methods in Molecular Biology) is being removed since the course is being inactivated effective September 1, 2025. New courses, BIOL 235 (Foundations of Molecular Biology), and BIOL 403 (Developmental Biology and Embryology) both effective September 1, 2024, are being added as options in the Pre-Clinical Specialization. All changes were initiated by and hence have been approved by the Department of Biology.

*Calendar Text:*

Admission to the Specialization requires a minimum cumulative overall average of 75% and a minimum cumulative major average of 75%.

In order to graduate with this Specialization, the following requirements must be met:

1. A minimum cumulative overall average of 75% and minimum cumulative major average of 75%.
2. Declare this Specialization before the beginning of 3A academic term.
3. Successful completion of 21.0 units, including all requirements of the Bachelor of Science, Honours Health Sciences degree.
4. Successful completion of 1.0 unit from the following list:
  - (0.5 unit) fourth-year research methods course: HLTH 432A, HLTH 432B, HLTH 433, HLTH 435, HLTH 442, HLTH 443, HLTH 451, HLTH 453, HLTH 455, HLTH 458, HLTH 461, HLTH 475
  - (0.5 unit) fourth-year seminar course: HLTH 403, HLTH 421, HLTH 427, HLTH 430, HLTH 448, HLTH 449, HLTH 450, HLTH 454, HLTH 465, HLTH 471, HLTH 479, HLTH 481

5. Successful completion of 3.5 total units from the following list:  
BIOL 201, BIOL 211, **BIOL 235**, BIOL 240, BIOL 240L, BIOL 241, BIOL 302, BIOL 303, BIOL 308, ~~BIOL 309~~, BIOL 331, BIOL 341, BIOL 354, BIOL 355/GERON 355, BIOL 373L, BIOL 376, **BIOL 403**, BIOL 441, BIOL 442, BIOL 444, BIOL 449, BIOL 455, BIOL 469, BIOL 472, BIOL 473  
CHEM 237, CHEM 237L, CHEM 266, CHEM 266L, CHEM 267, CHEM 267L  
KIN 100 and KIN 100L, KIN 146, KIN 301, KIN 308, KIN 312, KIN 340, KIN 404, KIN 406, KIN 407  
MATH 127, MATH 128  
PHYS 111, PHYS 111L, PHYS 112, PHYS 112L

#### Notes

1. Students must complete one additional unit beyond the 20.0 units required for their Health Sciences degree and should plan carefully, in consultation with an academic advisor, for when they will fit in the extra courses.
2. Other fourth-year research methods or seminar courses may be approved by the School of Public Health Sciences associate director, undergraduate studies.
3. Students may declare only one specialization.

# Appendix E: Faculty of Mathematics

February 05, 2024

## SENATE UNDERGRADUATE COUNCIL

### Submission by the Faculty of Mathematics

#### 1. New Courses

- 1.1. Applied Mathematics
  - 1.1.1. AMATH 445
- 1.2. Pure Mathematics
  - 1.2.1. PMATH 367
  - 1.2.2. PMATH 434

#### 2. Course Changes

- 2.1. Applied Mathematics
  - 2.1.1. AMATH 331
  - 2.1.2. AMATH 332
  - 2.1.3. AMATH 333 [*FC Jan 16*]
- 2.2. Combinatorics and Optimization
  - 2.2.1. CO 463
  - 2.2.2. CO 471
  - 2.2.3. CO 485
- 2.3. Computer Science
  - 2.3.1. CS 241 and CS 241E [*FC Jan 16*]
  - 2.3.2. CS 245 [*FC Jan 16*]
  - 2.3.3. CS 330 [*FC Jan 16*]
- 2.4. Pure Mathematics
  - 2.4.1. PMATH 331
  - 2.4.2. PMATH 332
  - 2.4.3. PMATH 333
  - 2.4.4. PMATH 334
  - 2.4.5. PMATH 336
  - 2.4.6. PMATH 343
  - 2.4.7. PMATH 352
  - 2.4.8. PMATH 365
  - 2.4.9. PMATH 432
  - 2.4.10. PMATH 433
  - 2.4.11. PMATH 465

#### 3. Course Deactivations

- 3.1. Co-op
  - 3.1.1. WK RTP 100M

#### 4. Academic Plan Changes (Minor Modifications)

- 4.1. Applied Mathematics
  - 4.1.1. Applied Mathematics Major [*FC Jan 16*]
  - 4.1.2. Joint Applied Mathematics [*FC Jan 16*]

- 4.1.3. Applied Mathematics with Scientific Computing [*FC Jan 16*]
  - 4.1.4. Mathematical Physics (1/3) [*FC Jan 16*]
  - 4.1.5. Mathematical Physics (2/3 invalid combinations)
  - 4.1.6. Mathematical Physics (3/3 allowable substitutions)
  - 4.2. Combinatorics and Optimization
    - 4.2.1. Combinatorics and Optimization Major
    - 4.2.2. Joint Combinatorics and Optimization
  - 4.3. Dean of Math Office
    - 4.3.1. Mathematics/Teaching
    - 4.3.2. Mathematical Economics
  - 4.4. Pure Mathematics
    - 4.4.1. Pure Mathematics Major
  - 4.5. Statistics and Actuarial Science
    - 4.5.1. Financial Analysis and Risk Management: Professional Risk Management
5. **For information:** Legacy course substitutions in program requirements and course prerequisites

**NEW COURSES** (for approval)

**Applied Mathematics**

**Effective 01-SEP-2024**

AMATH 445 (0.50) LEC, TUT Scientific Machine Learning

The course provides an in-depth exploration of how deep learning techniques are applied in various scientific and medical domains. The course introduces basic concepts of deep learning, explores different deep learning architectures and algorithms, and focuses on their applications in scientific and biomedical research. The integration of scientific knowledge with machine learning techniques is emphasized throughout the course. Students will gain hands-on experience by executing the acquired concepts using Python.

Requisites : Prereq: One of AMATH 250, 251, 350, MATH 211/ECE 205, MATH 218, 228.

Rationale : As data-driven methodologies become increasingly indispensable for the scientific community, deep learning emerges as a transformative tool, capable of modelling complex systems and phenomena that are often challenging for classical methods. For students of applied mathematics, mastering these computational techniques enriches their analytical toolkit, enabling them to remain at the forefront of research and innovation. By integrating deep learning into their curriculum, they not only enhance their employability in diverse sectors but also become better prepared to contribute to advancements in science and technology. This course is structured to introduce undergraduate students in applied mathematics to the emerging field of scientific machine learning. There is a wide area of applications where deep learning has become essential in applied mathematics research and applications. As such, deep learning knowledge applied to problems from science and medicine is becoming indispensable for applied mathematics students. The course is divided into three parts. The first part provides a short and non-technical introduction to machine learning, and the second part introduces standard and more advanced deep learning approaches. The third and main part of the course covers the application of deep learning to several disciplines, such as the biomedical sciences, fluid mechanics, and quantum physics. The short title matches the long title.

**Pure Mathematics**

**Effective 01-SEP-2024**

PMATH 367 (0.50) LEC Topology

Topological spaces, bases, and Hausdorff spaces. Subspace, product, and quotient topologies. Continuous maps, compactness, connectedness, and path-connectedness. Topological manifolds. The fundamental group, the Seifert-Van Kampen Theorem, and

covering spaces.

Requisites : Prereq: PMATH 336 or 347. Coreq: PMATH 351.  
Rationale : We would like to create a new course in Topology. Many faculty members and students have expressed a desire to have such a course offered. The material covered in this new course is foundational material that we would like most graduating Pure Math students to be familiar with. This course will be added in a "one of" list (with PMATH 365) to the PMATH major requirements. The material in this course would offer equal (or better) preparation for PMATH 465 than does PMATH 365. The short title matches the long title.

### Effective 01-SEP-2024

PMATH 434 (0.50) LEC Set Theory  
ZFC axioms, well-orders, ordinals, regular and singular cardinals, the cumulative hierarchy, Boolean algebras, ultrafilters, club and stationary sets, measurable cardinals, the reflection principle, Gödel's constructible universe, ordinal definable sets.

Requisites : Prereq: PMATH 432.  
Rationale : With PMATH 432 being changed to a broad introductory course and available to serve as a prerequisite, this allows the current PMATH 433, currently titled "Set theory and Model theory," to be split into two courses, namely Model Theory PMATH 433 and Set Theory PMATH 434 which go deeper into those respective areas. The intent is to offer two advanced logic courses per year which is an increase, with PMATH 432 every fall and with PMATH 433 and 434 alternating each winter. The short title matches the long title.

### COURSE CHANGES (for approval)

#### Applied Mathematics

#### Current Catalog Information

AMATH 331 (0.50) LEC Applied Real Analysis  
Topology of Euclidean spaces, continuity, norms, completeness. Contraction mapping principle. Fourier series. Various applications, for example, to ordinary differential equations, optimization and numerical approximation. [Note: PMATH 351 may be substituted for AMATH/PMATH 331 whenever the latter is a requirement in an Honours plan. Offered: F,W]  
No Special Consent Required  
Requisites : Prereq: MATH 237 or 247  
Cross-listed as: PMATH 331

### Effective 01-SEP-2024

Description Change: Topology of Euclidean spaces, continuity, norms, completeness. Contraction

mapping principle. Fourier series. Various applications, for example, to ordinary differential equations, optimization and numerical approximation.

Requisite Change : Prereq: MATH 237 or 247  
Antireq: [PMATH 333](#), [PMATH 351](#)

Rationale : The course PMATH 333 is normally a bit more challenging than PMATH 331. Students who take either PMATH 333 or PMATH 351 will have seen essentially all of the material in AMATH/PMATH 331 and should not be able to take AMATH/PMATH 331 for credit. Editorial: The note about PMATH 351 is ported to the various affected plans.

### Current Catalog Information

AMATH 332 (0.50) LEC, TST, TUT Applied Complex Analysis  
Complex numbers, Cauchy-Riemann equations, analytic functions, conformal maps and applications to the solution of Laplace's equation, contour integrals, Cauchy integral formula, Taylor and Laurent expansions, residue calculus and applications.  
**[Note: PMATH 352 may be substituted for AMATH/PMATH 332 whenever the latter is a requirement in an Honours plan. Offered: W,S]**  
No Special Consent Required  
Requisites : Prereq: MATH 237 or 247. Antireq: PHYS 365  
Cross-listed as: PMATH 332

### Effective 01-SEP-2024

Description Change: Complex numbers, Cauchy-Riemann equations, analytic functions, conformal maps and applications to the solution of Laplace's equation, contour integrals, Cauchy integral formula, Taylor and Laurent expansions, residue calculus and applications.

Requisite Change : Prereq: MATH 237 or 247.  
Antireq: PHYS 365, [PMATH 352](#)

Rationale : Students who have taken PMATH 352 will have seen essentially all the content of PMATH 332 and should not be able to take PMATH 332 for credit. Editorial: The note about PMATH 352 is ported to the various affected plans.

### Current Catalog Information

AMATH 333 (0.50) LEC Differential Geometry in Applied Mathematics and Physics  
Manifolds and tensors, Lie derivatives and Lie groups, differential forms and applications to physics. This course covers the basic concepts of differential geometry from the perspective of its applications to physics. The course focuses on the concepts and the techniques that allow us to formulate physical problems in the powerful language of differential geometry including thermodynamics, classical mechanics, fluid dynamics, and relativity. [Offered: F]  
No Special Consent Required  
Requisites : Prereq: PHYS 121; One of MATH 114, 136, 146; One of AMATH 231, MATH 227, PMATH 365

### Effective 01-SEP-2024

Title Change: Calculus on Manifolds for Applied Mathematics and Physics  
Rationale : The previous name was too ambitious for what it is covered. This is a more



faithful representation of the contents of the course. Short title: Calc on  
Mani Appl Math & Phys.

## Combinatorics & Optimization

### Current Catalog Information

CO 463 (0.50) LEC Convex Optimization and Analysis

An introduction to the modern theory of convex programming, its extensions and applications. Structure of convex sets, separation and support, subgradient calculus for convex functions, Fenchel conjugacy and duality, Lagrange multipliers. Ellipsoid method for convex optimization. [Offered: W]

No Special Consent Required

Requisites : Prereq: (CO 255 or 367), (AMATH/PMATH 331 or PMATH 351); Cumulative overall average of at least 80%

### Effective 01-SEP-2024

Requisite Change : Prereq: CO 255 or 367; One of AMATH/PMATH 331, [PMATH 333](#) or PMATH 351. Cumulative overall average of at least 80%.

Rationale : Students who have taken PMATH 333 will have seen essentially all the content of PMATH 331.

### Current Catalog Information

CO 471 (0.50) LEC Semidefinite Optimization

Optimization over convex sets described as the intersection of the set of symmetric, positive semidefinite matrices with affine spaces. Formulations of problems from combinatorial optimization, graph theory, number theory, probability and statistics, engineering design, and control theory. Theoretical and practical consequences of these formulations. Duality theory and algorithms. [Offered: S]

No Special Consent Required

Requisites : Prereq: MATH 239 or 249, AMATH/PMATH 331 or PMATH 351, CO 255 or 367; Cumulative overall average of at least 80%

### Effective 01-SEP-2024

Requisite Change : Prereq: MATH 239 or 249; [One of](#) AMATH/PMATH 331, [PMATH 333](#), or PMATH 351; CO 255 or 367; Cumulative overall average of at least 80%

Rationale : Students who have taken PMATH 333 will have seen essentially all the content of PMATH 331.

### Current Catalog Information

CO 485 (0.50) LEC The Mathematics of Public-Key Cryptography

An in-depth study of public-key cryptography. Number-theoretic problems: prime generation, integer factorization, discrete logarithms. Public-key encryption, digital signatures, key establishment, elliptic curve cryptography, post-quantum cryptography. Proofs of security. [Offered: F]

No Special Consent Required

Requisites : Prereq: One of PMATH 334, 336, 345, 346, 347; Cumulative overall average of at least 80%

### Effective 01-SEP-2024

Requisite Change : Prereq: One of PMATH 334, 336, 345, 346, 347, [348](#); Cumulative overall

Rationale : average of at least 80%  
Students who have taken PMATH 348 will have seen essentially all the content of PMATH 334.

## Computer Science - David R. Cheriton School of

### Current Catalog Information

CS 241 (0.50 ) LAB, LEC, TST, TUT Foundations of Sequential Programs

The relationship between high-level languages and the computer architecture that underlies their implementation, including basic machine architecture, assemblers, specification and translation of programming languages, linkers and loaders, block-structured languages, parameter passing mechanisms, and comparison of programming languages. [Note: Enrolment is restricted. Lab is not scheduled and students are expected to find time in open hours to complete their work. **CS 251 is a recommended corequisite.** Offered: F,W,S]

No Special Consent Required

Requisites : Prereq: CS 138 or (CS 246/246E and CS 136L) or (CS 136L and a grade of 85% or higher in one of CS 136 or 146); Computer Science and BMath (Data Science) students only. Antireq: CS 230, ECE 351

### Effective 01-SEP-2024

Description Change: The relationship between high-level languages and the computer architecture that underlies their implementation, including basic machine architecture, assemblers, specification and translation of programming languages, linkers and loaders, block-structured languages, parameter passing mechanisms, and comparison of programming languages. [Note: Enrolment is restricted; see Note 1 above. Lab is not scheduled and students are expected to find time in open hours to complete their work. Offered: F,W,S]

Rationale : The CS 251 recommendation is no longer relevant as CS 241 and CS 251 have diverged. Moreover, the recommendation was inaccurate since some students must take ECE 222 instead of CS 251, and other students may substitute CS 251E for CS 251. In addition, the recommendation was not a requirement and the Registrar is encouraging units to remove advice from the calendar.

### Current Catalog Information

CS 241E (0.50 ) LAB, LEC, TST, TUT Foundations of Sequential Programs (Enriched)

Enriched version of CS 241. [Note: CS 241E may be substituted for CS 241 wherever the latter is a requirement. Enrolment is restricted. Lab is not scheduled and students are expected to find time in open hours to complete their work. **CS 251 is a recommended corequisite.** Offered: As permitted by demand and available resources.]

No Special Consent Required

Requisites : Prereq: (CS 136L and a grade of 85% or higher in one of CS 136 or CS 146), or a grade of 85% or higher in CS 138; Computer Science and BMath (Data Science) students only. Antireq: CS 230, ECE 351

### Effective 01-SEP-2024

Description Change: Enriched version of CS 241. [Note: See notes 1 and 9 above. CS 241E may be

substituted for CS 241 wherever the latter is a requirement. Enrolment is restricted. Lab is not scheduled and students are expected to find time in open hours to complete their work. Offered: As permitted by demand and available resources.]

Rationale : The CS 251 recommendation is no longer relevant as CS 241E and CS 251 have diverged. Moreover, the recommendation was inaccurate since some students must take ECE 222 instead of CS 251, and other students may substitute CS 251E for CS 251. In addition, the recommendation was not a requirement and the Registrar is encouraging units to remove advice from the calendar.

### Current Catalog Information

CS 245 (0.50) LEC, TST, TUT Logic and Computation

Logic as a tool for representation, reasoning, and computation. Propositional and predicate logic. Formalizing the notions of correct and incorrect reasoning, defining what is computable, and exploring the limits of computation. Godel's Incompleteness Theorem. Applications of logic to computer science.

No Special Consent Required

Requisites : Prereq: (One of CS 136, 138, 146), MATH 135; Honours Mathematics students only. Antireq: PMATH 330, ECE 208, SE 212

### Effective 01-SEP-2024

Requisite Change : Prereq: (One of CS 136, 138, 146), (MATH 135 or [MATH 145](#)); Honours Mathematics students only. Antireq: PMATH 330, ECE 208, SE 212

Rationale : MATH 145 is the advanced-level version of MATH 135 and was overlooked when MATH 135 was added.

### Current Catalog Information

CS 330 (0.50) LEC, TST Management Information Systems

An introduction to information systems and their strategic role in business. Topics include types of information systems, organizational requirements, systems development strategies, decision support systems, data and information management, and information systems management, control, and implementation.

No Special Consent Required

Requisites : Prereq: One of CS 106, 116, 136, 138, 146, or (CS 114 with at least 60%; CS 115 or CS 135); Level at least 2B; Not open to Computer Science students. Antireq: AFM 241, BUS 415W, 486W, CS [480/490](#), [MSCI 441](#)

### Effective 01-SEP-2024

Requisite Change : Prereq: One of CS 106, 116, 136, 138, 146, or (CS 114 with at least 60% [and](#) (one of CS 115, CS 135, [or CS 145](#))); Level at least 2B; Not open to Computer Science students. Antireq: AFM 241, BUS 415W, 486W, CS 490

Rationale : CS 145 is the enriched version of CS 135. It was overlooked when the CS 115 and CS 135 prerequisites were added to the calendar. The course MSCI 441 Management Information Systems is outdated in that it last appeared in the 2004/05 calendar. CS 330 used to have an antirequisite of CS 480 Information Systems Management. That course was renumbered to CS 490 in the 2006/07 calendar. A new course CS 480 Introduction to Machine Learning was created in the 2018/19 calendar. The existing antirequisite does not refer

to the course that it was originally intended to. The School of Computer Science would like to develop an online version of CS 330 to better support the Stratford GBDA program.

## Pure Mathematics

### Current Catalog Information

PMATH 331 (0.50) LEC Applied Real Analysis  
Topology of Euclidean spaces, continuity, norms, completeness. Contraction mapping principle. Fourier series. Various applications, for example, to ordinary differential equations, optimization and numerical approximation. [Note: PMATH 351 may be substituted for AMATH/PMATH 331 whenever the latter is a requirement in an Honours plan. Offered: F,W]  
No Special Consent Required  
Requisites : Prereq: MATH 237 or 247  
Cross-listed as: AMATH 331

### Effective 01-SEP-2024

Description Change: Topology of Euclidean spaces, continuity, norms, completeness. Contraction mapping principle. Fourier series. Various applications, for example, to ordinary differential equations, optimization and numerical approximation.  
Requisite Change : Prereq: MATH 237 or 247  
Antireq: PMATH 333, PMATH 351  
Rationale : The course PMATH 333 is normally a bit more challenging than PMATH 331. Students who take either PMATH 333 or PMATH 351 will have seen essentially all of the material in AMATH/PMATH 331 and should not be able to take AMATH/PMATH 331 for credit. Editorial: The note about PMATH 351 is ported to the various affected plans.

### Current Catalog Information

PMATH 332 (0.50) LEC, TST, TUT Applied Complex Analysis  
Complex numbers, Cauchy-Riemann equations, analytic functions, conformal maps and applications to the solution of Laplace's equation, contour integrals, Cauchy integral formula, Taylor and Laurent expansions, residue calculus and applications. [Note: PMATH 352 may be substituted for AMATH/PMATH 332 whenever the latter is a requirement in an Honours plan. Offered: W,S]  
No Special Consent Required  
Requisites : Prereq: MATH 237 or 247. Antireq: PHYS 365  
Cross-listed as: AMATH 332

### Effective 01-SEP-2024

Description Change: Complex numbers, Cauchy-Riemann equations, analytic functions, conformal maps and applications to the solution of Laplace's equation, contour integrals, Cauchy integral formula, Taylor and Laurent expansions, residue calculus and applications.  
Requisite Change : Prereq: MATH 237 or 247.  
Antireq: PHYS 365, PMATH 352  
Rationale : Students who have taken PMATH 352 will have seen essentially all the

content of PMATH 332 and should not be able to take PMATH 332 for credit.  
Editorial: The note about PMATH 352 is ported to the various affected plans.

### Current Catalog Information

PMATH 333 (0.50) LEC Introduction to Real Analysis

The purpose of the course is to present the familiar concepts of calculus at a rigorous level and to provide students who took the MATH 137/MATH 138/MATH 237 sequence with the background needed to be successful in PMATH 351 and PMATH 352. Topics discussed include the completeness properties of the reals; the density of the rationals; the topology of real n-dimensional space: open and closed sets, connectedness, compactness (by open covers), the Heine-Borel theorem, completeness; sequences in real n-dimensional space: convergence, Cauchy sequences, subsequences, the Bolzano-Weierstrass theorem; multivariable functions: limits, point-wise and uniform continuity, the extreme value theorem, uniform convergence of sequences of functions, Taylor's theorem, term-by-term differentiation of power series; integration in real n-dimensional space: Riemann integrability, Fubini's theorem for continuous functions on rectangles, term-by-term integration of power series.

No Special Consent Required

Requisites : Prereq: One of (MATH 128 with at least 70%), (MATH 138 with at least 60%), MATH 148. Coreq: (MATH 235 or 245) and MATH 237. Antireq: MATH 247

### Effective 01-SEP-2024

Requisite Change : Prereq: One of (MATH 128 with at least 70%), (MATH 138 with at least 60%), MATH 148.

Coreq: (MATH 235 or 245) and MATH 237.

Antireq: MATH 247, [PMATH 351](#)

Rationale : Students who have taken PMATH 351 will have seen essentially all the content of PMATH 333 and should not be able to take PMATH 333 for credit.

### Current Catalog Information

PMATH 334 (0.50) LEC Introduction to Rings and Fields with Applications

Rings, ideals, factor rings, homomorphisms, finite and infinite fields, polynomials and roots, field extensions, algebraic numbers, and applications, for example, to Latin squares, finite geometries, geometrical constructions, error-correcting codes.

No Special Consent Required

Requisites : Prereq: MATH 235 or 245.

### Effective 01-SEP-2024

Requisite Change : Prereq: MATH 235 or 245.

[Antireq: PMATH 348](#)

Rationale : Students who have taken PMATH 348 will have seen essentially all the content of PMATH 334 and should not be able to take PMATH 334 for credit.

### Current Catalog Information

PMATH 336 (0.50) LEC Introduction to Group Theory with Applications

Groups, permutation groups, subgroups, homomorphisms, symmetry groups in two and three dimensions, direct products, Polya-Burnside enumeration.

No Special Consent Required  
Requisites : Prereq: MATH 235 or 245.  
**Effective 01-SEP-2024**  
Requisite Change : Prereq: MATH 235 or 245.  
[Antireq: PMATH 347](#)  
Rationale : Students who have taken PMATH 347 will have seen essentially all the content of PMATH 336 and should not be able to take PMATH 336 for credit.

### Current Catalog Information

PMATH 343 (0.50) LEC Introduction to the Mathematics of Quantum Information  
Finite dimensional normed vector spaces and inner product spaces. Positive and normal operators, the spectral theorem, and singular value decomposition. Tensor products, finite dimensional  $C^*$  algebras, and the GNS representation. Completely positive maps, Stinespring's theorem, the Choi-Jamiolkowski isomorphism, and the Choi-Krauss representation. Entanglement and the Bell and Tsirelson inequalities. Vector states and density matrices, quantum channels, observables, and quantum measurement.  
No Special Consent Required  
Requisites : Prereq: (MATH 235 or 245) and (AMATH/PMATH 331 or MATH 247 or PMATH 333).  
[Antireq: PMATH 399](#) taken Winter 2019

### Effective 01-SEP-2024

Requisite Change : Prereq: (MATH 235 or 245) and One of AMATH/PMATH 331, MATH 247, PMATH 333, [PMATH 351](#). [Antireq: PMATH 399](#) taken Winter 2019  
Rationale : Students who have taken PMATH 351 will have seen essentially all the content of PMATH 333.

### Current Catalog Information

PMATH 352 (0.50) LEC Complex Analysis  
Analytic functions, Cauchy-Riemann equations, Goursat's theorem, Cauchy's theorems, Morera's theorem, Liouville's theorem, maximum modulus principle, harmonic functions, Schwarz's lemma, isolated singularities, Laurent series, residue theorem.  
No Special Consent Required  
Requisites : Prereq: MATH 247 or PMATH 333

### Effective 01-SEP-2024

Requisite Change : Prereq: One of MATH 247, PMATH 333, [PMATH 351](#)  
Rationale : Students who have taken PMATH 351 will have seen essentially all the content of PMATH 333.

### Current Catalog Information

PMATH 365 (0.50) LEC Differential Geometry  
[Submanifolds of Euclidean n-space; vector fields and differential forms; integration on submanifolds and Stokes's Theorem; metrics](#) and geodesics; Gauss-Bonnet Theorem. No Special Consent Required  
Requisites : Prereq: (MATH 235 or 245) and (MATH 237 or 247)

### Effective 01-SEP-2024

Description Change: [Curves and hypersurfaces in Euclidean space; integration and Stokes'](#)

Rationale : [Theorem; Gaussian and mean curvatures; Frenet-Serret frames](#) and geodesics; Gauss-Bonnet Theorem.  
We have found that the current course description for PMATH 365 covers too many topics, and many instructors do not cover all of the listed material. Also, there is some overlap between the current version of PMATH 365 and the course PMATH 465 Smooth Manifolds. All of the topics which we propose to remove from PMATH 365, are covered (in greater generality) in the course PMATH 465.

### Current Catalog Information

PMATH 432 (0.50) LEC [First Order Logic and Computability](#)

[The concepts of formal provability and logical consequence in first order logic are introduced, and their equivalence is proved in the soundness and completeness theorems. Goedel's incompleteness theorem is discussed, making use of the halting problem of computability theory. Relative computability and the Turing degrees are further studied.](#)

No Special Consent Required

Requisites :

Prereq: PMATH 347

**Effective 01-SEP-2024**

Title Change:

[Mathematical Logic](#)

Description Change:

[First-order languages and structures, syntactic provability and semantic truth, the soundness and completeness theorems, compactness and its consequences, elementary equivalence, the ZFC axioms of set theory, ordinals, cardinals, computability, and Gödel's incompleteness theorem.](#)

Rationale : We would like PMATH 432, currently titled "First Order Logic and Computability Theory" and proposed new title "Mathematical Logic," to be modified so that it can serve as a broader introduction to mathematical logic at the advanced undergraduate/beginner graduate level. The main change is to remove about 2-3 weeks of the more advanced computability theory material and replace it with 2-3 weeks of introductory set theory material. With this broad introductory course in place, this allows the current PMATH 433, currently titled "Set theory and Model theory," to be split into two courses, namely Model Theory PMATH 433 and Set Theory PMATH 434 which go deeper into those respective areas. The intent is to offer two advanced logic courses per year which is an increase, with PMATH 432 every fall and with PMATH 433 and 434 alternating each winter. The short title matches the long title.

### Current Catalog Information

PMATH 433 (0.50) LEC [Model Theory and Set Theory](#)

[Model theory: the semantics of first order logic including the compactness theorem and its consequences, elementary embeddings and equivalence, the theory of definable sets and types, quantifier elimination, and omega-stability. Set theory: well-orderings, ordinals, cardinals, Zermelo-Fraenkel axioms, axiom of choice, informal discussion of classes and independence results. \[Note: PMATH 348 is highly recommended.\]](#)



No Special Consent Required

Requisites :

Prereq: **PMATH 347**

**Effective 01-SEP-2024**

Title Change:

**Model Theory**

Description Change:

Definable sets, quantifier elimination, algebraically closed fields, real closed fields, omitting types and prime models, interpretation and imaginaries, types, saturation, strongly minimal sets and the Zilber trichotomy, forking, and independence.

Requisite Change :

Prereq: **PMATH 432**

Rationale :

With PMATH 432 being changed to a broad introductory course and available to serve as a prerequisite, this allows the current PMATH 433, currently titled "Set theory and Model theory," to be split into two courses, namely Model Theory PMATH 433 and Set Theory PMATH 434 which go deeper into those respective areas. The intent is to offer two advanced logic courses per year which is an increase, with PMATH 432 every fall and with PMATH 433 and 434 alternating each winter. The short title matches the long title.

### Current Catalog Information

PMATH 465 (0.50) LEC

Smooth Manifolds

**Point-set topology**; smooth manifolds, smooth maps, and tangent vectors; the tangent and cotangent bundles; vector fields, tensor fields, and differential forms; **Stokes's** theorem; integral curves, Lie derivatives, the Frobenius theorem; de Rham cohomology.

No Special Consent Required

Requisites :

Prereq: PMATH 365

**Effective 01-SEP-2024**

Description Change:

Smooth manifolds, smooth maps, and tangent vectors; the tangent and cotangent bundles; vector fields, tensor fields, and differential forms; **Stokes'** theorem; integral curves, Lie derivatives, the Frobenius theorem; de Rham cohomology.

Requisite Change :

Prereq: PMATH 365 **or 367**

Rationale :

Once the new course PMATH 367 Topology is being offered, and once the content of PMATH 365 Differential Geometry has changed, the new course PMATH 367 will provide equal (or better) preparation for the course PMATH 465 than does PMATH 365, which is currently listed as the prerequisite. The two prerequisite courses (PMATH 365 and 367) will be added as "one of" list to the PMATH major requirements.

End of Report



1. **New Courses** (see catalogue report)
2. **Course Changes** (see catalogue report)

### 3. **Course Deactivations**

#### 3.1.1 **Deactivate WKRPT 100M**

Effective 1 September 2024, deactivate WKRPT 100M. The Math WKRPT requirements were removed effective 1 September 2023 and only WKRPT 200M, 300M, and 400M were deactivated at that time. WKRPT 100M should have been deactivated at the same time but was missed. This motion corrects this oversight. Prior to removal of the work report requirement, WKRPT 100M was not in use as students were given credit for their first work report upon completion of PD11.

For context, the motion deactivating WKRPT 200M, 300M, and 400M was passed at UAC on April 25, 2022, Mathematics Faculty Council on September 20, 2022, and Senate Undergraduate Council on October 4, 2022.

### 4. **Academic Plan Changes (Minor Modifications)**

#### 4.1. **Applied Mathematics**

##### 4.1.1. **Applied Mathematics Major [FC Jan 16]**

**Part 1:** Effective, 1 September 2024, remove “PHYS 111 Physics 1 with a grade of at least 70%” from the Applied Mathematics plan requirements and require all student to complete PHYS 121 Mechanics instead.

The two courses are not equivalent in content and having a good grade on PHYS 111 does not imply that students have seen equivalent content to that in PHYS 121. Additionally, there is an inconsistency as other Applied Math programs (Joint Applied Mathematics, Mathematical Physics) do not allow PHYS 111 to be substituted for PHYS 121. In the last three years, 14/64 of AMATH graduates have had credit for PHYS 111. The recommendation to take PHYS 121 is already communicated to students on the Applied Math webpages. The MUO will update webpages for incoming math students to communicate those interested in Applied Mathematics should take PHYS 121 instead of PHYS 111. Finally, this change will fix a loophole in the Applied Mathematics Physics Specialization where students could use PHYS 111 with a 70% grade to count it as extra PHYS elective, while this is forbidden for PHYS 121. This change was discussed and approved by Brenda Lee, Associate Chair Undergraduate Studies, Department of Physics and Astronomy on 18/12/2023.

**Part 2:** Effective, 1 September 2024, add a new “One of” list for AMATH 250 Introduction to Differential Equations and AMATH 251 Introduction to Differential Equations (Advanced Level) for the Applied Mathematics Major.

From 2013-14 to 2022-23 academic calendar for these Applied Mathematics plans included the note allowing AMATH 250 to be substituted for AMATH 251 with the consent of the department. For at least the past four years, consent for this substitution has been given to any student making the request. The note was removed in the 2023-24 calendar under the principle that allowable course substitutions not be coded in notes. This motion formally adds the option for students to take either AMATH 251 or AMATH 250 to fulfill plan requirements.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-AM-Degree-Requirements-Applied-Mathematics> )

Students in this academic plan must fulfil all the requirements in [Table 1](#) and [Table 2](#). This must include at least 26 math courses and the following specific requirements:

- One of
  - [MATH 237](#) Calculus 3 for Honours Mathematics
  - [MATH 247](#) Calculus 3 (Advanced Level)
- All of
  - [AMATH 231](#) Calculus 4
  - [AMATH 242/CS 371](#) Introduction to Computational Mathematics
  - ~~[AMATH 251](#) Introduction to Differential Equations (Advanced Level)~~
  - [AMATH 332/PMATH 332](#) Applied Complex Analysis
  - [AMATH 342](#) Computational Methods for Differential Equations
  - [AMATH 351](#) Ordinary Differential Equations
  - [AMATH 353](#) Partial Differential Equations 1
  - [PHYS 121](#) Mechanics
- ~~One of~~
  - ~~[PHYS 121](#) Mechanics~~
  - ~~[PHYS 111](#) Physics 1 with a grade of at least 70%~~
- One of
  - [AMATH 250](#) Introduction to Differential Equations
  - [AMATH 251](#) Introduction to Differential Equations (Advanced Level)

[...]

#### **4.1.2. Joint Applied Mathematics [FC Jan 16]**

#### **4.1.3. Applied Mathematics with Scientific Computing [FC Jan 16]**

#### **4.1.4. Mathematical Physics (1/3) [FC Jan 16]**

Effective, 1 September 2024, add a new “One of” list for AMATH 250 Introduction to Differential Equations and AMATH 251 Introduction to Differential Equations (Advanced Level) for the Joint Applied Mathematics, Applied Mathematics with Scientific computing, and Mathematical Physics plans.

From 2013-14 to 2022-23 academic calendar for these Applied Mathematics plans included the note allowing AMATH 250 to be substituted for AMATH 251 with the consent of the department. For at least the past four years, consent for this substitution has been given to any student making the request. The note was removed in the 2023-24 calendar under the principle that allowable course substitutions not be coded in notes. This motion formally adds the option for students to take either AMATH 251 or AMATH 250 to fulfill plan requirements.

### **Joint Applied Mathematics**

(<https://ugradcalendar.uwaterloo.ca/page/MATH-AM-Degree-Requirements-Joint-Applied-Math> )

[...]

- One of
  - [MATH 237](#) Calculus 3 for Honours Mathematics
  - [MATH 247](#) Calculus 3 (Advanced Level)
- All of
  - [AMATH 231](#) Calculus 4
  - [AMATH 242/CS 371](#) Introduction to Computational Mathematics
  - ~~[AMATH 251](#) Introduction to Differential Equations (Advanced Level)~~
  - [AMATH 332/PMATH 332](#) Applied Complex Analysis
  - [AMATH 351](#) Ordinary Differential Equations
  - [AMATH 353](#) Partial Differential Equations 1
  - [PHYS 121](#) Mechanics
- One of

- [AMATH 250](#) Introduction to Differential Equations
- [AMATH 251](#) Introduction to Differential Equations (Advanced Level)
- Three 400-level [AMATH](#) courses

[...]

### Applied Mathematics with Scientific Computing

(<https://ugradcalendar.uwaterloo.ca/page/MATH-AM-Degree-Requirements-Applied-Math-Sci-Comp>)

[...]

- All of
  - [AMATH 231](#) Calculus 4
  - [AMATH 242/CS 371](#) Introduction to Computational Mathematics
  - ~~[AMATH 251](#) Introduction to Differential Equations (Advanced Level)~~
  - [AMATH 342](#) Computational Methods for Differential Equations
  - [AMATH 442](#) Computational Methods for Partial Differential Equations
  - [CS 230](#) Introduction to Computers and Computer Systems
  - [CS 234](#) Data Types and Structures
  - [CS 475](#) Computational Linear Algebra
  - [STAT 341](#) Computational Statistics and Data Analysis
- One of
  - [AMATH 250](#) Introduction to Differential Equations
  - [AMATH 251](#) Introduction to Differential Equations (Advanced Level)

[...]

### Mathematical Physics plan

(<https://ugradcalendar.uwaterloo.ca/page/MATH-AM-Degree-Requirements-Mathematical-Physics>)

[...]

- All of
  - [AMATH 231](#) Calculus 4
  - [AMATH 242/CS 371](#) Introduction to Computational Mathematics
  - ~~[AMATH 251](#) Introduction to Differential Equations (Advanced Level)~~
  - [AMATH 271](#) Introduction to Theoretical Mechanics
  - [AMATH 331/PMATH 331](#) Applied Real Analysis
  - [AMATH 332/PMATH 332](#) Applied Complex Analysis
  - [AMATH 351](#) Ordinary Differential Equations
  - [AMATH 353](#) Partial Differential Equations 1
  - [AMATH 361](#) Continuum Mechanics
  - [AMATH 373](#) Quantum Theory 1
  - [AMATH 473/PHYS 454](#) Quantum Theory 2
  - [AMATH 475/PHYS 476](#) Introduction to General Relativity
  - [PHYS 121](#) Mechanics
  - [PHYS 122](#) Waves, Electricity and Magnetism
  - [PHYS 234](#) Quantum Physics 1
  - [PHYS 242](#) Electricity and Magnetism 1
- One of
  - [AMATH 250](#) Introduction to Differential Equations
  - [AMATH 251](#) Introduction to Differential Equations (Advanced Level)

[...]

#### 4.1.5. Mathematical Physics (2/3)

Effective, 1 September 2024, remove the BSc Astrophysics Minor from being an invalid credential combination with BMath Mathematical Physics. We want to allow Mathematical Physics majors in math to obtain an Astrophysics Minor if they desire so. BSc Mathematical Physics majors in Science (the Physics department program) are allowed to take the minor and the Applied Mathematics Department sees no reason why BMath Mathematical Physics students should not have the same opportunity. Consulted with the Faculty of Science Undergraduate Calendar Representative July 2023.

(<https://ugradcalendar.uwaterloo.ca/page/Acad-Regs-Invalid-Credential-Combinations>)

Mathematical Physics major (Bachelor of Mathematics)	Mathematics	<del>Astrophysics Minor;</del> Biophysics Minor; Life Physics major; Joint Honours X with Physics; Mathematical Physics major (Bachelor of Science); Physics major; Physics Minor; Physics and Astronomy major
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For BMath Mathematical Physics students to complete the BSc Astrophysics Minor, they would need to take at least 3 extra courses. Among the 10 courses (5.0 units) required by the BSc Astrophysics Minor, there are 4 elective PHYS courses that must be completed from a list of 7 courses and only one of those 7 courses are required by BMath Mathematical Physics.

#### 4.1.6. Mathematical Physics (3/3)

Effective 1 September 2024, add PMATH 333 Introduction to Real Analysis as a possible substitute for AMATH/PMATH 331 Applied Real Analysis in the Mathematical Physics plans. The Pure Mathematics department brought the advice that this should be an allowable substitution as PMATH 333 is more challenging than AMATH/PMATH 331 and students who have taken PMATH 333 will have seen essentially all of the material in AMATH/PMATH 331. UAC considered the advice, approved it in principle, and Applied Mathematics approved the changes to the Mathematical Physics plan.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-AM-Degree-Requirements-Mathematical-Physics>)

<p>Students in this academic plan must fulfil all the requirements in <a href="#">Table 1</a> and <a href="#">Table 2</a>. This must include at least 20 math courses and the following specific requirements:</p> <ul style="list-style-type: none"> <li>• One of <ul style="list-style-type: none"> <li>○ <a href="#">MATH 237</a> Calculus 3 for Honours Mathematics</li> <li>○ <a href="#">MATH 247</a> Calculus 3 (Advanced Level)</li> </ul> </li> <li>• One of <ul style="list-style-type: none"> <li>○ <a href="#">AMATH 331/PMATH 331</a> Applied Real Analysis</li> <li>○ <a href="#">PMATH 333</a> Introduction to Real Analysis</li> </ul> </li> <li>• All of <ul style="list-style-type: none"> <li>○ <a href="#">AMATH 231</a> Calculus 4</li> <li>○ <a href="#">AMATH 242/CS 371</a> Introduction to Computational Mathematics</li> <li>○ <a href="#">AMATH 251</a> Introduction to Differential Equations (Advanced Level)</li> <li>○ <a href="#">AMATH 271</a> Introduction to Theoretical Mechanics</li> <li>○ <del><a href="#">AMATH 331/PMATH 331</a> Applied Real Analysis</del></li> <li>○ <a href="#">AMATH 332/PMATH 332</a> Applied Complex Analysis</li> <li>○ <a href="#">AMATH 351</a> Ordinary Differential Equations</li> <li>○ <a href="#">AMATH 353</a> Partial Differential Equations 1</li> </ul> </li> </ul>
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- [AMATH 361](#) Continuum Mechanics
- [AMATH 373](#) Quantum Theory 1
- [AMATH 473/PHYS 454](#) Quantum Theory 2
- [AMATH 475/PHYS 476](#) Introduction to General Relativity
- [PHYS 121](#) Mechanics
- [PHYS 122](#) Waves, Electricity and Magnetism
- [PHYS 234](#) Quantum Physics 1
- [PHYS 242](#) Electricity and Magnetism 1

[..]

## 4.2. Combinatorics and Optimization

### 4.2.1. Combinatorics and Optimization Major

Effective 1 September 2024, add PMATH 351 Real Analysis as a possible substitute for PMATH 333 Introduction to Real Analysis and PMATH 441 Algebraic Number Theory as a possible substitute for PMATH 340 Elementary Number Theory in the Joint Combinatorics and Optimization plan. The Pure Mathematics department brought the advice that this should be an allowable substitution as students who have completed PMATH 351 will have seen essentially all the content of PMATH 333. UAC considered the advice, approved it in principle, and Combinatorics and Optimization approved the changes to their Joint plan.

The "Three of" requirement in the CO major and Joint CO major is designed to ensure that students graduating with the CO degree have some knowledge of a selection of either core pure/applied math topics related to CO (such as multivariable calculus, abstract algebra, analysis, or number theory), or core CS topics related to CO. PMATH 340 is the number theory component of this requirement. PMATH 440 (a legacy substitution see item # 5 for information) and PMATH 441 are so much more advanced than PMATH 340 that it is safe to assume that any student completing either PMATH 440 or PMATH 441 is very familiar with the content of PMATH 340.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-Combinatorics-and-Optimization2> )

[...]

- Three of
  - MATH 237 Calculus 3 for Honours Mathematics or MATH 247 Calculus 3 (Advanced Level)
  - AMATH 331/PMATH 331 Applied Real Analysis or PMATH 333 Introduction to Real Analysis or [PMATH 351 Real Analysis](#)
  - AMATH 332/PMATH 332 Applied Complex Analysis
  - CS 462 Formal Languages and Parsing
  - CS 466 Algorithm Design and Analysis
  - CS 487 Introduction to Symbolic Computation
  - PMATH 334 Introduction to Rings and Fields with Applications or PMATH 348 Fields and Galois Theory
  - PMATH 340 Elementary Number Theory or [PMATH 441 Algebraic Number Theory](#)

[...]

### 4.2.2. Joint Combinatorics and Optimization

Effective 1 September 2024, add PMATH 351 Real Analysis as a possible substitute for PMATH 333 Introduction to Real Analysis and PMATH 441 Algebraic Number Theory as a possible substitute for PMATH 340 Elementary Number Theory in the Joint Combinatorics and Optimization plan. The Pure Mathematics department brought the advice that this should be an allowable substitution as students who have completed PMATH 351 will have seen essentially all the content of PMATH 333. UAC considered

the advice, approved it in principle, and Combinatorics and Optimization approved the changes to their Joint plan.

The "Three of" requirement in the CO major and Joint CO major is designed to ensure that students graduating with the CO degree have some knowledge of a selection of either core pure/applied math topics related to CO (such as multivariable calculus, abstract algebra, analysis, or number theory), or core CS topics related to CO. PMATH 340 is the number theory component of this requirement. PMATH 440 (a legacy substitution see item # 5 for information) and PMATH 441 are so much more advanced than PMATH 340 that it is safe to assume that any student completing either PMATH 440 or PMATH 441 is very familiar with the content of PMATH 340.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-Joint-Combinatorics-and-Optimization1> )

[...]

Three of

- AMATH 331/PMATH 331 Applied Real Analysis or PMATH 333 Introduction to Real Analysis or [PMATH 351 Real Analysis](#)
- AMATH 332/PMATH 332 Applied Complex Analysis
- CS 341 Algorithms
- CS 360 Introduction to the Theory of Computing
- CS 466 Algorithm Design and Analysis
- MATH 237 Calculus 3 for Honours Mathematics or MATH 247 Calculus 3 (Advanced Level)
- PMATH 334 Introduction to Rings and Fields with Applications or PMATH 348 Fields and Galois Theory
- PMATH 340 Elementary Number Theory or [PMATH 441 Algebraic Number Theory](#)

[...]

### 4.3. Dean of Math Office

#### 4.3.1. Mathematics/Teaching

Effective 1 September 2024, add PMATH 351 Real Analysis as a possible substitute for PMATH 333 Introduction to Real Analysis and PMATH 348 Fields and Galois Theory as a possible substitute for PMATH 334 Introduction to Rings and Fields with Applications in the Mathematics/Teaching plan. The Pure Mathematics department brought the advice that this should be an allowable substitution as students who have completed PMATH 351 will have seen essentially all the content of PMATH 333. Students who have completed PMATH 348 will have seen essentially all the content of PMATH 334. UAC considered the advice and approved the changes to the Mathematics/Teaching plan.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-Mathematics-Teaching-co-op>)

[...]

- One of
  - AMATH 331/PMATH 331 Applied Real Analysis
  - AMATH 332/PMATH 332 Applied Complex Analysis
  - PMATH 333 Introduction to Real Analysis
  - [PMATH 351 Real Analysis](#)

[...]

- One of
  - PMATH 334 Introduction to Rings and Fields with Applications
  - PMATH 336 Introduction to Group Theory with Applications
  - PMATH 347 Groups and Rings
  - [PMATH 348 Fields and Galois Theory](#)

[...]

### 4.3.2. Mathematical Economics

Effective 1 September 2024, add PMATH 333 Introduction to Real Analysis as a possible substitute for AMATH/PMATH 331 Applied Real Analysis in the Mathematical Economics plan. The Pure Mathematics department brought the advice that this should be an allowable substitution as PMATH 333 is more challenging than AMATH/PMATH 331 and students who have taken PMATH 333 will have seen essentially all of the material in AMATH/PMATH 331. UAC considered the advice, approved it in principle, and Math/Business approved the changes to the Mathematical Economics plan.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-Mathematical-Economics-Degree-Requirements>)

[...]
<b>Mathematics Group</b>
<ul style="list-style-type: none"><li>• One of<ul style="list-style-type: none"><li>○ <u>MATH 237</u> Calculus 3 for Honours Mathematics</li><li>○ <u>MATH 247</u> Calculus 3 (Advanced Level)</li></ul></li><li>• One of<ul style="list-style-type: none"><li>○ <u>CO 250</u> Introduction to Optimization</li><li>○ <u>CO 255</u> Introduction to Optimization (Advanced Level)</li></ul></li><li>• One of<ul style="list-style-type: none"><li>○ <u>AMATH 331/PMATH 331</u> Applied Real Analysis</li><li>○ <u>PMATH 333</u> Introduction to Real Analysis</li></ul></li><li>• All of<ul style="list-style-type: none"><li>○ <del><u>AMATH 331/PMATH 331</u> Applied Real Analysis</del></li><li>○ <u>AMATH 350</u> Differential Equations for Business and Economics</li><li>○ <u>STAT 331</u> Applied Linear Models</li><li>○ <u>STAT 443</u> Forecasting</li></ul></li></ul>
[...]

## 4.4 Pure Mathematics

### 4.4.1 Pure Mathematics Major

**Motion and Rationale:** Once the new course PMATH 367 Topology is being offered, both PMATH 365 and PMATH 367 will cover important material in the related fields of geometry and topology. Taking either of these two courses would provide our Pure Math Major students with exposure to some of this important material.

(<http://ugradcalendar.uwaterloo.ca/page/MATH-Pure-Mathematics1>)

Students in this academic plan must fulfil all the requirements in <u>Table 1</u> and <u>Table 2</u> . This must include at least 26 math courses and the following specific requirements:
<ul style="list-style-type: none"><li>• One of<ul style="list-style-type: none"><li>○ <u>MATH 237</u> Calculus 3 for Honours Mathematics</li><li>○ <u>MATH 247</u> Calculus 3 (Advanced Level)</li></ul></li><li>• One of<ul style="list-style-type: none"><li>○ <u>MATH 239</u> Introduction to Combinatorics</li><li>○ <u>MATH 249</u> Introduction to Combinatorics (Advanced Level)</li></ul></li><li>• One of<ul style="list-style-type: none"><li>○ <u>PMATH 365</u> Differential Geometry</li></ul></li></ul>



- [PMATH 367 Topology](#)
- All of
  - [PMATH 347 Groups and Rings](#)
  - [PMATH 348 Fields and Galois Theory](#)
  - [PMATH 351 Real Analysis](#)
  - [PMATH 352 Complex Analysis](#)
  - ~~PMATH 365 Differential Geometry~~
  - [PMATH 450 Lebesgue Integration and Fourier Analysis](#)
- Three additional 400-level [PMATH](#) courses (1.5 units)
- Two additional 400-level math courses (1.0 unit) from [ACTSC](#), [AMATH](#), [CO](#), [CS](#), [MATBUS](#), [MATH](#), [PMATH](#), or [STAT](#)

#### 4.5. Statistics and Actuarial Science

##### 4.5.1. Financial Analysis and Risk Management: Professional Risk Management

Effective 1 September 2024, add PMATH 333 Introduction to Real Analysis as a possible substitute for AMATH/PMATH 331 Applied Real Analysis in the FARM PRM plan. The Pure Mathematics department brought the advice that this should be an allowable substitution as PMATH 333 is more challenging than AMATH/PMATH 331 and students who have taken PMATH 333 will have seen essentially all of the material in AMATH/PMATH 331. UAC considered the advice, approved it in principle, and FARM approved the changes to the Mathematical Physics plan.

(<https://ugradcalendar.uwaterloo.ca/page/MATH-Math-or-Fin-Analysis-Risk-Mgt-Degree-Reqmnt>)

[...]

##### Professional Risk Management Specialization

- All of
  - ~~AMATH 331/PMATH 331 Applied Real Analysis~~
  - [CO 372 Portfolio Optimization Models](#)
  - [CS 338 Computer Applications in Business: Databases](#)
  - [MATBUS 471 Fixed Income Securities](#)
- One of
  - [AMATH 331/PMATH 331 Applied Real Analysis](#)
  - [PMATH 333 Introduction to Real Analysis](#)
- One of
  - [ACTSC 445 Quantitative Enterprise Risk Management](#)
  - [MATBUS 472 Risk Management](#)

[...]

#### 5. Legacy course substitutions in program requirements and course prerequisites (for information only)

Significant editorial work is being done to the calendar in anticipation of the move to the Quali academic calendar and curriculum management software. Further details on the full project can be found on

In the current calendar there are several instances of courses which contain a note of the form [PMATH 351 may be substituted for AMATH/PMATH 331 whenever the latter is a requirement in an honours plan]. We are moving away from having such substitutions recorded in the course description, for three reasons:



- One unit shouldn't be able to bind another unit's plan by their own decisions. They can however offer valuable expert advice.
- The Quali calendar will present information slightly differently, and in the workflow to propose change to courses, all affected programs and courses will automatically be shown. This will prevent a number of situations we have experienced University wide where units do not consult all affected units when making changes.
- This should facilitate degree audits.

For the Faculty of Mathematics, here are the various courses whose descriptions contain such a note, and the note itself.

- CS 365: CS 365 may be substituted for CS 360 in any degree plan or for prerequisite purposes
- CS 371: This course may be substituted for CS 370 in any degree plan or for prerequisite purposes
- CS 145: This course may be substituted for CS 135 in any degree plan or for prerequisite purposes.
- CS 146: This course may be substituted for CS 136 in any degree plan or for prerequisite purposes.
- CS 240E: CS 240E may be substituted for CS 240 wherever the latter is a requirement
- CS 241E: CS 241E may be substituted for CS 241 wherever the latter is a requirement
- CS 245E: CS 245E may be substituted for CS 245 wherever the latter is a requirement
- CS 246E: CS 246E may be substituted for CS 246 wherever the latter is a requirement
- CS 251E: CS 251E may be substituted for CS 251 wherever the latter is a requirement.
- MATH 237: MATH 247 may be substituted for MATH 237 whenever the latter is a plan requirement.
- PMATH 331: PMATH 351 may be substituted for AMATH/PMATH 331 whenever the latter is a requirement in an Honours plan.
- PMATH 332: PMATH 352 may be substituted for AMATH/PMATH 332 whenever the latter is a requirement in an Honours plan.
- PMATH 330: PMATH 432 may be substituted for PMATH 330 whenever the latter is a requirement in an Honours plan.
- PMATH 340: PMATH 440 may be substituted for PMATH 340 whenever the latter is a requirement in an Honours plan.

Those notes will be deleted and the information propagated to the courses and programs impacted. This is editorial work, as this is how the Faculty operated for the past many years. This is also an opportunity to render visible what was somewhat hidden, and program committees will now have a better view of those things.

# Appendix F: Faculty of Science

## SCIENCE UNDERGRADUATE STUDIES COMMITTEE REPORT – FOR SUBMISSION TO FEBRUARY 2024 SENATE UNDERGRADUATE COUNCIL (SUC) (SFC approval- Dec 1, 2023)

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### 1. NEW COURSES & INACTIVATIONS

**Motion:** To create two new faculty-level courses, SCI 211 and 300, and to also create three new courses BIOL 235, PHYS 260A, 260B where content has been modified or aggregated to facilitate student learning. Associated with these new courses are the inactivation of BIOL 303, PHYS 232L, 242L, 256L, 260L [future inactivation planned for Sept. 1, 2025], and BIOL 303 [future inactivation planned for Sept. 1, 2026]

#### **Background and Rationale:**

The creation of SCI 211 and 300 expands the diversity of electives offered in science. SCI 211 exposes students to Indigenous knowledge and methods in interdisciplinary science topics with particular focus on the Indigenous ways of knowing in the field of medicines and healing as taught by community Elders. SCI 300 will allow the Faculty of Science to mount courses of broad interest when instructors are available. This topics course will allow six repeats so that students have opportunity to experience more than one topic.

The creation of BIOL 235 as a new 200-level molecular techniques laboratory, accompanied by the inactivation of BIOL 309 will address gap in these lab skills in the biology curriculum and will serve as a prerequisite for 300- and 400-level courses in place of BIOL 309.

There are no molecular or cell biology courses available at the 200-level, and students currently do not get practical experience with molecular biology techniques until third year. BIOL 235 will better prepare students for work terms with a lab component, and more broadly, the course fits with the biology curriculum structure where second year courses provide fundamentals for different sub-disciplines within biology. It will also remove instances of 300-level courses with 300-level prerequisites.

Impacted plans (BIOL 235 replaces BIOL 309): Hon. Biochemistry, Hon. Biochemistry, Biotechnology Specialization, Hon. Biotechnology/CPA, Hon. Science and Business, Biochemistry and Biotechnology Specializations, Hon. Health Sciences, Pre-Clinic Specialization.

Impacted plans (BIOL 308 replaces BIOL 309): Bioinformatics Specialization, Computer Science plans.

Impacted plans (BIOL 309 is simply removed from option list): Hon. Biomedical Sciences, Hon. Environmental Sciences, Ecology Specialization, Biochemistry Minor, Hon. Knowledge Integration, Life Science Option within Engineering plans.

The inactivation of BIOL 303, Introductory Developmental Biology and Embryology, with the repurposing of BIOL 403, Advanced Topics in Developmental Biology, will incorporate changes in the field of developmental biology and embryology, best suited as a 400-level course.

Impacted plans (BIOL 303 removed, BIOL core units reduced by 0.5 unit, BIOL elective requirement increased by 0.5 unit and BIOL 403 added to BIOL elective list): Honours Biomedical Sciences.

Impacted plans (BIOL 303 removed from 300-level BIOL elective list, BIOL 403 added to 400-level BIOL elective list): Honours Science and Business, Biochemistry Specialization.

Impacted plans (BIOL 403 replaces BIOL 303): Honours Biochemistry, Honours Biochemistry, Biotechnology Specialization, Honours Health Sciences, Pre-Clinic Specialization.

The changes to the PHYS 200-level laboratories will decouple the 0.25-unit second year labs (PHYS 232L, 242L, 256L and 260L) from their lecture courses, inactivating them effective Sept. 1, 2025, and replacing them with two new stand-alone 0.5-unit second-year labs, PHYS 260A and 260B, in the 2024-2025 Calendar, to employ best practices in physics education and focus more on experimental physics and critical thinking.

Impacted plans (PHYS 260 A/B replace PHYS 232L, 242L, 256L and 260L): Honours Physics and Honours Joint X with Physics plans.

Impacted plans (PHYS 260A replaces PHYS 242L and 256L): Honours Physics and Astronomy and Honours Biological and Medical Physics.

Impacted plans (PHYS 260A replaces PHYS 232L increasing PHYS and overall units by 0.25 unit; PHYS 260B added to elective option list): Honours Materials and Nanosciences.

Impacted plans (inactive labs removed as options): Honours Materials and Nanosciences, Biophysics Minor, Honours Knowledge Integration

## 2. COURSE CHANGES – minor updates

**Motion:** to update the calendar descriptions, including minor edits, changes to prerequisites or to indicate components (eg. Laboratories) for the following courses:

- BIOL 110, 201, 211, 220, 225, 241, 251, 273, 302, 310, 323, 325, 331, 335L, 342, 345, 346, 350, 351, 354, 355, 361, 364, 365, 414, 428, 431, 434, 438, 443, 447, 448, 451, 455, 456, 457, 458, 465, 473 and 484
- CHEM 266;
- EARTH 390, 437, 456, 490;
- PHARM 474;
- PHYS 111L, 112L, 160L, 242, 256, 437A, 437B

## 3. PLAN CHANGES

**Motion:** to update existing plans or options, including updating due to above course changes.

### Honours Biology (Reg/Co-op):

**Background and Rationale:** Students have often found themselves without required prerequisites when in higher level courses. This change will allow student to focus and obtain the correct pre-requisites, while allowing student to take other courses of general interest as elective units.

BIOL 201 Human Anatomy, BIOL 225 Plants and Civilization, and BIOL 280 introduction to Biophysics, are not prerequisites for any 300- or 400-level BIOL courses. Excluding these three courses from the “1.5 BIOL unit requirement at the 200-level”, will ensure students in the Honours Biology plans choose courses that will provide necessary prerequisites for the required “3.0 BIOL units at 300-level or higher”, and the required “2.5 BIOL units at the 400-level”. BIOL 201, 225 and 280, may still be taken as electives for these plans.

## Honours Biology

Successful completion requires:

1. 21.5 units distributed as follows:
  - 4.0 BIOL units: BIOL 110, BIOL 130, BIOL 130L, BIOL 239, BIOL 240, BIOL 240L, BIOL 273, BIOL 308, BIOL 359
  - 1.5 BIOL units, 200-level (**excluding BIOL 201, 225, 280**)
  - 5.5 BIOL units, 300-level or higher; 2.5 units must be 400-level
  - 3.0 CHEM units: CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 237, CHEM 237L, CHEM 266, CHEM 266L
  - 0.5 MATH unit: MATH 127
  - 0.5 PHYS unit: PHYS 111 or PHYS 121
  - 0.5 STAT unit: STAT 202
  - 0.5 unit: COMMST 193/ENGL 193
  - 5.5 elective units
2. Co-operative program requirements (where applicable).

### Honours Environmental Sciences, Ecology Specialization (Reg/Co-op):

**Background and Rationale:** The Environmental Sciences, Ecology Specialization plans change will allow for the option to take either BIOL 150 or the new BIOL 251, the latter providing students with a lab/field component.

The biology department recently introduced BIOL 251, Fundamentals of Ecology, which provides students with field experience in ecology and ecological assessment methods. Field work is a key part of training as an ecologist and this course would provide important hands-on learning opportunities for students. Currently, students in the Ecology Specialization plans require BIOL 150, which lacks a lab or field component. The proposed change to requirements, to allow “BIOL 150 or BIOL 251” will provide students the opportunity to take the 200-level ecology course and get direct field experience, filling a notable gap in the Environmental Sciences, Ecology Specialization plans.

## Honours Environmental Sciences, Ecology Specialization

Successful completion requires:

1. 21.25 units distributed as follows:
  - 6.75 BIOL units: BIOL 110, (BIOL 150 or BIOL 251), BIOL 165, BIOL 220, BIOL 239, BIOL 240, BIOL 240L, BIOL 350, BIOL 351, BIOL 354, BIOL 359, BIOL 361, BIOL 451, BIOL 457
  - 0.5 BIOL unit: BIOL 456 or BIOL 458
  - 2.0 CHEM units: CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 266
  - 0.5 CHEM unit: CHEM 233 or CHEM 237
  - 3.0 EARTH units: EARTH 121, EARTH 121L, EARTH 122, EARTH 122L, EARTH 123, EARTH 223, EARTH 342
  - 0.5 PHYS unit: PHYS 111
  - 1.5 BIOL units, 0.5 must be at 400-level, from: BIOL 309, BIOL 310, BIOL 312, BIOL 323, BIOL 325, BIOL 335L, BIOL 346, BIOL 370, BIOL 371, BIOL 383/ERS 383, BIOL 414, BIOL 439, BIOL 447, BIOL 448, BIOL 450, BIOL 452, BIOL 455, BIOL 461, BIOL 462/EARTH 444, BIOL 470, BIOL 479, BIOL 485, BIOL 489, BIOL 490A, BIOL 490B, BIOL 490C, or BIOL 499A and BIOL 499B
  - 0.5 EARTH unit from: EARTH 321, EARTH 333, EARTH 358, EARTH 421, EARTH 440, EARTH 458, EARTH 459
  - 0.5 BIOL or EARTH elective unit from: BIOL 211, BIOL 241, BIOL 309, BIOL 310, BIOL 312, BIOL 323, BIOL 325, BIOL 335L, BIOL 346, BIOL 370, BIOL 371, BIOL 383/ERS 383, BIOL 414, BIOL 439, BIOL 447, BIOL 448, BIOL 450, BIOL 452, BIOL 455, BIOL 461, BIOL 462/EARTH 444, BIOL 470, BIOL 479, BIOL 485, BIOL 489, BIOL 490A, BIOL 490B, BIOL 490C, (BIOL 499A and BIOL 499B), EARTH 221, EARTH 232, EARTH 235, EARTH 238, EARTH 281, EARTH 321, EARTH 333, EARTH 358, EARTH 421, EARTH 440, EARTH 458, EARTH 459
  - 0.5 ERS unit: ERS 215
  - 0.5 MATH unit: MATH 127
  - 0.5 STAT unit: STAT 202
  - 0.5 unit: COMMST 193/ENGL 193
  - 3.5 elective lecture course units
2. Co-operative program requirements (when applicable).

### **Bioinformatics Option:**

**Background and Rationale:** The updated requirements for the Bioinformatics Option will increase course flexibility and remove courses already required by most students in science programs, in addition to increasing the minimum cumulative average required to award this option credential to align this with other options.

Flexibility will be incorporated into the BIOL requirements by reducing the core units from 2.0 to 1.5, removing BIOL 465 as required BIOL course, and allowing 1.0 BIOL unit to be selected from structural bioinformatics, evolution, statistics, synthetic biology, and modelling of biological systems courses, which will include BIOL 465 in addition to BIOL 349, 359, 361 and 382. Likewise, CS 114, 230, 231, 234 and 235 will be added to the list of CS courses options, chosen in consultation with the David R. Cheriton School of Computer Science in the Faculty of Mathematics.

The minimum cumulative option average will increase from 60% to 65%, consistent with minors and options in other faculties and with the option being a targeted area of study within an undergraduate degree. The updated invalid credential combination list will include Biology, Biochemistry, and Biophysics Minors in addition to new Microbiology and Cell and Molecular Biology Options.

## Bioinformatics Option

Advisors: See Faculty of Science academic advisors.

The Bioinformatics Option is available to Bachelor of Science, honours students within the Faculty of Science.

Successful completion of the Bioinformatics Option requires:

- 4.0 units distributed as follows:
  - ~~1.0~~ **1.5** CS unit **chosen from: CS 114**, CS 115, CS 135, CS 116, CS 136; **CS 230, CS 231, CS 234, CS 330**
  - ~~2.0~~ **1.5** BIOL units: BIOL 266, BIOL 365, ~~BIOL 465~~, BIOL 469
  - 1.0 BIOL units chosen from: BIOL 349, BIOL 359, BIOL 361, BIOL 382, BIOL 465**
  - ~~0.5 STAT unit chosen from: STAT 202, STAT 221, STAT 231~~
  - ~~0.5 program unit from: MATH 114, MATH 127, MATH 137, PHYS 111~~
- A minimum cumulative overall average of ~~60~~ **65**%.

Before declaring this academic plan, see invalid credential combinations.

### Honours Physics and Astronomy:

**Background and Rationale:** The changes will remove a 0.25-unit upper year lab elective requirement from the Honours Physics and Astronomy plans to align plans and reduce student workloads.

Students in Honours Physics plans require 0.5 unit of upper year labs, PHYS 360A and another 0.25-unit PHYS lab elective of choice, while students in Honours Physics and Astronomy plans require a total of 0.75 units of upper year labs, PHYS 370L and a 0.5-unit of PHYS lab electives of choice. Removing 0.25 unit of required upper year PHYS lab elective from the latter, will equate upper year lab requirements in both the Honours Physics and Honours Physics and Astronomy plans, reducing the total plan units by a 0.25 unit, to 21.75 units.

## Honours Physics and Astronomy

Successful completion requires:

- ~~22.0~~ **21.75** units distributed as follows:
  - 11.25 PHYS units: PHYS 121, PHYS 121L, PHYS 122, PHYS 122L, PHYS 124, PHYS 175, PHYS 175L, PHYS 234, PHYS 242, PHYS 242L, PHYS 249, PHYS 256, PHYS 256L, PHYS 263, PHYS 267, PHYS 270L, PHYS 334, PHYS 342, PHYS 358, PHYS 359, PHYS 363, PHYS 364, PHYS 370L, PHYS 375, PHYS 474, PHYS 475
  - 1.0 PHYS elective unit selected from: PHYS 275, PHYS 349, PHYS 476/AMATH 475
  - 2.0 MATH units: MATH 127, MATH 128, MATH 227, MATH 228
  - 1.25 CHEM units: CHEM 120, CHEM 120L, CHEM 123, or Year One BIOL or EARTH courses
  - 0.5 CS unit: CS 114
  - 0.5 unit: COMMST 193/ENGL 193
  - 5.5 elective units distributed as follows:
    - 1.0 PHYS lecture unit, any level
    - 0.5 PHYS lecture unit, 400-level (exclusive of PHYS 437A and PHYS 437B)
    - ~~0.5~~ **0.25** PHYS lab unit, from: PHYS 360A, PHYS 360B, PHYS 391L, PHYS 460A, PHYS 460B
    - 3.5 units chosen from any subject, with a maximum of 1.5 lab units and a maximum of 3.0 SCI units
- Enrolment in PHYS 10 when offered
- Co-operative program requirements (when applicable).

**NEW COURSES** (for approval)

**Biology**

**Effective 01-SEP-2024**

BIOL 235 (0.50) LAB, LEC Foundations of Molecular Biology

This course introduces fundamental approaches used to study the biomolecules that mediate cellular processes. Topics include the central dogma of molecular biology, the theoretical basis for molecular methods, scientific principles of hypothesis development, and experimental design in molecular biology research. The laboratory will cover essential experimental techniques for analyzing biomolecules (DNA, RNA, and protein).

Requisites : Prereq: BIOL 130, 239. Antireq: BIOL 309

Rationale : The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisites, retaining BIOL 309 as a legacy prerequisite, for upper year cell and molecular courses (BIOL 331, 335L, 342, 428, 431, 434 and 438), removing instances of 300-level courses with 300-level prerequisites. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. The short title for this course will be "Molecular Biology Foundations". Inactivation of BIOL 309 is planned for Sept. 1, 2025 effective dating.

**Physics & Astronomy**

**Effective 01-SEP-2024**

PHYS 260A (0.50) LAB Intermediate Physics Laboratory 1

An intermediate laboratory course for students in physics.

Requisites : Prereq: PHYS 122L; Honours Physics, Physics and Astronomy, Biological and Medical Physics, BSc Mathematical Physics, Materials and Nanosciences, or Biophysics Minor

Rationale : As part of an initiative to employ best practices based in physics education research, and shift the learning goals for labs to focus on teaching experimental and critical thinking skills, the Physics

undergraduate laboratory committee plans to decouple four 0.25 unit labs (PHYS 232L, 242L, 256L, and 260L) from their associated lecture course, inactivate them for Sept. 1, 2025, and create two 0.5 unit stand alone lab courses (PHYS 260A and 260B) at the second year level. The new courses will become effective Sept. 1, 2024, offered for the 2024 cohort starting in fall 2025 (PHYS 260A) and winter and spring 2026 (PHYS 260B). PHYS 260A will be normally be offered each fall term thereafter.

**Effective 01-SEP-2024**

PHYS 260B (0.50) LAB Intermediate Physics Laboratory 2

Experiments in selected physics topics.

Requisites :

Prereq: PHYS 260A

Rationale :

As part of an initiative to employ best practices based in physics education research, and shift the learning goals for labs to focus on teaching experimental and critical thinking skills, the Physics undergraduate laboratory committee plans to decouple four 0.25 unit labs (PHYS 232L, 242L, 256L, and 260L) from their associated lecture course, inactivate them for Sept. 1, 2024, and create two 0.5 unit stand alone lab courses (PHYS 260A and 260B) at the second year level. The new courses will become effective Sept. 1, 2024, offered for the 2024 cohort in fall 2025 (PHYS 260A) and winter and spring 2026 (PHYS 260B). PHYS 260B will normally be offered each winter and spring thereafter.

**Dean of Science Office**

**Effective 01-SEP-2024**

SCI 211 (0.50) FLD Traditional Medicines Land-Based Field Course

A 4-day land-based field course. Students will engage with Indigenous instructors and community members to learn traditional medicine knowledges. Delivery will be blended with online preparatory lectures. Land-based learning, and teaching circles with Indigenous Knowledge Holders.

Requisites :

Prereq: Level at least 2A

Rationale :

SCI 211 is a new on-the-land field course designed to expose students to Indigenous knowledges and methods in interdisciplinary science topics. It is Waterloo's first on-the-land Indigenous experiential learning course where students are exposed to the teachings and ceremonies of an Ontario indigenous community. The students will participate with and be evaluated by Elders and Indigenous instructors. This course hopes to bridge the work done on campus with the history of the land that surrounds campus, and bring a personal connection to the territorial acknowledgments students hear on campus. The goal is to present Science student with an opportunity to develop a better understanding of the different ways of knowing, so they can develop a wider perspective surrounding some of the topics discussed in their Science courses. The course will require department consent, and



there would be a preference for Science students, and in particular Indigenous identifying Science students, however Science prerequisites have not be added to allow students from other faculties an opportunity to form connections with Indigenous communities should there be space available. The course runs between winter and spring terms, and students can choose to add the course to either their winter or spring term. Students will be directed to contact Science Indigenous Initiatives Manager for additional information (in the Calendar notes and likely via the schedule of classes),

**Effective 01-SEP-2024**

SCI 300 (0.50 ) FLD, LAB, LEC, SEM Special Topics in Science

These special topics courses will cover material relevant to all students in the Faculty of Science. Course content is not specific to an individual program.

Rationale :

This special topics course will allow the Faculty of Science to mount courses of broad interest when instructors are available. The creation of a special topics umbrella will increase the flexibility for the faculty to rapidly mount new courses, which in turn will allow for more choice for students. As curriculums continue to evolve, this flexibility will facilitate the exploration of student interest in courses in emerging or transdisciplinary areas. The Science Undergraduate Office will maintain a list of Special Topics courses that are offered each term, and will communicate that to students through advisors and online tools. It is the intention of the Science Undergraduate Office that should a particular Special Topics be sufficiently popular over multiple terms or years, that this course would then be separated out from the Special Topics groups and would be mounted as an individual course. The component used for delivery of a topic will be dependent on the topic and may or may not include a final exam. The course will not have any prerequisites, but will require instructor consent, and students will be permitted multiple enrolments in this topics course (6 maximum). The course will be graded numerically, and the short title for this course will be "Special Topics in Science". A note in the Calendar will be direct students to the Science UG office for further information.

**COURSE CHANGES** (for approval)

**Biology**

**Current Catalog Information**

BIOL 110 (0.50 ) LAB, LEC, TST Biodiversity, Biomes, and Evolution

A survey of organisms that inhabit a range of aquatic and terrestrial ecosystems (e.g., coral reefs, lakes, forests). Through a lens of evolution this course focuses on how life has adapted to physical conditions, interactions with neighbouring



organisms, and the influence of flora and fauna on the world we inhabit. Evolutionary and ecological frameworks will be used to explore how organisms diversify and are considered distinct species. Developing hypotheses, collecting and analyzing data, and determining how to best communicate results will be carried out. [Offered: F]

No Special Consent Required

Requisites :

Prereq: Not open to Faculty of Environment students

**Effective 01-SEP-2024**

Description Change:

A survey of organisms that inhabit a range of aquatic and terrestrial ecosystems (e.g., coral reefs, lakes, forests). Through a lens of evolution this course focuses on how life has adapted to physical conditions, interactions with neighbouring organisms, and the influence of flora and fauna on the world we inhabit. Evolutionary and ecological frameworks will be used to explore how organisms diversify and are considered distinct species. Laboratory activities include developing hypotheses, collecting and analyzing data, and determining how to best communicate results will be carried out. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

**Current Catalog Information**

BIOL 201 (0.50) LAB, LEC Human Anatomy

This course takes a systems approach to study the structure of the human body and its relationship to function. [Formerly BIOL 301; Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 130

**Effective 01-SEP-2024**

Description Change:

This course takes a systems approach to study the structure of the human body and its relationship to function. Structural features of organ systems will be explored through lectures and laboratory exercises. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness. In addition, an antirequisite of the former number is added, to replace the note indicating the former number.

**Current Catalog Information**

BIOL 211 (0.50) LAB, LEC, TST Introductory Vertebrate Zoology

An introduction to the structure, evolution and development of vertebrate organ systems. [Offered: W]

No Special Consent Required

**Effective 01-SEP-2024**

Description Change:

An introduction to the structure, evolution, and development of vertebrate organ systems, explored through lectures and laboratory exercises. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a

course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 220 (0.50) LAB, LEC, TST Introduction to Plant Structure and Function

An introduction to plant diversity, and the anatomy and physiology of vascular plants. The course will include a description of major cell and tissue types, and their organization in roots, stems, and leaves. Topics such as the processes of water and ion uptake, photosynthesis, long distance transport, and growth regulation will also be covered. [Note: Formerly BIOL 120; Offered: W]

No Special Consent Required

Requisites : Antireq: BIOL 120

### Effective 01-SEP-2024

Description Change:

An introduction to plant diversity, and the anatomy and physiology of vascular plants. The course will include a description of major cell and tissue types, and their organization in roots, stems, and leaves. Topics such as the processes of water and ion uptake, photosynthesis, long distance transport, and growth regulation will also be covered in lectures and through laboratory experiments. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 225 (0.50) LEC Plants and Civilization

This course examines the importance of plants and the role they have in the local and global community. It introduces students to the impact of plants on the past, present and future of human civilization and describes the importance of plants as sources of food, medicine, fuel, shelter, clothing and psychoactive agents. Topics include medicinal plants and human health, the origin of agricultural crops, plants that changed the course of history, plant-based biofuels, the green revolution, plant biotechnology and genetic engineering of plants. [Offered: F]

No Special Consent Required

### Effective 01-SEP-2024

Description Change:

This course welcomes students and knowledge keepers together to explore the long-lasting relationships between plants and humans, how our histories entwine, and the importance of botanical familiarity in our lives. Both historical and contemporary connections to plants will be discussed including with an Indigenous context. Plant structures and life histories will be discussed as well as medicinal, textile, food, and other usages in modern contexts. Knowledge of plants will be shared from multiple sources to construct a fuller understanding of, and relation to, plants and their fundamental importance to human civilization. [Offered: F]

Rationale :

The previous course instructor has retired and this presents the opportunity to make substantive change to the content of this course. With support from the new Science Indigenous Initiatives Manager, the

opportunity is here to present a Biology course teaching introductory botany with perspectives from Indigenous knowledge keepers to support a systems-level view of the interconnectedness of plants and humans. Presenting this course offers Biology and other students an opportunity to learn fundamental botany alongside the integral relationships between plants and humans that have persisted in our civilization across time. Offering this course within the Biology department is an authentic commitment to acknowledging the tenants of the Truth and Reconciliation Committee of Canada's calls to action. This course is not core to any one program but is an optional program elective within the urban studies minor, so there has been outreach to Faculty of Environment for awareness.

### Current Catalog Information

BIOL 241 (0.50) LAB, LEC Introduction to Applied Microbiology

Introduction to microbial ecology, environmental microbiology, food microbiology, and medical microbiology. Topics in environmental microbiology include biogeochemical cycling and biological treatment of wastes and pollutants. Topics in medical microbiology include concepts of immunology and host-parasite relationships.

[Offered: W,S]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240 and 140/240L

### Effective 01-SEP-2024

Description Change:

Introduction to microbial ecology, environmental microbiology, food microbiology, and medical microbiology explored through lectures and laboratory exercises. Topics in environmental microbiology include biogeochemical cycling and biological treatment of wastes and pollutants. Topics in medical microbiology include concepts of immunology and host-pathogen relationships. [Offered: W,S]

Rationale :

The new Calendar software will not display components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness. In addition, "host-parasite" is replaced with "host-pathogen" as this is a broader description and more representative of microbial interactions.

### Current Catalog Information

BIOL 251 (0.50) LAB, LEC Fundamentals of Ecology

This course provides students with an introduction to the breadth of the ecology discipline. It covers hypothesis testing and the nature of scientific inquiry, organismal, population, community, and ecosystem levels of ecology. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 110 or 2A Faculty of Environment students. Antireq: BIOL 150

### Effective 01-SEP-2024

Description Change:

This course provides students with an introduction to the breadth of the ecology discipline, including laboratory and field components. It covers hypothesis testing and the nature of scientific inquiry, organismal, population, community, and ecosystem levels of ecology. [Offered: F]

Rationale : The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 302 (0.50) LAB, LEC Functional Histology

A hierarchical approach to biological structure with an emphasis on functional morphology. Starting with the cell, the fundamental unit of structure and function, the material progressively develops how cells organize to form tissues such as epithelium, connective tissue and muscle. Emphasis on how these tissue building blocks cooperate to form the major organs and organ systems of the human body.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 130, 273

### Effective 01-SEP-2024

Description Change:

A hierarchical approach to biological structure with an emphasis on functional morphology. Starting with the cell, the fundamental unit of structure and function, the material progressively develops how cells organize to form tissues such as epithelium, connective tissue and muscle. Emphasis on how these tissue building blocks cooperate to form the major organs and organ systems of the human body. The laboratory component includes preparation and staining of tissues for microscopy, and use of virtual tools for viewing high resolution tissue scans.[Offered: W]

Rationale : The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 310 (0.50) LAB, LEC Invertebrate Zoology

The diversity of invertebrate animals will be explored in this class. Topics covered will include reproduction, development, life history, feeding, locomotion, and behaviour. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 110 or 165

### Effective 01-SEP-2024

Description Change:

The diversity of invertebrate animals will be explored in this class. Topics covered in lectures and laboratory will include reproduction, development, life history, feeding, locomotion, and behaviour. [Offered: F]

Rationale : The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 323 (0.50) LAB, LEC Plant Physiology

A study of plant physiological processes with an emphasis on the role of key

metabolic pathways in plant growth and development. Topics such as photosynthesis, nitrogen assimilation, growth regulators, mineral nutrition, water relations, and stress physiology will be covered. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 120/220, 130

**Effective 01-SEP-2024**

Description Change:

A study of plant physiological processes with an emphasis on the role of key metabolic pathways in plant growth and development. Topics such as photosynthesis, nitrogen assimilation, growth regulators, mineral nutrition, water relations, and stress physiology will be covered through lectures and laboratory experiments. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

**Current Catalog Information**

BIOL 325 (0.50 ) LAB, LEC Flowering Plants

A study of floral morphology in relation to classification and evolution. An introduction to taxonomy and nomenclature. History of taxonomy. Systems of classification. Mechanisms of pollination. [Offered: F]

No Special Consent Required

**Effective 01-SEP-2024**

Description Change:

This course provides an introductory level survey of members of the Class Angiospermae, the largest group of plants, through lectures and laboratory sessions. Topics covered include the identification, nomenclature, taxonomy, and basic morphology of flowering plants, as well as a brief history of classification, pollination biology, and plant molecular systematics. Cultural importance of plant species will be discussed along with historic and contemporary uses of select native plants as food and medicine. [Offered: F]

Rationale :

The proposed change in course description now states that this course includes a lab component and provides a more detailed description of the course content, including cultural importance and uses of plants for food and medicine.

**Current Catalog Information**

BIOL 331 (0.50 ) LAB, LEC, TST Advanced Cell Biology

The functional organization of cells with particular reference to cell-cell interaction, the structure, function and development of organelles and the biological roles of cellular membranes. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 308 or 309; CHEM 233 or 237; (BIOL 308 or BIOL 309) and co-req CHEM 233 or CHEM 237 for Science and Business/Biotechnology Specialization or Honours Biotechnology/Economics or CS Honours Bioinformatics

**Effective 01-SEP-2024**

Description Change:

The functional organization of cells with particular reference to cell-cell

interaction, the structure, function, and development of organelles and the biological roles of cellular membranes. Laboratory exercises apply techniques for isolation and analysis of cellular components. [Offered: W]  
Requisite Change : Prereq: One of BIOL 235, 308 or 309; CHEM 233 or 237; (BIOL 235, 308 or 309) and coreq CHEM 233 or CHEM 237 for Science and Business/Biotechnology Specialization or Honours Biotechnology/Economics or CS Honours Bioinformatics  
Rationale : The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite other than retaining BIOL 309 as a legacy prerequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. The description is updated to include some detail related to the associated lab, for student awareness, as the new software will not display components associated with each course.

### Current Catalog Information

BIOL 335L (0.50) LAB, TUT Molecular Biology Techniques

Selected experiments to provide students with a range of laboratory skills in recombinant DNA technology. [Note: Students in the Molecular Biology and Biotechnology Specialization are encouraged to take this course unless they have previous laboratory experience involving molecular biology techniques. Offered: F,W]  
No Special Consent Required

Requisites : Prereq: BIOL 240L. Coreq: BIOL 309

### Effective 01-SEP-2024

Description Change: Selected experiments to provide students with a range of laboratory skills in recombinant DNA technology. [Offered: F,W]

Requisite Change : Prereq: BIOL 240L; BIOL 235 or (coreq: BIOL 309).

Rationale : The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite, other than retaining BIOL 309 as a legacy prerequisite. The introduction of BIOL 235 at a 200-level, allows it

be a prerequisite for BIOL 335L, while BIOL 309 will be retained as a legacy corequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. In addition, the description note is removed as there are no longer specializations within the Biology major, nor will description notes be used in the new software system.

### Current Catalog Information

BIOL 341 (0.50) LAB, LEC Fundamentals of Immunology

This course will provide students with an understanding of the fundamental concepts of the vertebrate immune system. Topics will focus on the components of the immune system, innate and adaptive immunity, immune cell development, communication, and recognition of non-self leading to an immune response. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140/240L, (241 or 273). Antireq: BIOL 441 prior to Spring 2015

### Effective 01-SEP-2024

Description Change:

This course will provide students with an understanding of the fundamental concepts of the vertebrate immune system. Topics will focus on the components of the immune system, innate and adaptive immunity, immune cell development, communication, and recognition of non-self leading to an immune response. Theory will be complemented with laboratory experiments applying immunological techniques. [Offered: W]

Requisite Change :

Prereq: BIOL 240, 240L; BIOL 241 or Level at least 3A Biochemistry major  
Rationale :  
Students need specific lab skills to handle the microbes that are used in BIOL 341. BIOL 273 does not provide those skills however the BIOL 240 and BIOL 241 labs do, therefore BIOL 273 is removed as an optional prerequisite. Students in Biochemistry plans have accumulated the necessary lab skills by third year through multiple lab courses even if they have not taken BIOL 241 specifically, as confirmed and supported by the biochemistry advisors. As such, the prerequisite is updated to provide a path for Biochemistry students, who may not have the BIOL 241 prerequisite, to take BIOL 341. The antirequisite is removed, since it's unlikely anyone interested in BIOL 341 after 2024 will have BIOL 441 from prior to spring 2015. For student awareness, the description is updated to include reference to the associated as the new software will not display components associated with each course. Lastly, the old numbers, BIOL 140 and BIOL 140L are removed as they have not been used in over 10 years.

### Current Catalog Information

BIOL 342 (0.50) LEC, TUT Molecular Biotechnology 1

Molecular biotechnology applies the principles of recombinant DNA technology (genetic engineering, gene cloning) to the development of commercial products. The methods of recombinant DNA technology, molecular diagnostic systems for detecting diseases and transgenic organisms will be discussed. [Note: Recommended prerequisite BIOL 241. It



is recommended that BIOL 342 be taken after completion of second year. Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, BIOL 208/309

**Effective 01-SEP-2024**

Description Change:

Molecular biotechnology applies the principles of recombinant DNA technology (genetic engineering, gene cloning) to the development of commercial products. The methods of recombinant DNA technology, molecular diagnostic systems for detecting diseases, and transgenic organisms will be examined in lectures and tutorial sessions. [Offered: F]

Requisite Change :

Prereq: BIOL 240; BIOL 235 or 309

Rationale :

The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite, other than retaining BIOL 309 as a legacy prerequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. Additionally, the old numbers, BIOL 140 and BIOL 208 are removed, not having been used in years, and the description is updated to include reference to the components associated with this course, while the recommendation note within the description is removed, as the new software will not display components nor allow notes within the description.

**Current Catalog Information**

BIOL 345 (0.50 ) LAB, LEC Microorganisms in Foods

Food preservation, spoilage, poisoning and modern concepts in quality assurance programs are studied. The aim is to understand factors governing microbial changes in foods. Problem solving in the food industry is emphasized. Laboratory work will reflect current practices in quality control and testing. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140L/240L, 241

**Effective 01-SEP-2024**

Requisite Change :

Prereq: BIOL 240, 240L, 241 or Level at least 3A Biochemistry major

Rationale :

Students in Biochemistry plans have accumulated strong lab skills by third year through multiple lab courses even if they have not taken BIOL 241 specifically. Supported by biochemistry advisors, the prerequisite is updated to provide a path for Biochemistry students, who may not have the BIOL 241 prerequisite, to take BIOL 345. In addition, the old numbers, BIOL 140 and BIOL 140L are removed as they have not been used in over 10 years.

**Current Catalog Information**



BIOL 346 (0.50) LAB, LEC Microbial Ecology and Diversity

Examples from terrestrial and aquatic ecosystems, and plant- and animal-associated environments, will be used to illustrate the activities and diversity of microorganisms in these habitats. The importance of the ecological roles of microbes to aspects of agriculture, geochemistry, human biology, and the biology of extreme environments will be considered. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140/240L, 241

**Effective 01-SEP-2024**

Description Change:

Examples from terrestrial and aquatic ecosystems, and plant- and animal-associated environments, will be used to illustrate the activities and diversity of microorganisms in these habitats. The importance of the ecological roles of microbes to aspects of agriculture, geochemistry, human biology, and the biology of extreme environments will be considered. Laboratory work will apply current methods in environmental microbiology.[Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 350 (0.50) LEC, TUT Ecosystem Ecology

This course provides an overview of the dynamic interactions among microbes, plants, animals and their physical environment with emphasis on ecosystem structure and function. Topics include the hydrological cycle, biogeochemical cycling, ecological energetics, roles of population and community interactions, paleoecology and current topics in ecosystem science. [Offered: F]

No Special Consent Required

Requisites :

Prereq: One of BIOL 150, 251, ENVS 200

**Effective 01-SEP-2024**

Description Change:

This course provides an overview of the dynamic interactions among microbes, plants, animals, and their physical environment with emphasis on ecosystem structure and function. Topics explored through lectures and tutorial sessions include the hydrological cycle, biogeochemical cycling, ecological energetics, roles of population and community interactions, paleoecology, and current topics in ecosystem science. [Offered: F]

Requisite Change :

Prereq: (One of BIOL 150, 251, ENVS 200) or Level of at least 3A Environmental Sciences majors

Rationale :

Effective fall 2024, Environmental Science, Ecology Specialization plans will require BIOL 150 or BIOL 251, whereas Environmental Sciences, Geoscience and Water Science Specialization plans, will retain the required BIOL 110 or BIOL 150 requirement. As such, students in the latter specializations may not have the prerequisite for BIOL 350, but consultation with the Department of Earth and Environmental Sciences confirms that these students will have sufficient background through other

required BIOL and EARTH courses, for success in BIOL 350. As such, the prerequisite is updated to include Environmental Sciences students in level at least 3A. In addition, the description is updated to identify components associated with this course, as the new software will not display components.

### Current Catalog Information

BIOL 351 (0.50) LEC

Aquatic Ecology

Study of the structure and function of lake and stream ecosystems. The course emphasizes biological components and processes, but includes the origin and nature of lake and stream systems and the fundamentals of surface water chemistry and physics. Human influences, management options and current issues will be examined with readings and project work. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 150 or 251; One of BIOL 110, 120/220, 165

### Effective 01-SEP-2024

Requisite Change :

Prereq: One of BIOL 110, 120/220, 165; One of BIOL 150, 251, ENVS 200 or level at Least 3A Environmental Sciences

Rationale :

Effective fall 2024, Environmental Science, Ecology Specialization plans will require BIOL 150 or BIOL 251, whereas Environmental Sciences, Geoscience and Water Science Specialization plans, will retain the required BIOL 110 or BIOL 150 requirement. As such, students in the latter specializations may not have the prerequisite for BIOL 351, but consultation with the Department of Earth and Environmental Sciences, confirms that these students will have sufficient background through other required BIOL and EARTH courses, for success in BIOL 351. As such, the prerequisite is updated to include Environmental Sciences students in level at least 3A. In addition, ENVS 200 is also added as an alternative prerequisite to BIOL 150 or 251, providing a path for Faculty of Environment students and eliminating the need for course overrides, supported by Faculty of Environment.

### Current Catalog Information

BIOL 354 (0.50) LAB, LEC, TST

Environmental Toxicology 1

An introduction to the basic theories, principles and techniques of environmental toxicology. A comparative study of the effects of specific groups of toxicants on ecosystems; biodegradation and cycling. [Offered: F,S]

No Special Consent Required

Requisites :

Prereq: One of CHE 102, CHEM 120, 121

### Effective 01-SEP-2024

Component Change:

LAB, LEC

Title Change:

Environmental Toxicology

Description Change:

An introduction to the basic theories, principles, and techniques of environmental toxicology. A comparative study of the effects of specific groups of toxicants and how they can affect molecular, cellular, and organismal processes will be explored in lectures and through laboratory

experiments.  
Requisite Change : Prereq: One of any 100- or 200-level BIOL; One of CHE 102, CHEM 120, 121  
Rationale : The title is updated to reflect that that BIOL 354 is a standalone course and does not imply a subsequent course in a series, while the description is updated to better align with the concepts covered in the course and to reference components associated with the course, as new software will not display components. Assessments for BIOL 354 are not done outside the lecture therefore, a TST component is not required. Lastly, the prerequisite is updated to include some biology background in addition to requiring some background in chemistry, ensuring students are suitably prepared for success.

### Current Catalog Information

BIOL 355 (0.50) LEC Biology of Human Aging

An overview of current aspects of the biology of human aging and the functional changes associated with both normal aging and pathological problems often present in the elderly. Biological theories of aging and normal age-related structural and physiological changes on all of the major body systems will be discussed. Extrinsic factors such as diet and exercise and their role on the aging process will be examined as well as various medical treatments. [Offered: W]

No Special Consent Required

Requisites : Prereq: BIOL 130

Cross-listed as: GERON 355

### Effective 01-SEP-2024

Requisite Change : Prereq: BIOL 273

Rationale : It was recognized that students would benefit with a stronger background in human physiology to describe and discuss physiological changes associated with aging. Therefore BIOL 273, Human Physiology 1, is added as a prerequisite for BIOL 355. Since BIOL 273 requires BIOL 130, the latter is removed as a prerequisite for BIOL 355. This course is cross-listed with GERON 355, and the Faculty of Health has been made aware of requisite changes on the BIOL of the cross-listing and approves the revision to GERON 355 as well.

### Current Catalog Information

BIOL 361 (0.50) LAB, LEC Biostatistics and Experimental Design

An introduction to hypothesis testing and experimental design in biology. Topics will include exploratory data analysis, analysis of variance, categorical data analysis, correlation, linear regression, multiple linear regression, power analysis, visualization tools, and statistical software. [Offered: W]

No Special Consent Required

Requisites : Prereq: One of STAT 202, ECON 221, ENV5 278. Antireq: PSYCH 391, STAT 332

### Effective 01-SEP-2024

Description Change : An introduction to hypothesis testing and experimental design in biology. Topics will include exploratory data analysis, analysis of variance, categorical data analysis, correlation, linear regression, multiple linear

regression, power analysis, and visualization tools. Statistical software will be used in computer laboratories to explore examples and applications. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 364 (0.50) LAB, LEC Mathematical Modelling in Biology

An introduction to the mathematical modelling of biological processes using a variety of techniques including linear difference models, ordinary differential equations, and Markov models. Modelling applications ranging from genetics to ecosystem biology will be addressed. [Offered: F]

No Special Consent Required

Requisites :

Prereq: One of MATH 116,127,137,147; Level at least 3A

**Effective 01-SEP-2024**

Description Change:

An introduction to the mathematical modelling of biological processes using a variety of techniques including linear difference models, ordinary differential equations, and Markov models. Modelling applications ranging from genetics to ecosystem biology will be addressed. Examples and applications will be explored as part of the course computer laboratory. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 365 (0.50) LAB, LEC Methods in Bioinformatics

This course covers bioinformatics methods with an emphasis on analysis of high-throughput '-omics' data. Topics include analysis of genome-scale gene and protein expression, construction of species and gene trees from molecular sequence data, and analysis of biological systems using bioinformatics tools. Included will be practical experience with bioinformatics tools and datasets.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 239; One of BIOL 266, CHEM 140, CS 116, CS 136

**Effective 01-SEP-2024**

Description Change:

This course covers bioinformatics methods with an emphasis on analysis of high-throughput '-omics' data. Topics include analysis of genome-scale gene and protein expression, construction of species and gene trees from molecular sequence data, and analysis of biological systems using bioinformatics tools. Practical experience with bioinformatics tools and datasets will be provided through computational laboratory exercises.[Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components

connected with the course, for student awareness.

### Current Catalog Information

BIOL 403 (0.50) LEC Advanced Topics in Developmental Biology

This course explores the cellular and molecular basis of developmental phenomena in animals. Lectures will emphasize the experimental basis for both historical and contemporary knowledge with a focus on the major developmental systems in model organisms. Course content will concentrate on themes that permeate current published research. [Note: BIOL 208/309 is recommended as a prerequisite. Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 303, 308

### Effective 01-SEP-2024

Title Change:

Developmental Biology and Embryology

Description Change:

This course explores the cellular and molecular basis of developmental phenomena in animals. Fundamental processes and concepts in embryonic development will be discussed including the acquisition of multicellularity, morphogenesis of tissues, major organ systems, fetal membranes, growth, differentiation, and analysis of common developmental defects. Lectures will emphasize the experimental basis for animal development with a focus on the major developmental systems in model organisms.

Requisite Change :

Prereq: BIOL 273, 308; Antireq: BIOL 303

Rationale :

Developmental biology and embryology has changed over the last 15 years and now has a much stronger emphasis on molecular biology and genetic pathways. This is reflected in the course content for BIOL 303; however, it makes this course very challenging for third year students who may not have taken BIOL 308, Principles of Molecular Biology, prior to BIOL 303. To address this, BIOL 303 will become inactive (Sept. 1 2026), and BIOL 403, Advanced Topics in Developmental Biology, which was last offered fall 2016, with no plans be offered as is again, will be updated with BIOL 303 content, which is more suitable fourth year material, after a background in BIOL 308. Therefore, BIOL 308 is retained as a prerequisite for the updated BIOL 403, and BIOL 273 is added as an additional prerequisite, which will provide a background which better aligns with course content and student success in BIOL 403. The updated BIOL 403 will first be offered in the fall of 2026, allowing a final offering of BIOL 303 in the fall of 2025, which will be added as an antirequisite to BIOL 403, since the content will be moved over to BIOL 403. The short title for this course will be "Dev Biology & Embryology".

### Current Catalog Information

BIOL 414 (0.50) LEC, TUT Parasitology

This course will explore how parasites affect their host(s) and interact with other parasites. Attention will be given to eukaryotic parasites impacting human and domestic animal health. Public measures of parasite control will be covered.

[Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 110, 359

**Effective 01-SEP-2024**

Description Change:

Through lectures and tutorials, this course will explore how parasites affect their host(s) and interact with other parasites. Attention will be given to eukaryotic parasites impacting human and domestic animal health. Public measures of parasite control will be covered. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore the description is updated to reference components connected with this course, for student awareness.

### Current Catalog Information

BIOL 428 (0.50 ) LAB, LEC, TUT Plant Molecular Genetics

An examination of the current molecular techniques used to study plant development physiology. Topics include mutant isolation, transcript and metabolite profiling, gene silencing and protein localization. [Note: BIOL 120/220 is recommended; Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 309

**Effective 01-SEP-2024**

Description Change:

An examination of the current molecular techniques used to study plant development physiology. Topics in lectures and laboratories include mutant isolation, transcript and metabolite profiling, gene silencing, and protein localization. [Offered: W]

Requisite Change :

Prereq: BIOL 235 or 309

Rationale :

The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite, other than retaining BIOL 309 as a legacy prerequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. The description is updated to include reference to components associated with this course, and the description note is removed. New software will not display components and will not permit notes within course descriptions.

### Current Catalog Information

BIOL 431 (0.50 ) LEC Bacterial Molecular Genetics

Bacterial molecular biology with an emphasis on the use of genetic tools to study the

biology of microorganisms. Topics include mutagenesis, conjugation, recombination, gene regulation, plasmids, transposons, bacteriophage and genomics. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140/240L, 208/309, 308

**Effective 01-SEP-2024**

Requisite Change :

Prereq: BIOL 240, 240L, 308; BIOL 235 or 309

Rationale :

The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite, other than retaining BIOL 309 as a legacy prerequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. Additionally, the old numbers, BIOL 140, 140L, and BIOL 208 are removed as they have not been used in over 10 years.

**Current Catalog Information**

BIOL 434 (0.50 ) LEC, SEM Human Molecular Genetics

Recent advances in human molecular genetics will be examined with emphasis on how human disease-causing genes are mapped, identified, isolated and characterized.

Examples will draw from research on Duchenne muscular dystrophy, Huntington disease, cystic fibrosis, Alzheimer disease, cancer, vision defects and other disorders.

[Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 208/309, 308

**Effective 01-SEP-2024**

Requisite Change :

Prereq: BIOL 235 or 309; BIOL 308

Rationale :

The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite, other than retaining BIOL 309 as a legacy prerequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. Additionally, the old number, BIOL 208, as well as the seminar component, are removed, as both have not been used in over 10 years.



### Current Catalog Information

BIOL 438 (0.50) LEC, SEM Molecular Biology of Animal Development

An examination of the current major issues in the regulation of gene expression during animal development with emphasis on technical and conceptual advances. Current research literature will be reviewed. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 208/309, 303, 308

### Effective 01-SEP-2024

Component Change:

LEC

Requisite Change :

Prereq: BIOL 308; BIOL 235 or 309; BIOL 303 or 403

Rationale :

The department of Biology is creating two 200-level molecular and cell biology courses (BIOL 235, Foundations of Molecular Biology in 2024/2025, and BIOL 231 to be developed and introduced in 2025/2026) to give students practical experience with molecular biology techniques and skills, and to better prepare them for 300-level course content as well as co-op job skills with the lab component that will accompany the new course. Having these courses and skills at the second year level better fits the biology curriculum structure in which second year courses provide students with the fundamentals for different sub-disciplines within biology. BIOL 235 will replace BIOL 309 as a prerequisite, other than retaining BIOL 309 as a legacy prerequisite. Content and problem-solving aspects of BIOL 309 will be retained in the curriculum, integrating the concepts into the new BIOL 235. Additionally, the department of Biology is also inactivating BIOL 303 and moving its content into an updated BIOL 403. BIOL 438 is the only course which lists BIOL 303 as a prerequisite, therefore, this is replaced with BIOL 403 keeping BIOL 303 as a legacy prerequisite (see rationale for BIOL 303 and 403). Lastly, the old number, BIOL 208, and the SEM component, are removed as both not been used in years.

### Current Catalog Information

BIOL 443 (0.50) LAB, LEC Fermentation Biotechnology

Biology of industrial micro-organisms: fermentation systems; fermentation raw materials; downstream processing; biomass production; food fermentations; production of industrial chemicals, food additives, enzymes and other products by fermentation.

[Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140/240L, 241

### Effective 01-SEP-2024

Description Change:

Biology of industrial micro-organisms: fermentation systems; fermentation raw materials; downstream processing; biomass production; food fermentations; production of industrial chemicals, food additives, enzymes, and other products by fermentation. This course includes practical examples in the laboratory. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a



course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 447 (0.50) LEC, TUT Environmental Microbiology

A study of the environmental impact of microorganisms. Aspects of pollution, waste treatment, biodegradation of environmental contaminants, and nutrient cycling will be examined. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140/240L, 241

**Effective 01-SEP-2024**

Description Change:

A study of the environmental impact of microorganisms. Aspects of pollution, waste treatment, biodegradation of environmental contaminants, and nutrient cycling will be examined. Tutorials emphasize critical analysis of primary literature. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 448 (0.50) LAB, LEC Microbial Physiology and Biochemistry

A study of the physiology of microorganisms. Provides biochemical- and molecular-level detail on the diverse structures and metabolic functions of bacterial, archaeal, and eukaryal cells. Aspects of microbial growth, nutrition, and metabolism are examined in the context of how microorganisms develop diverse solutions for meeting essential requirements for life. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 140/240, 140/240L, 241, 308

**Effective 01-SEP-2024**

Description Change:

A study of the physiology of microorganisms through lectures and laboratories. Provides biochemical- and molecular-level detail on the diverse structures and metabolic functions of bacterial, archaeal, and eukaryal cells. Aspects of microbial growth, nutrition, and metabolism are examined in the context of how microorganisms develop diverse solutions for meeting essential requirements for life. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 451 (0.50) LEC, SEM Advanced Ecology and Evolution

Students will use scientific literature to explore and analyze a range of advanced topics in ecology and evolution at the individual, population, community, and ecosystem scales. Recent advances in understanding of fundamental concepts as well as current frontiers in the field will be examined through written reports, essays, and oral presentations. [Offered: F]

No Special Consent Required  
Requisites : Prereq: BIOL 150 or 251; BIOL 359, 361  
**Effective 01-SEP-2024**  
Component Change: LEC  
Description Change: Students will read and analyze scientific papers to deepen their understanding of core topics in ecology and evolution and how they are related. These topics include the ecological niche, plasticity, competition, community ecology, and climate change. Topics are explored through in-class discussions, written reports, and oral presentations. Students will also improve their proficiency at understanding primary literature and identifying key elements such as research questions, hypotheses, experimental design, and main results.  
Rationale : The updated course description for BIOL 451 provides additional detail on the content of this course and the emphasis on research methods and experimental design. BIOL 451 will continue to be offered in the fall term, but the seminar component is removed as it's not been used in numerous years.

### Current Catalog Information

BIOL 455 (0.50) LEC, TUT Ecological Risk Assessment and Management

Examination of the use of scientific information characterizing the risks posed to the environment by anthropogenic stresses. Discussions will take place in the context of aquatic ecology and presume a background of standard aquatic toxicology methods. Methods for assessing risks, including environmental impact assessment, risk quotients, national, and international risk assessment paradigms, and cumulative effects assessment will be examined. Critical connections between assessment and management will also be discussed. [Offered: F of even years]

No Special Consent Required

Requisites :

Prereq: BIOL 150 or 251; BIOL 354, STAT 202

**Effective 01-SEP-2024**

Description Change: Examination of the use of scientific information characterizing the risks posed to the environment by anthropogenic stresses. Discussions will take place in the context of aquatic ecology and presume a background of standard aquatic toxicology methods. Methods for assessing risks, including environmental impact assessment, risk quotients, national, and international risk assessment paradigms, and cumulative effects assessment will be examined. Critical connections between assessment and management will be discussed in lectures and tutorials. [Offered: F of even years]

Rationale : The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 456 (0.50) LEC, TUT Population Biology

The analysis of the structure and dynamics of plant and animal populations.

Theoretical, mathematical and experimental approaches to the study of population ecology. [Note: Students are advised that this course involves computer and numerical applications. Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 350; One of STAT 202, ECON 221, ENVS 278

**Effective 01-SEP-2024**

Description Change:

The analysis of the structure and dynamics of plant and animal populations. Theoretical, mathematical, and experimental approaches to the study of population ecology will be discussed through lectures and tutorials. [Offered: F]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

**Current Catalog Information**

BIOL 457 (0.50) LEC, TUT Analysis of Communities

A study of the organization, structure and development of communities with emphasis on vegetation change. Topics include: diversity, stability; succession; sampling procedures and multivariate analysis. [Offered: W]

No Special Consent Required

Requisites :

Prereq: One of BIOL 150, 251, ENVS 200; One of STAT 202, ECON 221, ENVS 278

**Effective 01-SEP-2024**

Description Change:

A study of the organization, structure, and development of communities with emphasis on vegetation change. Topics include diversity, stability; succession; sampling procedures and multivariate analysis. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

**Current Catalog Information**

BIOL 458 (0.50) LAB, LEC Quantitative Ecology

The course addresses the integration of mathematical and statistical tools to solve problems in ecology, using examples from individual, population, community, and ecosystem scales. Coursework will explore the relationships between models, hypotheses, experiments and data.

No Special Consent Required

Requisites :

Prereq: One of BIOL 150, 251, ENVS 200; One of STAT 202, ECON 221, ENVS 278

**Effective 01-SEP-2024**

Description Change:

The course addresses the integration of mathematical and statistical tools to solve problems in ecology, using examples from individual, population, community, and ecosystem scales. Coursework and computer laboratory exercises will explore the relationships between models, hypotheses, experiments, and data.

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 465 (0.50) LAB, LEC Structural Bioinformatics

Analysis of proteins using structural and bioinformatics approaches. Topics include methods of protein structure determination and visualization, structure comparison and prediction, prediction of protein function and interactions, molecular dynamics, and protein design. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 266/366 or BIOL 365; CHEM 233 or CHEM 237 or BCS Bioinformatics Specialization or BMath (CS) Bioinformatics Specialization

### Effective 01-SEP-2024

Description Change:

Analysis of proteins using structural and bioinformatics approaches. Topics explored in lectures and labs include methods of protein structure determination and visualization, structure comparison and prediction, prediction of protein function and interactions, molecular dynamics, and protein design. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

### Current Catalog Information

BIOL 473 (0.50) LAB, LEC Mammalian Reproduction

This course will provide an in-depth coverage of reproductive biology in a range of mammalian species. Emphasis will be on the principles underlying the regulation of key reproductive processes, from the whole animal to the molecular level. Topics will include applications of these principles to human and veterinary medicine, and ethical problems posed by some reproductive technologies. [Offered: F]

No Special Consent Required

Requisites :

Prereq: BIOL 273, 373

### Effective 01-SEP-2024

Requisite Change :

Prereq: BIOL 130L, 373

Rationale :

As a 400-level course with a lab component, students enrolled in BIOL 473 should be familiar with basic wet-lab techniques in addition to the physiology background provided by BIOL 273 and 373. BIOL 130L provides the hands-on experience in techniques such as pipetting, preparing serial dilutions and standard curves, spectroscopy and microscopy that will be expected for the labs in this course, therefore, it is added as a prerequisite, while BIOL 273 is removed, being it's the prerequisite for BIOL 373. Although term of offering will no longer be listed in the UG calendar as a note within the description, this course will move to a winter offering versus the current fall term offering.

### Current Catalog Information

BIOL 484 (0.50) LEC, TUT Advanced Eukaryotic Genetics

The role of classical genetic analysis in the context of today's genomic era. Topics:

meiotic recombination, meiosis, complementation analysis, chromosome aberrations, and genetic interactions. Methods used in model eukaryotic genetic organisms such as forward and reverse genetic screens, genetic mosaics, conditional mutants, and genetic mapping will be discussed. Examples will illustrate how genes continue to be identified using classical-based approaches in a variety of biological processes, including cell cycle progression, cancer and metastasis, learning and memory, as well as pattern formation and embryonic development. Alternatives to traditional mutagenesis-based screens and the links between classical and molecular genetics will also be discussed. [Offered: W]

No Special Consent Required

Requisites :

Prereq: BIOL 130, 139/239, 308

**Effective 01-SEP-2024**

Description Change:

The role of classical genetic analysis in the context of today's genomic era. Topics discussed in lectures and labs include meiotic recombination, meiosis, complementation analysis, chromosome aberrations, and genetic interactions. Methods used in model eukaryotic genetic organisms such as forward and reverse genetic screens, genetic mosaics, conditional mutants, and genetic mapping will be discussed. Examples will illustrate how genes continue to be identified using classical-based approaches in a variety of biological processes, including cell cycle progression, cancer and metastasis, learning and memory, as well as pattern formation and embryonic development. Alternatives to traditional mutagenesis-based screens and the links between classical and molecular genetics will also be discussed. [Offered: W]

Rationale :

The new Calendar will not be displaying components associated with a course, therefore, the description is updated to reference components connected with the course, for student awareness.

## Chemistry

### Current Catalog Information

CHEM 266 (0.50) LEC, TST Basic Organic Chemistry 1

Structure, nomenclature, and reactions of important classes of organic compounds.

Stereochemistry and its role in reaction mechanisms. [Offered: F]

No Special Consent Required

Requisites :

Prereq: CHEM 120, 123 or CHEM 121, 125. Antireq: CHEM 262, 264, NE 122/222

**Effective 01-SEP-2024**

Requisite Change :

Prereq: CHEM 123 or 125. Antireq: CHEM 262, 264, NE 222

Rationale :

The prerequisite for CHEM 123 is CHEM 120, and the prerequisite for CHEM 125 is CHEM 121. CHEM 266 requires one complete year of first year chemistry, so it's sufficient to list either CHEM 123 or CHEM 125 as prerequisites. This will allow students who've changed programs and who have credit for CHEM 120 and CHEM 125, or, CHEM 121 and CHEM 123, access to the course without a need for an override. In addition, the old NE 122 number is removed as there are currently no students that would have this version of the chemistry course.

## Earth and Environmental Sciences

### Current Catalog Information

EARTH 390 (0.50) LAB Methods in Geological Mapping

Field study in Sudbury and Whitefish Falls areas. Held for at least nine days at end of the winter term. Geological and geotechnical field techniques, map construction, and report writing. [Note: Additional field trip fees will apply to all students. Depending on availability of space, EARTH 390 is also open to students who do not require this course in their plan. There will be an additional fee for such students.

Offered: W]

Department Consent Required

Requisites :

Prereq: EARTH 235. Coreq: EARTH 238, 333

#### Effective 01-SEP-2024

Component Change:

FLD

Rationale :

This course meets outside the classroom, taught in the field, so a FLD component is a better fit per definition. The description note regarding fees will be moved to another field within the new Calendar software, but is not being changed.

### Current Catalog Information

EARTH 437 (0.50) LEC Rock Mechanics

Stress, strain and strength in geomaterials. Origins of stress and stress measurement methods, including hydraulic fracture and strain relief. Rock Mechanics principles and design procedures in areas of mining, civil engineering and petroleum engineering. Monitoring methods, including introduction to microseismic surveillance. Course includes laboratory and project work. [Note: Prerequisites are not listed for this course which is highly suitable for interested Engineering and Science students. However, some background in engineering, materials science, mechanics or structural geology is recommended; Offered: W]

No Special Consent Required

Requisites :

Prereq: Level at least 3A

#### Effective 01-SEP-2024

Description Change:

Stress, strain, and strength in geomaterials. Origins of stress and stress measurement methods, including hydraulic fracture and strain relief. Rock mechanics principles and design procedures in areas of mining, civil engineering, and petroleum engineering. Monitoring methods, including introduction to microseismic surveillance. Course includes laboratory and project work. [Offered: W]

Requisite Change :

Prereq: Level at least 3A Earth and Environmental Sciences or Geological or Civil Engineering majors

Rationale :

The description note, which recommended some background in engineering, materials science, mechanics or structural geology, is removed, and replaced with a program requirement prerequisite for students in 3A Earth and Environmental Sciences, or those in Geological or Civil Engineering.

These programs were chosen based on the last five years of enrolment data for EARTH 437 (106 Geological Engineering students and 1 Civil Engineering student). New curriculum software will no longer include notes as part of the course description and it was felt that recommendation notes associated with this course would be fitting as actual program prerequisites, added to the level prerequisite, for student success.

### Current Catalog Information

EARTH 456 (0.50) LEC Numerical Methods in Hydrogeology

An introduction to the theory and practice of groundwater flow and contaminant transport modeling. Topics related to variably-saturated flow will focus on derivation of Richard's equation, a control volume finite difference discretization, assembly and solution of the flow equation, material balance error, truncation error analysis, stability and monotonicity. Topics related to contaminant transport will focus on derivation of the contaminant transport equation, a control volume finite difference discretization along with various spatial and temporal weighting schemes and their associated accuracy, monotonicity, and material balance error. Hands-on experience is provided using software applied to industry-standard variably-saturated flow and transport problems, with an emphasis on visualization and interpretation of results. [Note: EARTH 458, a first-year linear algebra, and a second-year calculus course are recommended. Offered: W]

No Special Consent Required

Requisites :

Prereq: Not open to students in the Faculty of Mathematics

### Effective 01-SEP-2024

Description Change:

An introduction to the theory and practice of groundwater flow and contaminant transport modeling. Topics related to variably-saturated flow will focus on derivation of Richard's equation, a control volume finite difference discretization, assembly and solution of the flow equation, material balance error, truncation error analysis, stability and monotonicity. Topics related to contaminant transport will focus on derivation of the contaminant transport equation, a control volume finite difference discretization along with various spatial and temporal weighting schemes and their associated accuracy, monotonicity, and material balance error. Hands-on experience is provided using software applied to industry-standard variably-saturated flow and transport problems, with an emphasis on visualization and interpretation of results. [Offered: W]

Requisite Change :

Prereq: (EARTH 458; MATH 106 or MATH 114; MATH 128), or, Environmental, Geological, or Chemical Engineering students; Not open to students in the Faculty of Mathematics

Rationale :

The description note which recommended a prerequisite course and prerequisite subjects, is removed, and replaced with prerequisite courses requiring students to have EARTH 458, MATH 106 or MATH 114 as an algebra, and MATH 128 as a second year calculus, or, requiring students to be in Environmental, Geological, or Chemical Engineering programs. These programs were chosen based on the last five years of enrolment data in EARTH 456 (15 Environmental, 11 Geological, and 9 Chemical Engineering students). New



curriculum software will no longer include notes as part of the course description and it was felt that recommendation notes associated with this course would be fitting as actual prerequisites, for student success. Students in the Faculty of Mathematics continue to be excluded from this course.

### Current Catalog Information

EARTH 490 (0.00) LAB

Field Course

One or more trips that emphasize field observations. Specific trips may be organized to examine field aspects of any of the disciplines within Earth Sciences or Geological Engineering. Field exercises and reports may be part of the requirements. Additional field trip fees will apply.

No Special Consent Required

Requisites :

Prereq: Level at least 3A; Honours Earth Sciences or Environmental Science (Geoscience Specialization) or Geological Engineering

### Effective 01-SEP-2024

Unit Change:

(0.50)

Component Change:

FLD

Description Change:

One or more trips that emphasize field observations. Specific trips may be organized to examine field aspects of any of the disciplines within earth and environmental sciences or geological engineering. [Note: Additional filed trip fees will apply]

Rationale :

This course meets outside the classroom, in the field, so a FLD component is a better fit per definition. The course will organize an international trip that will take place between the winter and spring terms, possibly overlapping the start of spring term. It will be scheduled in both the winter and spring terms, following the practice in SCI 230, allowing students to mount the course to either term, where they could benefit most, based on total units per term. EARTH 490 will now included assessments, via field exercises and reports, allowing it to count for 0.5 unit credit. As such, the decription is updated to remove reference that these assessments may occur. Additional fees will apply and will be noted in a separate field for fees in the new software, so this statement will not appear within the description as shown here. For winter 2024 specifically, the course will run in early May.

## Pharmacy - School of

### Current Catalog Information

PHARM 474 (0.25) LEC

Advanced Pharmacotherapeutics in the Hospital Setting

This course will provide students the opportunity to apply clinical knowledge and skills to manage pharmacotherapy problems commonly encountered in hospitalized patients. The focus will be on disease states not covered in the integrated patient focused care series. Additionally, problems unique to delivery of care in the hospital setting, such as formulary management, utilization review, and medication problems relating to transitions among care settings will be explored. [Offered:



W,S,F]

No Special Consent Required

Requisites :

Prereq: PHARM 320, 321, 326; Pharmacy students only

**Effective 01-SEP-2024**

Description Change:

This course will provide students the opportunity to develop and strengthen clinical problem-solving and communication skills required for practice in an institutional setting. The focus will be on disease states commonly encountered in patients requiring acute inpatient care. [Offered: W,S,F]

Rationale :

The description is updated to reflect revised content due to course-reweighting. This course was previously a 0.5-unit credit and is currently a 0.25 unit credit, so some content has been removed.

## Physics & Astronomy

### Current Catalog Information

PHYS 111L (0.25 ) LAB

Physics 1 Laboratory

For students who have taken or are taking PHYS 111. [Note: Lab alternates weeks.

Offered: F]

No Special Consent Required

Requisites :

Coreq: PHYS 111 Antireq: PHYS 121L or 131L

**Effective 01-SEP-2024**

Description Change:

Biweekly lab for students who have taken or are taking PHYS 111.

Rationale :

The description note is removed as there won't be associated description notes with the new curriculum software system. Content to indicate that the lab runs biweekly, is added to the course description.

### Current Catalog Information

PHYS 112L (0.25 ) LAB

Physics 2 Laboratory

For students who have taken or are taking PHYS 112. [Note: Lab alternates weeks.

Offered: W,S]

No Special Consent Required

Requisites :

Coreq: PHYS 112 Antireq: PHYS 122L or 132L

**Effective 01-SEP-2024**

Description Change:

Biweekly lab for students who have taken or are taking PHYS 112.

Rationale :

The description note is removed as there won't be associated description notes with the new curriculum software system. Content to indicate that the lab runs biweekly, is added to the course description.

### Current Catalog Information

PHYS 160L (0.25 ) LAB

Introductory Measurement Laboratory

A lab for students following the Honours Physics Plan. [Note: Lab alternates weeks.

Offered: W]

No Special Consent Required

Requisites :

Prereq: Honours Physics students only. Coreq: PHYS 122L. Antireq: PHYS 132L

**Effective 01-SEP-2024**

Description Change:

Biweekly lab for students following the Honours Physics plan.

Rationale : The description note is removed as there won't be associated description notes with the new curriculum software system. Content to indicate that the lab runs biweekly, is added to the course description.

### Current Catalog Information

PHYS 437A (0.50) PRJ Research Project

A research project in any area of Physics approved by the course co-ordinator(s). The student is required to present a summary of the project orally and to submit a written report in a style suitable for publication. Some projects, especially those with an experimental emphasis, will likely continue as 437B. In these cases, students will submit an interim written report, in addition to the oral presentation.

[Offered: F,W]

Department Consent Required

Requisites : Prereq: Honours Physics, Chemical Physics, Mathematical Physics, Physics and Astronomy, Materials and Nanosciences or Life Physics students only

### Effective 01-SEP-2024

Requisite Change : Prereq: Cumulative overall average of at least 70%; Level at least 4A Honours Physics, Chemical Physics, BSc Mathematical Physics, Physics and Astronomy, Materials and Nanosciences, Life Physics or Biological and Medical Physics students only

Rationale : Currently a description note states that the cumulative average must be 70% or higher to participate in this research course, but the description notes will not carry forward in the new curriculum software. Since a 70% or higher is required, it's being added as a prerequisite. In addition, the new Biological and Medical Physics program (effective Sept. 1, 2023) is added to the list of program prerequisites.

### Current Catalog Information

PHYS 437B (0.50) PRJ Research Project (Continued)

A research project in any area of physics approved by the course co-ordinator(s). This is often a continuation of the project started in PHYS 437A. [Note: Cumulative average must be 70% or higher; Offered: F,W,S]

Department Consent Required

Requisites : Prereq: PHYS 437A

### Effective 01-SEP-2024

Requisite Change : Prereq: Cumulative overall average of at least 70%; PHYS 437A

Rationale : Currently a description note states that the cumulative average must be 70% or higher to participate in this research course, but the description notes will not carry forward in the new curriculum software. Since a 70% or higher is required, it's being added as a prerequisite.

End of Report

# Final Assessment Report

## Civil Engineering (BASc), Environmental Engineering (BASc, Option), Geological Engineering (BASc), Water Resources (Option)

### September 2022

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#### Executive Summary

External reviewers found that the Civil Engineering (BASc), Environmental Engineering (BASc, Option), Geological Engineering (BASc), Water Resources (Option) delivered by the Department of Civil and Environmental Engineering were in good standing.

*The undergraduate Civil, Environmental and Geological Engineering programs are strong programs taught by a group of high-quality faculty, supported by highly qualified technical and administrative staff. The programs offer solid training to students, both broad and deep, are student-centered and highly regarded.*

A total of five recommendations were provided by the reviewers, regarding curriculum review, EDI and flexible and innovative approaches to teaching and learning. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2027-2028.

#### Enrollment over the past three years

	Civil Engineering	Environmental Engineering	Environmental Engineering Option	Geological Engineering	Water Resources Option
2021-2022	586	275	7	61	1
2020-2021	636	277	6	67	9
2019-2020	613	290	9	90	17

Based on Active Students Extract in Quest, accesses September 20, 2022.

## **Background**

In accordance with the University of Waterloo's Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Civil Engineering (BASc), Environmental Engineering (BASc, Option), Geological Engineering (BASc), Water Resources (Option) delivered by the Department of Civil and Environmental Engineering (CEE). A self-study (Volume I, II, III) was submitted to the Associate Vice-President, Academic on August 16, 2021. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the data collected from a student survey, along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for each faculty member with a key role in the delivery of the program(s) were included in Volume II of the self-study.

From Volume III, two arm's-length external reviewers were selected by the Associate Vice-President, Academic: Dr. Jocelyn Hayley, Professor of Civil Engineering, University of Calgary, and Dr. Mamadou Fall, Professor of Environmental Engineering, University of Ottawa.

Reviewers appraised the self-study documentation and conducted a virtual site visit to the University between January 10 and January 14, 2022. An internal reviewer from the University of Waterloo, Dr. Bruce Taylor, Professor of Fine Arts, was selected to accompany the external reviewers. The visit included interviews with the Associate Vice-President, Academic; Dean of the Faculty of Engineering; Chair of the Department, as well as faculty members, staff and current undergraduate. The Review Team also had an opportunity to view the undergraduate laboratories and meet with representatives from the library, and Co-operative Education.

Following the site visit, the external reviewers submitted a report on their findings, with recommendations. Subsequently, the program responded to each recommendation and outlined a plan for implementation of the recommendations. Finally, the Dean responded to the external reviewers' recommendations, and endorsed the plans outlined by the program.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report, the program response and the Dean's response.

## Program Characteristics

The following programs and options were reviewed:

- [Bachelor of Applied Science, Honours Civil Engineering, Co-operative Program](#)
- [Bachelor of Applied Science, Honours Environmental Engineering, Co-operative Program](#)
- [Bachelor of Applied Science, Honours Geological Engineering, Co-operative Program](#)
- Water Resources Option (see [2018-19 Archived Calendar](#) > Faculty of Engineering > Bachelor of Applied Science ... Degree Requirements > Option in Water Resources)
- [Environmental Engineering Option](#)

Civil engineers design and maintain the massive infrastructure on which society depends, including roads, buildings, bridges, dams, tunnels, levees, sewer systems, and water treatment plants. Given this strong interaction with society, civil engineers often deal with the human impact of engineering, including social, moral, and legal issues.

Geological engineers apply geological knowledge to the siting, design, construction, operation and maintenance of civil engineering structures and facilities. They also provide the expertise to develop mines, petroleum reservoirs, hydroelectric dams and reservoirs, groundwater and surface water resources, as well as building and managing the necessary infrastructure to bring the resulting commodities to market. It is a niche program that continues to draw students interested in the physical mechanics of the earth's surface and subsurface, sustainable resource management, environmental stewardship, and reducing the risk of geological hazards to create a safer world.

Environmental engineers are charged with managing the residual waste streams of civilization. This responsibility includes cleaning up existing pollution from our water and soils, developing technological solutions to reduce the presence or risk of pollutants from future human activities, and providing a safe supply of water for domestic, industrial, and agricultural use. This work is necessarily interdisciplinary, and environmental engineers work with planners, industry, environmental advocacy groups, government regulators, and others.

All engineering programs, including Civil Engineering (CIVE), Environmental Engineering (ENVE), and Geological Engineering (GEOE) are co-op programs requiring students to alternate study terms with work terms and graduate with up to two years of relevant, paid work experience. This means two years of experience learning how to navigate the hiring process, applying skills to real-life problems and learning about oneself along the way.

## Summary of Strengths, Challenges and Weaknesses based on Self-Study

### Strengths

- Co-operative education: Waterloo's world leading co-operative education is mandatory for all engineering programs. Co-op is a key aspect of undergraduate training. During their work-terms, students learn to function and communicate in a professional workplace and to solve real-world engineering problems. Co-operative education also makes employers active participants in the undergraduate pedagogical process. Not only do the employers directly train students during their co-op placements, but they also provide feedback to the Department about strength and weaknesses in the preparation of the students, information that is incorporated into our continual improvement process. Ultimately, many of the employers hire co-op students into full-time, permanent positions.
- Rankings and reputation: The CIVE, ENVE and GEOE programs contribute to and benefit from the high world academic rankings (e.g., Shanghai Ranking's 11<sup>th</sup> in Transportation Science and Technology, 33<sup>rd</sup> in Water Resources, Top 75 in CIVE, Top 100 ENVE and Top 200 in Earth Science) and a strong Canadian reputation (e.g., Maclean's survey of comprehensive universities place Waterloo in the top three of Best Overall (2), Highest Quality (3) and Most Innovative (1)).
- Satisfied and successful graduates: National, provincial and exit survey results demonstrate that CEE graduates are satisfied with their programs and educational experiences, would do the same program again if starting over, and find work within 6 months of graduation in areas that are related to their program of study.
- Faculty and staff: CEE faculty and staff are talented, experienced and dedicated. The CEE age demographic is well-balanced, with low risk of losing many members. CEE has an excellent work environment that leads to high retention of faculty and staff. This collegial culture enhances and allows for healthy communication and relationships between faculty, staff and students.
- Quality of students: CEE programs attract outstanding students from high school, and other engineering and science programs. High school grades for first-year students were at least 90% for 80% of CIVE, 60% of ENVE and 50% of GEOE. Students who start in CEE are highly retained by the faculty and university. CIVE, ENVE and GEOE students were on average retained in their original program 94%, 86% and 80% of the time, and retained at UW 97%, 99% and 98% of the time.

- Teaching quality: CEE has a rich history and culture of teaching excellence with instructor and course evaluations consistent with the faculty average. The CEE teaching assessment scores are at least 2% higher than the faculty averages with less variance and higher modes.
- Physical resources: CEE students have access to outstanding services and resources, including the UW Library services, Rapid Prototyping Centre, Engineering Machine Shops, faculty and department computer labs and specialized engineering software. CEE students have access to the CEE Structures, Environmental, Geotechnical and Hydraulics and Hydrology Labs, most of which were updated in 2013.
- Process to measure learning outcomes: CEE has developed a comprehensive process of mapping and reviewing graduate attributes (GAs) by measuring performance indicators (PIs) or learning outcomes across the curricula. The process is continual and used to improve the programs.
- Program specialization: CEE programs include 9 to 11 elective courses within and outside of the department. The curricula were recently revised to include specializations which focus technical elective choices into theme areas. These came into effect in 2020/21.
- Environmental Engineering Option: the ENVE Option is well subscribed in terms of numbers of graduates with an option, ranking 4<sup>th</sup> across the faculty options. It is also broadly subscribed across the Chemical, Civil, Mechanical and Systems Design Engineering programs.

### Challenges

- Graduate attribute data collection and decision making: CEE is measuring PIs across all courses in all programs. It is a large effort to collect, organize, analyze and review the GA data, and it can be challenging to engage all teaching teams. CEE strives to increase efficiencies in the process so that meaningful and necessary data are collected to continually improve the programs.
- Outreach and recruitment: CEE programs attract strong students; however, the number of high school applicants and registrants in the ENVE and GEOE programs has decreased. CEE is currently working on promotional and outreach materials to promote ENVE and GEOE, especially with high school guidance counsellors.
- Academic integrity: New communication technologies and the proliferation of internet-banked assignments and lab reports present new challenges to academic integrity that must be overcome.



- Student wellness/resiliency: The CEE programs are challenging experiences for undergraduate students, and often involve long working hours under intense pressure. While these conditions are formative, and help students develop organizational and time management skills, there is an increasing appreciation that they can also adversely affect mental and emotional wellbeing. Waterloo Engineering is known for hard work and rigor, but these need to be better balanced with wellness so that the students find more enjoyment and satisfaction.

### **Weaknesses**

- Additional GA measurements are needed in three areas: CEE has targeted GA8: Professionalism, GA9: Impact of Engineering, and GA11: Economics & Project Management for more aggressive data collection.

### **Summary of Key Findings from the External Reviewers**

The undergraduate Civil, Environmental and Geological Engineering programs are strong programs taught by a group of high-quality faculty, supported by highly qualified technical and administrative staff. The programs offer solid training to students, both broad and deep, are student-centered and highly regarded. The programs meet the academic goals of the University and support the University of Waterloo's mission and academic strategic plans. The programs include a Co-op and the employment prospects of graduates are good. The presence of a co-op option adds a dimension of experiential learning to an already rich program of study and attracts high quality students.

All recommendations should be viewed through the lens of a virtual visit, understanding that limited interactions may lead to gaps in our understanding. A summary of program strengths along with five recommendations for improvements are provided, with further commentary on each. In summary, the recommendations are: 1) conduct a curriculum review with the guiding question of how to educate the engineer of the future; 2) bring attention, awareness and best practices around equity, diversity and inclusion to all aspects of the programs and department; 3) enable, encourage and support flexible and innovative approaches to teaching and learning; 4) consider how design is integrated throughout and between the programs and culminates in the capstone design experience; and 5) consider combined undergraduate and graduate program reviews.



## Program Response to External Reviewers' Recommendations

- 1. Recommendation 1: Each program conduct a review and self-assessment of their curriculum to understand how they are, and will be, educating the engineer of the future with attention to integration between the programs, balancing STEM and non-STEM content, and incorporating flexibility.**

We recommend each program, coordinated by the department, conduct a self-assessment of their curriculum with the guiding question of how the program is meeting the needs of the engineer of the future. In particular, the programs may want to consider:

- a. Integration across the programs and between the years. Leveraging on the strength of being housed in one department, the programs have the opportunity to integrate between the four different programs, with potential mechanisms such as integrated capstone design. In addition, although operationally challenging with student on campus at different times, we suggest more integration between the years/cohorts would be highly beneficial for the student experience.
- b. Balancing content. Consider the balance of technical content within traditional science and engineering with content outside of traditional STEM (e.g. creativity, sustainability, human behaviour, socio-economics, entrepreneurship, etc.).
- c. Content continuity. Consider the continuity of content such as design, digital/computing, sustainability, or other key forward looking topics/skills between the years and across the programs (e.g. design spines, digital tools and technologies, etc.)
- d. Program flexibility. Consider added flexibility in the programs enabling students to have more flexibility between the four programs and outside of traditional STEM. Consider incorporating flexibility into the programs earlier (i.e., years 2 or 3).

### Program Response

The last major curriculum changes to the CIVE, ENVE and GEOE programs were implemented in 2015, and the new AE program is undergoing accreditation in 2022 and graduates its first class in 2023. It is an opportune time to review all curricula together.

The suggested focus of educating the “engineer of the future” is appreciated, as are the proposed considerations of a) integration within and across courses, levels, and programs, b)

balance of STEM and non-STEM content, c) continuity of important content themes, and d) increasing student flexibility.

CEE commits to the curriculum review of all programs. Additional curriculum considerations will be developed, including important feedback from the accreditation continual improvement process. This work has already commenced (as of Spring 2023) for the ENVE program, with a major review now underway and a draft of proposed revisions discussed at several recent department meetings. The committee doing this work is aiming to start the approval process for implementing these revisions in 2024. For the other programs, it is expected that curriculum review will begin in 2024 and leverage ideas generated in the current strategic planning cycle, which has just begun and will wrap up at the department level in Spring 2024. The results of this review will follow the ENVE revisions through the approval process in 2025.

### **Dean's Response**

I have asked our Associate Dean Undergraduate to work with all the Associate Chairs on a curriculum diet to provide more flexibility to our students and open up room in our curriculum so that students can chose to customize their academic journey depending on their interests and passions.

- 2. Recommendation 2: The programs bring attention to equity, diversity, and inclusion, which could include seeking to understand the state of EDI in the programs, faculty, and spaces, setting goals and deliverables, and tracking progress in a way that brings EDI awareness to all faculty and staff.**

We recommend attention be brought to issues of equity, diversity and inclusion as a whole. In particular, the programs could seek to understand EDI issues, set goals/milestones, track and monitor progress through deliverables. There are a variety of ways the programs can bring EDI to the forefront, including but not limited to, more awareness about EDI through consistent widespread programming/discussions, opting in to faculty level programs or initiatives with subsequent broad discussion, and clear, consistent and forward looking best practices for diversity in faculty hiring.

### **Program Response**

Increasing attention on issues of equity, diversity and inclusion is a vital recommendation. Seeking to understand the issues within our department, faculty and university is an important step. The Office of Equity, Diversity, Inclusion and Anti-racism will soon release the 2022-2025

Strategic Plan Framework (targeted release was May 2022), which will help CEE leadership better understand the issues and proposed methods to work towards removing barriers, making safe spaces and transforming culture. This framework follows the President's Anti-Racism Taskforce (PART) Report published in April 2022.

The recommendation to set goals and measure progress on bringing attention to EDI issues is warranted. To start, CEE commits to adding EDI content to UG seminars in addition to the current content on wellness each term. CEE commits to presenting and discussing an EDI issue in a department meeting each term.

CEE will continue to follow best practices for diversity in faculty hiring. CEE has hired five female faculty members since 2019, such that in Sept 2022 regular faculty members (tenure track or lecturers) will be 20% female (headcounts). CEE participated in the University's cluster hiring initiatives for indigenous and black faculty, resulting in an offer to an established professor who identifies as black.

CEE will work with Engineering Outreach and Admissions on recruiting and admission practices that increase the diversity of applicants and admitted students. The Ontario University Application Centre (OUAC) will be collecting self-reported EDI data for the first time in the upcoming admissions cycle. These data will help Waterloo Engineering move towards the goal of a student body that represents the diversity of Canada.

EDI issues need careful consideration when reviewing the curriculum for all programs (Recommendation 1). These issues are connected to many desired engineering graduate attributes such as teamwork, professionalism, and ethics and equity.

### **Dean's Response**

Addressing issues of equity, diversity, and inclusivity is of paramount importance to the Faculty. In 2021, I appointed Prof. Mary Robinson to be the 1<sup>st</sup> Associate Dean, Outreach, Equity, and Diversity. In that role, and with full support of the Engineering Departments, Prof. Robinson has put forward several EDI initiatives, and facilitated Engineering's participation in several existing initiatives. These include:

- The creation of a new EDI Website
- Participation in the PALs program to promote EDI-R training across the campus

- The creation of the Equity Champion role within each department
- Activities that draw attention to gender-based violence
- Work to improve washroom accessibility on campus, and to provide free menstrual products
- Participation in the IBET PhD Project which provided scholarships and mentoring to black and indigenous students
- Creation of the Elder in Residence and Indigenous spaces within the Engineering Faculty.

**3. Recommendation 3: The programs are recommended to consider and support flexible and novel approaches to teaching and student learning.**

We recommend the programs reflect on elements, methodologies, and/or technologies which were successfully implemented during covid to consider bringing these innovations into ongoing teaching practices. This may involve promoting novel teaching methods through capitalizing on university level programs and supporting faculty who are exploring non-traditional teaching methods. Overall, the programs are encouraged to consider, support, and promote flexibility in approaches to teaching and student learning.

**Program Response**

CEE students, staff and faculty are transitioning from online to in-person focused teaching and learning. During the transition CEE has encouraged teaching teams to use successful online practices with in-person delivery, such as digital submission of coursework and providing asynchronous recorded materials to supplement live in-person activities. CEE will continue to encourage and support individual instructors with non-traditional teaching methods, in addition to the encouragement and support provided by Centre for Teaching Excellence.

CEE will consider how teaching and learning practices enhance curricula and student experience during the program curriculum review (Recommendation 1). For example, there may be specific courses or parts of courses that can be delivered more effectively using online practices at specific locations in the programs (just in time delivery). In addition, CEE is interested in developing MEng curricula for primarily online delivery.

**Dean's Response**

I support the department's proposed actions to address this recommendation.

**4. Recommendation 4: The programs consider how design is developed throughout the curriculum and culminates in the capstone project, with consideration of cross-program capstone groups with industrial (and academic) advisors.**

The capstone design experience is an integral component of the engineering experience and the programs have done well leveraging the capstone with the Co-op and integrated learning experience. We recommend further improvements could be considered with capstone and design elements throughout the curriculum. In particular, the programs may consider: a) how design is introduced into the curriculum and how students are prepared for capstone design; b) further leveraging the programs industry relations to obtain capstone projects from industry with industry advisors; and c) increasing interactions between capstone groups (within and across programs), to further student learning and potentially provide a broader design perspective/experience. For example, the programs may consider and encourage an inter-departmental capstone that brings student from the four different programs together into one design team, thus further leveraging the strength of one department housing these different programs.

#### **Program Response**

The recommendation to further improve the capstone design experience is appreciated. How design is introduced, developed and practiced will be considered in the curriculum review of each program (Recommendation 1).

The CEE Capstone Coordinator, Nadine Ibrahim, created the CEE Capstone Design Portal to collect capstone project ideas and volunteer technical advisors from industry. Though students have preferred to pursue their own project ideas to date, CEE will continue to develop capstone ties with industry and promote their opportunities with our students.

The CEE programs have different streams of academic and co-op work terms. The AE and CIVE programs take the first capstone design course together in the same term, whereas the ENVE and GEOE programs take the first capstone together in another term. This means it is not possible to combine all programs for a common capstone design course delivery. However, it is easy for AE and CIVE students or ENVE and GEOE students to form mixed groups since they are on the same stream for capstone. It is also possible for students from other engineering programs on the same stream to join our capstone courses, or a group of students from different programs to all join an interdisciplinary capstone course available in the faculty.

The AE program has a studio course each term which exposes students to group open-ended design activities. Technical advisement and criticism are given during weekly studio sessions. This exposes groups to many experts and allows the experts to interact with many groups. This model of technical capstone advisement will be considered for all programs as it broadens the design perspective and exposure.

CEE will allow some mixed groups of AE and CIVE students (mixed groups of ENVE and GEOE students are already permitted) starting in the 2023-24 capstone sequence. CEE will also consider implementing a studio model for technical advisement.

#### **Dean's Response**

I support the department's proposed actions to address this recommendation.

#### **5. Recommendation 5: The program consider combined undergraduate and graduate program reviews.**

The overlap of program review with considerations such as faculty contingent, EDI, space, resources, could be optimized by a combined review of the undergraduate and graduate programs in one process. Although incrementally more work, it may optimize the process for both the department and the review teams.

#### **Program Response**

CEE will work with the Quality Assurance Office to combine future undergraduate and graduate program reviews.

#### **Dean's Response**

I support the department's proposed actions to address this recommendation.

#### **Recommendations Not Selected for Implementation**

N/A

**Implementation Plan**

Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
<p>1. Each program conduct a review and self-assessment of their curriculum to understand how they are, and will be, educating the engineer of the future with attention to integration between the programs, balancing STEM and non-STEM content, and incorporating flexibility.</p>	<p>CEE will review curriculum for each program.</p>	<p>Curriculum Review Committee to be formed, including UG Associate Chair, AE Director, GEOE Director</p>	<p>current to 2024</p>
<p>2. The programs bring attention to equity, diversity, and inclusion, which could include seeking to understand the state of EDI in the programs, faculty, and spaces, setting goals and deliverables, and tracking progress in a way that brings EDI awareness to all faculty and staff.</p>	<p>CEE will review the Strategic Plan Framework by the Office of Equity, Diversity, Inclusion and Anti-racism (EDI-R). CEE will partner with EDI-R and Engineering EDI to better understand and address EDI issues in the department. CEE will present and discuss EDI issues in one UG seminar and departmental meeting each term.</p>	<p>Chair, UG Associate Chair, and Chair's Advisory Committee</p>	<p>current to 2023</p>
<p>3. The programs are recommended to consider and support flexible and novel approaches to teaching and student learning.</p>	<p>CEE will continue to support flexible and novel teaching and learning. CEE will consider teaching and learning methodologies in the curriculum review for each program.</p>	<p>Curriculum Review Committee, UG Associate Chair, Grad Associate Chair</p>	<p>current to 2023</p>

4.	The programs consider how design is developed throughout the curriculum and culminates in the capstone project, with consideration of cross- program capstone groups with industrial (and academic) advisors.	CEE will review curriculum for each program, including how design is developed. CEE will allow more mixed capstone groups in next capstone cycle. Capstone Coordinator will continue to solicit and promote industrial projects and will explore the studio model for technical advisement.	Curriculum Review Committee, Capstone Coordinator	current to 2023
5.	The program consider combined undergraduate and graduate program reviews.	CEE will work with the Quality Assurance Office to combine future undergraduate and graduate program reviews.	Chair and QA Director	After CEE grad and AE UG program reviews

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for the Implementation Plan.



Date of next program review

2027-2028

Date

Signatures of Approval



September 28, 2023

Chair/Director

Date

AFIW Administrative Dean/Head (*For AFIW programs only*)

Date

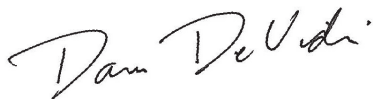
**Mary Wells**

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Faculty Dean

Date

**Note:** AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.



July 11, 2023

Associate Vice-President, Academic  
(For undergraduate and augmented programs)

Date

# Final Assessment Report

## Computer Science (BCS, BMath, Minor, MMath, PhD), Computer Science – Data Science (BCS), Business Administration and Computer Science (BBA/BCS), Computing (Option)

### September 2022

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#### Executive Summary

External reviewers found that the Computer Science (BCS, BMath, Minor, MMath, PhD), Computer Science – Data Science (BCS), Business Administration and Computer Science (BBA/BCS), Computing (Option) delivered by the David R. Cheriton School of Computer Science were in good standing.

*The programs examined in this review are excellent and have national recognition for content and execution. The co-op programs are attractors nationally to first-rate students and industrial partners.*

A total of four recommendations were provided by the reviewers, regarding community building, equity, diversity and inclusion, and curriculum review. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2027-2028.

#### Enrollment over the past three years

	BCS Honours	BCS Honours Co-op	BMath Honours	BMath Honours Co-op	CS Minor
<b>2021-2022</b>	187	2490	42	125	7
<b>2020-2021</b>	217	2584	44	180	27
<b>2019-2020</b>	297	2126	58	180	107

Based on Active Student Extract in Quest, accessed September 9, 2022.

	CS – Data Science Honours (BCS)	CS - Data Science Honours Co-op (BCS)	Business Admin and CS (BBA/BCS)	Computing Option
<b>2021-2022</b>	5	43	504	58
<b>2020-2021</b>	8	54	391	120
<b>2019-2020</b>	10	49	364	112

Based on Active Student Extract in Quest, accessed September 12, 2022.

	CS MMath - Research	CS MMath – Research Co-op	CS MMath - Coursework	CS MMath - Coursework Co-op	CS PhD
<b>2021-2022</b>	199	19	21	6	205
<b>2020-2021</b>	176	21	21	8	190
<b>2019-2020</b>	183	15	35	24	172

Based on Active Student Extract in Quest, accessed September 12, 2022.

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## Background

In accordance with the University of Waterloo’s Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Computer Science (BCS, BMath, Minor, MMath, PhD), Computer Science – Data Science (BCS), Business Administration and Computer Science (BBA/BCS), Computing (Option) programs delivered by the David R. Cheriton School of Computer Science (the School). A self-study (Volumes I, II, III) was submitted to the Associate Vice-President, Academic and Associate Vice-President, Graduate Studies and Postdoctoral Affairs on 13 October 2020. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the data collected from a student survey, along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for each faculty member with a key role in the delivery of the program(s) were included in Volume II of the self-study.

From Volume III, two arm’s-length external reviewers were selected by the Associate Vice-President, Academic and Associate Vice-President, Graduate Studies and Postdoctoral Affairs: Dr. Carolyn Watters, Professor Emeritus, Faculty of Computer Science, Dalhousie University, and Dr. Hanan Luftiyya, Professor, Department of Computer Science, University of Western Ontario.

Reviewers appraised the self-study documentation and conducted a site visit to the University between January 31, 2022 and February 4, 2022. An internal reviewer from the University of Waterloo, Su-Yin Tan, Lecturer, Geography and Environmental Management, University of Waterloo, was selected to accompany the external reviewers. The visit included interviews with the Vice-President, Academic & Provost; Associate Vice-President, Graduate Studies and

Postdoctoral Affairs; Dean of the Faculty of Mathematics; Faculty Associate Dean of Undergraduate Studies; Faculty Associate Dean of Graduate Studies; Faculty Associate Dean of Cooperative Education; Director of Computer Science, as well as faculty members, staff and current undergraduate and graduate students. The Review Team also had an opportunity to meet with representatives from the library, and Co-operative Education.

Following the site visit, the external reviewers submitted a report on their findings, with recommendations. Subsequently, the program responded to each recommendation and outlined a plan for implementation of the recommendations. Finally, the Dean responded to the external reviewers' recommendations, and endorsed the plans outlined by the program.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report, the program response and the Dean's response.

## **Program Characteristics**

### **Undergraduate programs**

#### **Bachelor of Computer Science (BCS)**

The School's flagship undergraduate degree program is the Bachelor of Computer Science (BCS), which is direct entry from high school and can be completed in either a regular or co-op stream. It allows students to develop a solid understanding of computer science with the flexibility to choose from a wide range of courses in this area.

#### **Bachelor of Mathematics – Major in Computer Science [BMath (CS)]**

The School also offers a Bachelor of Mathematics with a Major in Computer Science [BMath (CS)], which allows students to study Computer Science with a larger combination of Math courses (and is offered in both regular and co-op). Students are admitted to the BMath program and declare a major in Computer Science starting in second year.

The differences between the BCS and the BMath(CS) are summarized [here](#). Students are able to switch from one program to the other.

#### **BCS (Data Science)**

Beginning in September 2017, the University of Waterloo introduced two Data Science programs: the [BCS \(Data Science\)](#) and the [BMath \(Data Science\)](#). Both programs are offered jointly by the Department of Statistics and Actuarial Science and by the David R. Cheriton School of Computer Science. Students in the two plans graduate with a background in both computer science and statistics, taking a combination of required and elective courses that together provide a solid foundation in this emerging area.

It should be noted that the BCS (Data Science) is administered by the School of Computer Science, hence its inclusion in this review, while the BMath (Data Science) is administered by the Department of Statistics and Actuarial Science, and is included in their academic program review.

### **Business Administration and Computer Science Double Degree (BBA/BCS)**

The [BBA/BCS Double Degree](#) allows students to earn two degrees in five years in both computer science and business. Graduates from the BBA/BCS receive a full Bachelor of Computer Science from Waterloo and a full Bachelor of Business Administration from Wilfrid Laurier University.

### **Specializations**

In addition, the School administers a number of specializations that enhance these degrees. Specializations are small packages of courses that customize a student's undergraduate experience and end up as added text in their degree. The Software Engineering Specialization can be combined with the BCS. The Artificial Intelligence, Bioinformatics, Business, Computational Fine Art, Digital Hardware, and Human-Computer Interaction Specializations can be combined with either the BCS or the BMath (CS).

### **Computer Science Minor / Computing Minor**

The School maintains a [Computer Science Minor and a Computing Minor](#) (formerly known as the Computing Option), and 13 non-specialist courses that target these students and students in other degrees that require CS content. The Computer Science Minor and the Computing Minor have different plan requirements, as outlined [here](#).

### **Graduate programs**

The School offers graduate programs leading to the following degrees:

#### **Master of Mathematics (MMath) in Computer Science**

- **MMath Thesis option:** the basic requirements for the Thesis option are four one-term graduate courses and a thesis based upon directed research or scholarly work. The thesis should be equivalent to four one-term courses in effort required, and the results must be presented at a public seminar.
- **MMath Research Paper option:** this option requires the completion of seven one-term courses and a research paper. There is no direct entry to this option. Rather, students in the MMath Thesis or Coursework option may transfer to the Research Paper option with the support of their supervisor(s). Work on the research paper should be done during the third and fourth terms of study. Students must present their paper or a related study in an appropriate seminar or class.
- **MMath Coursework option:** the basic requirements for this option are eight one-term courses, in addition to any remedial work. Students may enroll in this option on either a full or part-time basis. Unlike the Thesis and Research Paper options, Coursework

students are not guaranteed financial support. However, some TA assignments may be available on a term-by-term basis.

### **Doctor of Philosophy in Computer Science (PhD)**

The PhD program in Computer Science combines coursework; seminars; Comprehensive I requirement, by which the candidate demonstrates a breadth of knowledge by taking a number of advanced courses in a broad range of categories and areas in Computer Science; and a Comprehensive II exam, by which the candidate demonstrates a depth of knowledge in the chosen research area, leading to a thesis.

The PhD course requirements differ depending on when the student starts the program after having completed a Master's or a Bachelor's degree. If a student holds a Master's degree, they must complete four one-term graduate courses, with at least one course at the 800-level and at most one course at the 600-level. If a student holds only a Bachelor's degree, they must complete eight one-term graduate courses, with at least three courses at the 800-level and at most three courses at the 600-level.

### **Specialized Degree in Quantum Information**

This unique interdisciplinary master's and doctoral program is a collaboration between the [Institute for Quantum Computing](#), the David R. Cheriton School of Computer Science, and departments in the Faculty of Mathematics and the Faculty of Engineering. This program is designed to provide students with knowledge of quantum information, including both theory and its implementations, advanced expertise in quantum information science, and in home-program disciplines, as well as training in research. This program is not part of this review and will be assessed separately.

More details on the School's graduate programs are available here: <https://cs.uwaterloo.ca/current-graduate-students/overview-degree-programs>

## **Summary of Strengths, Challenges and Weaknesses based on Self-Study**

### **Strengths**

- The School provides one of the best Computer Science undergraduate programs in Canada, and certainly the largest.
- The flexibility of the School's programs and the benefits of co-operative education.
- The School has a strong research culture, which informs teaching, and attracts substantial research funding, both from government and private-sector sources.
- Graduates from the School's academic programs are in high demand.

### **Challenges**

- How to sustain the School's position as one of the leading providers of undergraduate and graduate programs in Computer Science; how to ensure they have the teaching resources necessary to meet the demand for undergraduate and graduate-level courses.
- How to compete internationally in attracting top-quality applicants to their graduate programs.
- How to attract and retain more top-quality faculty members, especially in areas of high demand, such as AI, machine learning, and systems & networking.
- How to increase gender diversity in their undergraduate and graduate programs beyond the current (improved) levels.
- How to increase gender diversity in their faculty complement.
- How to diversify the international demographics of their undergraduate program.

### **Weaknesses**

- While the School's technical education is good, they are falling short on providing a well-rounded experience, particularly for their undergraduate students.
- The School still relies heavily on sessional instructors for course delivery. While this has the advantage of providing good opportunities for graduate and post-doctoral training, it is problematic in terms of quality control and continuity.
- Undergraduate students lack a sense of community and cohesiveness.

## **Summary of Key Findings from the External Reviewers**

### **Commendations**

1. National and international rankings continue to recognize both the undergraduate and graduate programs.
2. The quality of the faculty and staff is high and the support provided is best practice.
3. The research in the School is nationally and internationally recognized for its excellence.
4. The students admitted to these programs are highly skilled and highly motivated.
5. The content and delivery of the programs of study at both the undergraduate and graduate levels are excellent.
6. The excellence and commitment of the teaching faculty and support staff are recognized by the students.
7. The co-op program continues to build the reputation of the School and provide a high-quality experience for both students and employers.
8. Students, faculty, staff, and administration are proud to be members of the University of Waterloo and the Cheriton School.

### **Chief strengths of the program**

The programs examined in this review are excellent and have national recognition for content and execution. The co-op programs are attractors nationally to first-rate students and industrial partners.

The support layer for both undergraduate and graduate programs use best practices, including graduate advocacy, undergraduate advising, course co-ordinators, undergraduate lecturers, director of women in CS, EDI committee, cooperative education, and library.

The research impact of the faculty is outstanding, notable given the pressure of enrollment growth. The presence and impact of the CS Computer Facilities group as a separate entity from the university IT provides local IT infrastructure and support within the university overall IT model that is aligned with the research IT environment required by modern research in CS.

### **Major challenges and weaknesses**

Several high-level challenges have been identified, which may require a strategic School-wide approach.

The first is the capacity to maintain faculty growth in the context of increasing student enrollment and the current very competitive hiring market. A strategic approach that also factors in future disciplinary needs, including interdisciplinary areas, and diversity of hires is difficult, but necessary.

The strategic plan of the School is at a level that is sparse with few clear actions and measures to gauge the success in meeting the aspirations and goals for student success, competitive research, diversity, and interdisciplinary goals.

Many of the current policies and processes slow the progress of the School in reaching EDI goals across the board including those related to faculty hires, student admission, student transfers, and interdisciplinarity.

An ongoing challenge is balancing the imperative of the co-op terms with the need for building of a community within the undergraduate student body.

### **Program Response to External Reviewers' Recommendations**

- 1. Community Building.** The need for student community and cohort building has been expressed by both undergraduate students and graduate students, with recognition of the negative impact of the competitive environment amongst students for best co-ops and



jobs. Although success in building student communities and cohorts is difficult in the context of complex co-op schedules, there are opportunities for improving the situation.

- *More discussion with students about problems with cohorts.*
- *Increase the designation of and availability of shared space for undergraduate students on campus for social and academic interaction.*
- *Increase the course opportunities for undergraduate students to work in teams on assignments over all years.*
- *Strengthen community interaction and building across multiple co-op terms.*

### **Program Response**

We recognize the benefits of improved community building. However, it is important that all stakeholders also understand the disadvantages of cohorts. We will consult with students on that matter and review the experiences of a prior trial of forming cohorts in the first year. We will align these efforts with a corresponding strategic initiative for the entire Faculty of Math. If possible, we will explore options to offer optional cohorts at the expense of academic flexibility, at least for the first three study years. Space allocation is done at the faculty and university level, but we need to argue for more shared space along this recommendation. The Faculty of Math currently plans a new building with significant shared student space. The addition of CS 346 recently and CS 136L forthcoming provide opportunities for teamwork, which adds to teamwork components in CS 246 and various 4th-year courses (CS 445, CS 449, CS 452). We will continue to add such opportunities, for example in our redesigned capstone project course.

### **Dean's Response**

As noted, some notion of cohorts are being developed at the Faculty level, and CS shares a common first year with the rest of the faculty. The new building has a significant number of student-focused spaces which will address the needs of computer science. The faculty is investing in community relations, initially through a strategic plan activity which has now been made permanent with a full-time Community Well-being & Engagement Officer.

2. **EDI.** Success in addressing EDI strategic goals depends on both identifying and executing proactive initiatives and identifying and reducing potential barriers lurking in the current processes and decision making in CS, including admission and hiring processes, impact of very restricted transfer policies, and openness of course assignments to teamwork and interdisciplinary perspectives.

- *Capitalize on the appointment of the Director of Women in Computer Science and the establishment of an EDI Committee to develop a strategic plan to remove barriers through revised admission criteria from high school and current restrictions to transfer into BCS program to capture a wider diversity of experience in the undergraduate*

*programs.*

- *Review undergraduate core courses and integrate additional opportunities for team work on assignments and assignments that reflect broader student perspectives.*
- *Review all hiring and promotion processes to ensure a seamless and consistent application of EDI best practices.*
- *Examine carefully the unintended consequences of moving gender hires to “open” slots.*
- *Review the results of faculty search decisions that are unsuccessful in attracting top choices to the School and develop strategies for use during both decision making and negotiation to increase success in diverse hires.*

### **Program Response**

We agree with most of the above recommendations and outline our implementation plan below. We also want to point out the Faculty of Math’s and the university’s activities in terms of promoting EDI. For example, the university is about to start a deep EDI review of all admissions processes. We believe that the recommendation about gender hires is based on a misunderstanding and does not apply. This is further explained below (see page 11).

### **Dean’s Response**

The Faculty of Math is in full concordance and support of the School of CS’s activities and plans. In support of all EDI activities, we have recently hired a full-time Faculty Equity Officer to facilitate and help lead faculty-wide activities around equity, diversity, inclusion and indigenization as well as anti-racism, and to interface with departmental/School, as well as university-wide initiatives. This role also includes equity training for faculty and staff hiring and evaluation of institutional processes with an EDI-R lens.

**3. Curriculums and Programs.** The current core curriculum is well tested and well supported. It is not as clear that the School engages in a robust cyclical review of the core curriculum topics and course content and timely rotation of professors in teaching these courses. Enriched courses and new electives, service courses.

- *Go ahead with soft skills new course in first or second year.*
- *Course and program learning outcomes should be measured and made available as a quality assessment.*
- *A strategic review of undergraduate program options is advised in order to project future demand.*
- *An examination of the number of specializations is needed result in streamlining of offerings.*
- *As new professional course based masters are developed, systematic consideration should be given to retiring fading programs.*
- *Consideration should be given to changing the name of the thesis masters degree from MMath to MCS to reflect and clarify the value of the degree.*

### **Program Response**

Given the magnitude and expected difficulty of some of them, implementation will require careful planning and a staged approach as outlined in the implementation plan. On the graduate program side, we are in the processes of creating a master's program in cybersecurity (jointly with the C&O department), but we will not engage in the development of any further masters' programs until we achieve a comprehensive understanding of how various programs compete for limited resources. On the other hand, we are in the process of phasing out programs already. In particular, the discontinuation of our course-based general master's program in Computer Science is in the calendar approvals process, currently at the Senate Graduate Council level. We appreciate the suggestion for a name change, but we note that such a change involves many stakeholders.

### **Dean's Response**

Math has been a major driver in the new Complementary Teaching Assessment Project which will be used to assess teaching and curriculum university-wide. As noted, our new faculty-level professional master's program in cybersecurity and privacy will be led by CS and C&O, and will hopefully be coming online in the next year or two.

**4. Research Group Structure.** The Research Group structure reinforces research-based *de facto* silos of interest. This may have unintended ramifications going forward on engaging interdisciplinary perspectives, building community amongst grad students and faculty across research groups, and hiring outcomes.

- *Establish a rapid task force to examine the role of the research groups and impact of structure on increasing inter-group and interdisciplinary collaboration and on hiring practices.*

### **Program Response**

We accept this recommendation and intend to implement it as suggested. We believe that the level of inter-group and interdisciplinary collaboration is strong and commensurate with a research unit of our size and stature but will nonetheless evaluate all aspects of internal structuring as part of this process.

### **Dean's Response**

I concur that inter-group and inters-disciplinary collaboration is strong and groups in CS are light-weight and "organic" in their construction. The Faculty and School will also be looking to facilitate connections to university-level initiatives around interdisciplinarity.

**Recommendations                      Not                      Selected                      for                      Implementation**

Regarding the recommendation under EDI to “Examine carefully the unintended consequences of moving gender hires to “open” slots” – we believe this recommendation arises from a misunderstanding. Underrepresented groups are given priority in all targeted and open slots. However, it turns out that the number of qualified female applicants for the open slots is so high that we often only interview female candidates for open slots. That anecdote might have led to a misunderstanding that we somehow only consider gender priority for open slots.

**Implementation Plan**

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	<p><b>Community Building.</b> The need for student community and cohort building has been expressed by both undergraduate students and graduate students, with recognition of the negative impact of the competitive environment amongst students for best co-ops and jobs. Although success in building student communities and cohorts is difficult in the context of complex of co-op schedules, there are opportunities for improving the situation.</p> <ul style="list-style-type: none"> <li>• <i>More discussion with students about problems with cohorts.</i></li> <li>• <i>Increase the designation of and availability of shared space for undergraduate students on campus for social and academic interaction.</i></li> <li>• <i>Increase the course opportunities for opportunities for undergraduate students to work in teams on assignments over all years.</i></li> </ul>	<p>A) Cohorts: Create an ad-hoc committee to review previous attempts at forming cohorts, to coordinate with the corresponding faculty- level initiative, and to engage undergraduate students. Derive recommendations and document the trade-offs involved with cohorts from the students’ perspective.</p> <p>B) Space: Review existing space under SCS purview (computer labs) for potential re-allocation to social and academic interaction. Engage the Faculty and University to add appropriate space to future space development projects.</p> <p>C) Teamwork: Redesign 4th-year capstone project course to make it more accessible to a larger group of students.</p> <p>D) Community: Based on the outcome of Item A), an ad-hoc committee will investigate an optional cohort scheme available to students who are willing to trade off academic flexibility.</p>	<p>A) Director of Undergraduate Studies</p> <p>B) Associate Director of School</p> <p>C) Director of Undergraduate Studies</p> <p>D) Director of Undergraduate Studies</p>	<p>A) Fall 2023</p> <p>B) Fall 2024</p> <p>C) Fall 2024</p> <p>D) Fall 2024</p>

	<ul style="list-style-type: none"> <li>Strengthen community interaction and building across multiple co-op terms.</li> </ul>			
2.	<p><b>EDI.</b> Success in addressing EDI strategic goals depends on both identifying and executing proactive initiatives and identifying and reducing potential barriers lurking in the current processes and decision making in CS, including admission and hiring processes, impact of very restricted transfer policies, and openness of course assignments to teamwork and interdisciplinary perspectives.</p> <ul style="list-style-type: none"> <li>Capitalize on the appointment of the Director of Women in Computer Science and the establishment of an EDI Committee to develop a strategic plan to remove barriers through revised admission criteria from high school and current restrictions to transfer into BCS program to capture a wider diversity of experience in the undergraduate programs.</li> </ul>	<p>A) Admissions: WiCS/EDI joint subcommittee to review CS admissions procedures and practices in coordination with the corresponding university-level activities.</p> <p>B) Perspectives: In addition to Item 1.C), the Undergraduate Academic Plans Committee (UAPC) will study how course assignments can reflect broader student perspectives.</p> <p>C) Hiring/Promotion: Senior faculty member to review hiring and promotion processes and document their findings in a written report.</p> <p>D) Gender Hires: N/A</p> <p>E) Review: Institute a formal process by which each year’s hiring committee convenes after the hiring season is concluded to review the results and document the potential reasons for unsuccessful hires.</p>	<p>A) Director of WiCS, Chair of EDI Committee</p> <p>B) Director of Undergraduate Studies</p> <p>C) Director of School</p> <p>D) N/A</p> <p>E) Chair of School Advisory Committee on Appointments (SACA)</p>	<p>A) Review: Fall2023; Recommendations: Fall 2024</p> <p>B) Fall 2023</p> <p>C) Fall 2023</p> <p>D) N/A</p> <p>E) Spring 2023</p>



	<ul style="list-style-type: none"> <li>• Review undergraduate core courses and integrate additional opportunities for team work on assignments and assignments that reflect broader student perspectives.</li> <li>• Review all hiring and promotion processes to ensure a seamless and consistent application of EDI best practices.</li> <li>• Examine carefully the unintended consequences of moving gender hires to “open” slots.</li> <li>• Review the results of faculty search decisions that are unsuccessful in attracting top choices to the School and develop strategies for use during both decision making and negotiation to increase success in diverse hires.</li> </ul>			
3.	<p><b>Curriculums and Programs.</b> The current core curriculum is well tested and well supported. It is not as clear that the School engages in a robust cyclical review of the core curriculum topics and course content and timely rotation of professors in teaching these</p>	<p>A) Soft Skills: Plan for a dedicated soft-skills course.</p> <p>B) Outcomes: The Undergraduate Academic Plans Committee (UAPC) will review existing mechanisms in other programs. Afterwards, a</p>	<p>A) Director of Undergraduate Studies</p> <p>B) Director of Undergraduate Studies</p>	<p>A) Fall 2025</p> <p>B) Fall 2025</p>

<p>courses. Enriched courses and new electives, service courses.</p> <ul style="list-style-type: none"> <li>• <i>Go ahead with soft skills new course in first or second year.</i></li> <li>• <i>Course and program learning outcomes should be measured and made available as a quality assessment.</i></li> <li>• <i>A strategic review of undergraduate program options is advised in order to project future demand.</i></li> <li>• <i>An examination of the number of specializations is needed result in streamlining of offerings.</i></li> <li>• <i>As new professional course based masters are developed, systematic consideration should be given to retiring fading programs.</i></li> <li>• <i>Consideration should be given to changing the name of the thesis masters degree from MMath to MCS to reflect and clarify the value of the degree.</i></li> </ul>	<p>UAPC subcommittee will formulate a specific plan towards the objective of measuring program learning outcomes.</p> <p>C) Options: We will establish an ad-hoc committee to review our program options, both considering viability of the specializations and determining what updates are needed.</p> <p>D) Specializations: We have established an ad-hoc committee, which is currently reviewing our specializations, both considering viability of the specializations and determining what updates are needed.</p> <p>E) Retiring Programs: Discontinuation of the course-based master’s program in Computer Science in progress.</p> <p>F) Program Name: Survey the opinions of the constituents in the school (faculty, graduate students, alumni) to determine the desire for a name change, then potentially discuss with other stakeholders. Report to School.</p>	<p>C) Director of Undergraduate Studies</p> <p>D) Director of Undergraduate Studies</p> <p>E) Director of Graduate Studies</p> <p>F) Director of Graduate Studies</p>	<p>C) Fall 2024</p> <p>D) Fall 2023</p> <p>E) Spring 2023</p> <p>F) Fall 2023</p>
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4.	<p><b>Research Group Structure.</b> The Research Group structure reinforces research-based <i>de facto</i> silos of interest. This may have unintended ramifications going forward on engaging interdisciplinary perspectives, building community amongst grad students and faculty across research groups, and hiring outcomes.</p> <ul style="list-style-type: none"> <li>• <i>Establish a rapid task force to examine the role of the research groups and impact of structure on increasing inter-group and interdisciplinary collaboration and on hiring practices.</i></li> </ul>	<p>Establishing a task force to examine the role of research groups, particularly in our hiring process. Report to School.</p>	<p>Director of School</p>	<p>Fall 2023</p>
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The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for the Implementation Plan.

Date of next program review \_\_\_\_\_ 2027-28 \_\_\_\_\_  
Date

### Signatures of Approval

Raouf Boutaba,  
Director

Digitally signed by Raouf Boutaba, Director  
DN: cn=Raouf Boutaba, Director, o=University of Waterloo,  
ou=Cheriton School of Computer Science, email=cs-  
director@uwaterloo.ca, c=CA  
Date: 2023.09.21 16:30:28 -04'00'  
Adobe Acrobat version: 2020.005.30524

21 September 2023

Chair/Director \_\_\_\_\_ Date

AFIW Administrative Dean/Head (*For AFIW programs only*) \_\_\_\_\_ Date

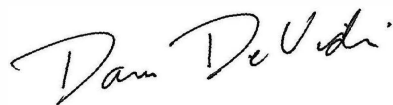


Mark Giesbrecht  
Dean, Faculty of Mathematics

26 September 2023

Faculty Dean \_\_\_\_\_ Date

**Note:** AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.



July 11, 2023

Associate Vice-President, Academic \_\_\_\_\_ Date

(For undergraduate and augmented programs)

On behalf of the Associate Vice-President, Graduate Studies and Postdoctoral Affairs



# Final Assessment Report

## Nanotechnology Engineering (BASc)

### July 2023

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#### Executive Summary

External reviewers found that the Nanotechnology Engineering program (BASc) delivered by the Department of Chemical Engineering and the Department of Electrical and Computer Engineering in the Faculty of Engineering, and the Department of Chemistry in the Faculty of Science was in good standing.

“The NE program has been developed and successfully delivered as a collaboration through three departments. The curriculum is well structured to educate students with necessary fundamental and applied knowledge in the key areas of nanotechnology and provide students with the skills necessary to address key technological challenges. Experiential learning is the core feature of the program, which is obtained through extensive laboratory experience and mandatory Coop term placements.”

A total of 14 recommendations were provided by the reviewers, regarding administration, teaching, and engagement/outreach education at the program level; formal budget allocation, teaching, and admissions at the faculty level; and administration at the university level. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2027-2028.

#### Enrollment over the past three years

	<b>BASc</b>
2022-2023 (CURRENT YR)	531
2021-2022 (LAST YR)	518
2020-2021 (THREE YRS)	519

This data is based on Active Student Extracts in Quest on July 6, 2023.

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#### Background

In accordance with the University of Waterloo’s Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Nanotechnology Engineering program (BASc) delivered by the Department of Chemical Engineering and the Department of Electrical and Computer Engineering in the Faculty

of Engineering, and the Department of Chemistry in the Faculty of Science. A self-study (Volume I, II, III) was submitted to the Associate Vice-President, Academic on March 24, 2022. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the data collected from a student survey, along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for each faculty member with a key role in the delivery of the program(s) were included in Volume II of the self-study.

From Volume III, two arm's-length external reviewers were selected by the Associate Vice-President, Academic: Dr. Liying Jiang, Professor and Associate Chair - Graduate Research Programs, Mechanical and Materials Engineering, University of Western Ontario, and Dr. Larry D. Unsworth, Professor of Chemical and Materials Engineering, University of Alberta.

Reviewers appraised the self-study documentation and conducted a remote visit to the University on January 23-23, 2023. An internal reviewer from the University of Waterloo, Dr. Brian Dixon, Professor of Biology, was selected to accompany the external reviewers. The visit included interviews with the Associate Vice-President, Academic; Dean of the Faculty of Engineering; Dean of the Faculty of Science; Undergraduate Associate Deans; Director of the Program, Director and Associate Director of First Year Engineering, Chairs and Associate Chair from all three departments, as well as faculty members, staff and current undergraduate student representatives and student society representatives. The Review Team also had an opportunity to visit with representatives from the library, technical staff, and Co-operative Education.

Following the site visit, the external reviewers submitted a report on their findings, with recommendations. Subsequently, the program responded to each recommendation and outlined a plan for implementation of the recommendations. Finally, the Dean responded to the external reviewers' recommendations, and endorsed the plans outlined by the program.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report, the program response and the Dean's response.

### **Program Characteristics**

The Nanotechnology Engineering program provides education in key areas of nanotechnology, including fundamental chemistry, physics, engineering of nanostructures and nanosystems, and theories and techniques employed in the modelling, design, fabrication, and characterization of technological applications. Its multidisciplinary nature requires an extensive knowledge base that is significantly broader than that of typical engineering programs. The program aims to provide students with a thorough understanding of physical phenomena occurring at the nano-scale, the ability to apply that knowledge to the analysis of physical situations, and to solve problems through the consideration and deliberate design of nano-materials and -devices.

Students gain very extensive laboratory experience through the program under the direction of a large team of experienced instructors, and this is a hallmark feature of the program. Emphasis is placed on training with modern instrumentation techniques that are employed in research and development in emerging nano-technologies. Exceptionally well-equipped laboratories, which include research-grade instruments and a cleanroom, are dedicated to the undergraduate program.

All students participate in work-integrated learning through a mandatory cooperative education component. During work terms, students are required to take online professional development courses through the Professional Development program (WatPD) to supplement on-the-job training.

### **Summary of Strengths, Challenges and Weaknesses based on Self-Study**

#### **Strengths**

- The interdisciplinary Nanotechnology Engineering program is much broader in comparison to other engineering disciplines, pulling expertise from Chemistry, Chemical Engineering and Electrical Engineering. The fundamental science background in the core curriculum is a significant strength of this program, which provides a solid foundation for the technical elective courses. NE provides a large number of technical electives, 8 total, where 4 can be taken from outside the NE program, including other engineering departments or departments outside the faculty.
- Students receive significant laboratory experience under the guidance of highly experienced lab instructors. NE laboratories are housed in purpose-built facilities, including state-of-the-art, industrial-grade equipment and what we believe to be the only cleanroom in Canada for undergraduate training. Students are sufficiently trained on advanced techniques, e.g., scanning electron microscopy, to be able to later book these instruments to support the development of their prototypes in their design projects.
- Courses are delivered by leading researchers drawn from the program's three departments in two faculties in a collaboration essential to delivery of the broad curriculum.
- NE cohorts undertake a wide variety of Capstone Design projects in their final year. Student teams work on problems of their own selection and develop solutions, including prototypes, that are often novel and highly innovative. The development of prototypes is supported by program funding for each group.
- The academic experience is complemented by co-operative education work terms, where students can learn while working in varied roles. This is a core strength of the program.

- The quality of the program is evidenced by the early career outcomes of our graduating students, who go on to succeed in engineering, academic and scientific positions, many of which support their own entrepreneurial endeavours.
- The program undergoes a regular process of reflection and improvement through the “graduate attributes and continual improvement process”, which is a requirement to maintain CEAB accreditation. This process is working and, with resources devoted to this on an ongoing basis, we expect to see continued progress in this area. Students are regularly consulted to identify areas of concern and actions are taken to address these where appropriate. Over the past six years, a number of curriculum improvement actions have been taken, including:
  - Introduction of a first-year core course, NE109 Societal and Environmental Impacts of Nanotechnology, to provide a clear focus for the program’s content.
  - We have provided a mechanism for students to take technical electives outside of the nanotechnology program, which provides additional opportunity to explore areas of interest.
  - Enhancement of the design experience through an overhaul of the NE100 Introduction to Nanotechnology Engineering course, the “Design Days” initiative, and enhancements to the capstone design course and elective laboratories.
  - Introduction of a third-year technical elective NE381 Introduction to Nanoscale Biosystems to enhance the biotechnology content of the program.
  - Introduction of first-year core course, NE140 Linear Circuits, to resolve an identified curriculum gap.
  - Introduction of a requirement that one complementary studies elective be a communication course.
  - Reduction of the number of complementary studies electives (CSEs) by one (note that this change first appeared in the 2019/20 calendar) to reduce student workload.

### **Challenges**

- Feedback from students and employers indicates an ongoing issue with the recognition and understanding of what nanotechnology is, particularly in relation to “nanotechnology jobs.” We believe this is in part a communication issue and have identified the need for a clearer message about the program and related opportunities to the students, faculty, staff and industry.
- Students’ acquisition of co-op employment was more challenging in the beginning of the program but has now improved, with 2018 showing the largest ever number of employed students for the program. However, a perception of employment challenges persists,

particularly with regard to a “lack of nano jobs.” It seems that many stakeholders, including students, faculty, staff and industry, remain unclear about how nanotechnology jobs fit into current industrial sectors.

- While breadth and depth are highlighted above as a strength of the program, managing the balance between them is an ongoing curriculum challenge. This is complicated by the existing communication lines between departments, faculties and faculty members, because NE students have backgrounds that do not easily line up with those of students in other departments, such that the delivery of content to NE students cannot simply be a mirror of what is provided to other departments.
- The program is currently well-resourced, but we identify two potential issues:
  - First, some issues have been encountered with the quality of sessional instructors assigned to courses when regular faculty instructors have been absent. We will identify opportunities to provide better support to these sessional instructors and monitor how often sessional instructors are required.
  - Second, the program’s facilities and equipment, including the cleanroom, instruments, etc., are aging. We anticipate a need for increased spending on maintenance and replacement; a plan is in place to manage this challenge.
- Coordinating administration of, and strengthening engagement to, the program across 2 Faculties and 3 Departments is a challenge given that faculty are affiliated to Departments and Faculties, not programs. Although the Program Director has responsibility for the program, only the Associate Directors report to the Program Director, and the reporting structure falls back to individual Departments. Any task change for instructors will require home department approval rather than from the program director. In addition, critical information, such as leaves or accident reports, are often delayed or not reported to the NE directors.
- Faculty members will not necessarily identify themselves as NE. Faculty members identify themselves as Chemical Engineers, Electrical Engineers or Chemists teaching NE and thus there is a cultural rift between the students and faculty in terms of identity.

### **Weaknesses**

- The engineering design content in the first three years of the curriculum has been identified as a weakness. We have overhauled the introductory NE100 course to have a clear design focus and piloted the first “Nano Design Day” for first-year students. These first offerings have been successful, and we plan to build on this initiative to enhance the design components of the first to third years of the program.
- The breadth of the program also presents a weakness: it is challenging to ensure that a student goes in depth in any area.



- The students' workload is high compared to that of other engineering programs, which may lead to undue levels of stress in our students. We are very attentive to this issue and take measures to address it (e.g., elimination of one CSE course).
- It is also challenging to maintain faculty engagement, given the inter-department and -faculty structure of the program; initiatives are underway to promote greater faculty engagement and communication around the undergraduate curriculum, including regular general meetings of involved faculty and staff and subject-area-specific curriculum meetings.

### **Summary of Key Findings from the External Reviewers**

The Nanotechnology Engineering program is, "well aligned with the strategic plans of both the Faculty of Engineering and University of Waterloo. The implementation of professional and transferable skills development through mandatory courses is also one of the merits. The multidisciplinary nature of the program trained students in a broader area with extensive knowledge, offering more options for the advancement of their future careers. We shared a particularly positive assessment of the NE undergraduate program. Some considerations and a series of recommendations are provided for further enhancement."

### **Program Response to External Reviewers' Recommendations**

#### PROGRAM LEVEL RECOMMENDATIONS

1. Administrative: Hold faculty meetings, regularly but not overly frequently, to disseminate information as a departmental meeting would.

Potential result: NE ownership by all faculty involved.

#### **Response**

##### **Program Response:**

The Program Director will arrange town-hall meetings for each team to discuss topics of concern and disseminate information to the staff and faculty in the NE program. This meeting will be introduced in the Fall 2023 term.

##### **Dean of Engineering's Response:**

I support the director's approach related to providing information to faculty members related to the NE program. Since the director and associate directors each come from the departments participating in the NE program, another venue for dissemination is the regular department meetings.

##### **Dean of Science's Response:**

The Faculty of Science also supports the approach of the Director, with the expectation that the Associate Directors and faculty from each participating department understand their role in disseminating information related to the NE program.

2. Administrative: The NE Director makes a budget related to measurable outcomes from strategic planning.

Potential result: Risks associated with ad hoc budget process are mitigated and will allow for longer term management of large costs (maintenance, instrument renewal) and strategic initiatives.

### **Response**

#### **Program Response:**

The program director will prepare a proposed program budget by February of each year, beginning in 2024, with inputs from the NE executive committee members. The committee should complete and approve the final version of the program budget before March 1 of each year. The budget should include (1) operating costs from each laboratory, (2) costs related to student activities, (3) new capital equipment purchases, (4) staff team building expenses, (5) recruitment, and (6) miscellaneous.

The proposed budget should also include a forward-looking multiyear capital expense plan which includes new capital expenditures for new labs or replacements.

#### **Dean of Engineering's Response:**

I support this approach related to a proposed annual budget for the NE program.

#### **Dean of Science's Response:**

The Faculty of Science also supports the proposed annual budget approach for the NE program.

3. Administrative: Professors are available to teach from 8 am to 5 pm.

Potential result: Administrative load for scheduling is streamlined, and allows for undergraduate program flexibility by removing the constraint of 'professor working hours'.

### **Response**

#### **Program Response:**

It is not in the power of the Nanotech program itself to implement a recommendation like this one because the NE program staff and faculty originated from three different departments and two different faculty, this policy is not determined and enforceable by the NE program.

**Dean of Engineering's Response:**

I agree that it would be difficult for the program director to impose teaching times on faculty members but I can work with the two department chairs in engineering to ensure there is more flexibility in the teaching times similar to our other engineering programs.

**Dean of Science's Response:**

The Faculty of Science will support the chemistry department chair to ensure flexibility in teaching times in support of the NE program.

4. Teaching: Generate hand-off document (1 pg) for each course that summarizes:
  - a. content that students normally have problems with stated through recurring student feedback
  - b. examples of syllabus, midterm, and final exams
  - c. upload to on-line class materials, only for instructors
  - d. coop student hired to facilitate

Potential result: Sessionals, lecturers, and those who step in for a course rarely will have a baseline to understand the course, have similar evaluation metrics, prepare for areas students need reinforcement, and maintain similar offerings from one lecturer to another.

**Response****Program Response:**

Instructors are required to distribute NE course outlines to the students during the first week of each academic term. A copy of the course outline is also delivered to the program coordinator as a record. Course outlines contain information on the topics to be delivered and the grade distributions of course assessments. Some of the course outlines will be posted online for public viewing after receiving consent from the instructors.

In the future, the NE Program Coordinator will request instructors to grant access to course websites on Waterloo LEARN. This is a UW educational website designed to facilitate instructors. Upon granting access to the teaching materials, future instructors will have access to the teaching materials, such as presentation slides, homework, quizzes, or exams. The amount of teaching materials available will depend on the authorization granted by the authors. The NE Program Coordinator will notify instructors of this service at the beginning of each term. We plan to implement this in Fall 2023 term.

**Dean of Engineering's Response:**

I support the director's response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation.

5. Teaching: Allow written student feedback twice per semester for all classes, regardless of year, with professor response in class.

Potential result: Students think once per semester is too early, and do not hear back regarding feedback and how it might or might not be implemented by the professor.

### **Response**

#### **Program Response:**

The NE program will increase the number of class representative meetings from one to two per term. Both class representatives (4 – 5 students) and course instructors will attend these meetings. During the meeting, students will disclose course-related issues to the corresponding instructor and discuss possible solutions/implementations. Meeting minutes will be created for the record. Increasing the number of class rep meetings to two per term will allow the NE administration to track the progress recommended by the stakeholders.

NE Director and Program Coordinator will also remind the class representatives to disseminate the meeting minutes to the entire class. We plan to implement this in Fall 2023 term.

#### **Dean of Engineering's Response:**

I support the director's response to this recommendation.

#### **Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation.

6. Engagement and Outreach Education: Leverage Capstone and NanoDesign Day to engage industry, forming an NE advisory council that incorporates industrial and government representatives.

Potential results: Advancing awareness of NE, industrial feedback on nano related fields, and potential research opportunities.

### **Response**

#### **Program Response:**

This is an excellent recommendation and could be achieved. A few local technology companies, such as Alchemy, Angstrom Engineering, and VueReal, may be interested. Other global companies that have a strong tie with the UW coop program will also be explored, such as Tesla and J&J.

A possible way to increase the visibility of the NE program is to invite companies to be judges for the Fourth-Year Design Project Symposium (FYDP) and/or Poster Sessions. In addition, the NE program may invite industry representatives to provide seminars on UW campus. The NE Associate Director will manage this activity. We expect to implement this during Winter 2024 during the FYDP events.

**Dean of Engineering's Response:**

I support the director's response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation.

7. Engagement and Outreach Education: Conduct NE specific outreach (through new or existing outreach activities) to high schools to achieve EDI initiatives as well as education of high school students on NE careers/opportunities.

Potential results: Enhance pool of 1st year applicants, provide general knowledge to community regarding NE.

**Response**

**Program Response:**

The NE Associate Director will coordinate the outreach activities with the Associate Dean of Outreach, Equity and Diversity from the Faculty of Engineering. This includes but is not limited to activities with students from the Indigenous, Black, and other underrepresented communities. The NE program will allocate two coops each year to facilitate these outreach programs and develop hands-on experiments to highlight the excitement of the NE field. Some of the initiatives that the NE program may contribute to include, but are not limited to, Catalyst summer programs for grade 10-12 students, STEMpowered Camps for Black Youth, and workshops for Indigenous Youth who are participating in Land Camps. A detailed plan is being drafted and is expected to be completed by December of 2023.

**Dean of Engineering's Response:**

As the director has indicated, we engage in significant outreach activities to a range of diverse students to showcase our various engineering programs.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation, but it is recognized that there is an opportunity for greater and targeted outreach in Science.

## FACULTY LEVEL RECOMMENDATIONS

8. Formal Budget Allocation: Formalize a budget by the NE Director tied to measurable outcomes from strategic planning related to NE program operations.

Potential results: Manage foreseeable large costs (maintenance, instrument renewal), develop multi-year strategic program initiatives, while minimizing unnecessary exposure to risks associated with an ad hoc budget process.

### **Response**

#### **Program Response:**

This recommendation links to “Program level recommendation #1”. Working with the Director and Associate Directors, the NE Curriculum Committee is best suited to develop and monitor program learning outcomes. The Committee can provide input for needs re: urgent instrument maintenance and plans/rationale for instrument renewal or replacement (the latter allowing for new experiments to be developed, replacing older ones). A multi-year renewal plan could be implemented with the Director/Associate Directors monitoring outcomes.

#### **Dean of Engineering’s Response:**

I support the director’s response to this recommendation.

#### **Dean of Science’s Response:**

The Faculty of Science also supports the director’s response to this recommendation

9. (a) Teaching: Develop mechanism for NE leadership group to manage instructors who teach within the NE program.

### **Response**

#### **Program Response:**

The NE Director or their designate will work with Associate Chairs or their designate to oversee instructors of courses within the NE program. This team of administrators will meet each term after the first NE class representative meeting to go over any instructor-related issue. The NE Program Coordinator will also request instructor teaching assignments from the Associate Chairs or their designate at least one term prior to the courses being offered. This will allow the NE administrators to ensure appropriate instructors are assigned to the courses. This item is planned to be implemented in Fall 2023 term.

#### **Dean of Engineering’s Response:**

I support the director’s response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation.

9. (b) Teaching: Provide NE Director the ability to review student evaluations of instructors.

Potential results: The NE leadership group should have the ability to guide who teaches in that program, and ability to ascertain who needs support to ensure program integrity.

**Response****Program Response:**

Associate Dean, Teaching & Student Experience will grant access to student evaluations of courses within the NE program to the NE Director or their designate. This item has been executed.

**Dean of Engineering's Response:**

I support the director's response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation

10. Teaching: Do not require instructor consent for approved NE electives. This unnecessary barrier for students in an approved course, required for their degree, should not exist.

Potential results: Undergraduate and administration time will be used more effectively.

**Response****Program Response:**

This item is not selected for implementation. NE program-offered electives do not require approval. However, courses outside of the NE program will need approval. The approval process for non-NE courses will be difficult to change as each department and faculty has its own policy and requirements.

**Dean of Engineering's Response:**

I support the director's response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation, but we are committed to reviewing our courses to reduce unnecessary barriers to all students.

11. (a) Teaching: Leverage CTE to build a summer course that sessionals can take to fill already known knowledge gaps that sessionals have and have the host department require sessionals to pass it prior to hiring as a sessional.

**Response**

**Program Response:**

This item is not selected for implementation. Since the UW sessional instructors are forming a union, any hiring requirement will need to go through a collective bargaining process between the university and the union. Hence, this recommendation will be difficult to implement in the near term. However, the NE program will suggest sessional instructors enroll in training offered by CTE. A special note will be distributed to all of the NE instructors each term to provide information regarding the supporting facilities for teaching. A selection of CTE courses can be found on the Centre for Teaching Excellence website depending on the sessional instructors' knowledge gap.

<https://uwaterloo.ca/centre-for-teaching-excellence/support-faculty-and-staff/support-new-faculty>

We planned to implement this in Fall 2023 term.

**Dean of Engineering's Response:**

I support the director's response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation.

11. (b) Teaching: More experienced TAs should be assigned to sessionals or new course instructors.

Potential results: Consistent course delivery and evaluation metrics to enhance student education.

**Response**

**Program Response:**

This is already a practice that is in place and will continue.

**Dean of Engineering's Response:**

I support the director's response to this recommendation.

**Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation.



- 12. Admissions:** Develop, with admissions, an inclusive pathway to ensure students with non-standard backgrounds can pursue higher education in a way that maintains the rigor of the Engineering degree. A potential solution is a preliminary year of tailored studies where standard courses could be offered to fill knowledge gaps and prepare these students for a 1st year application process where they will be competitive.

Potential results: Enhanced 1st year applicants, as well as meeting the standard for EDI in admissions by accounting for non-standard backgrounds of still exceptional students.

### **Response**

#### **Program Response:**

This item is not selected for implementation because it is beyond the ability of the program to implement. However, the University is taking steps that may address the reviewers' concerns."

The University of Waterloo is conducting an admissions process review. The goal of the review is to streamline our admissions processes and remove barriers that might adversely affect equity, diversity, inclusion, and anti-racism on campus. The review was initiated by the Registrar's Office in December 2021 and it is expected to present a comprehensive set of recommendations in the near future. Engineering admissions has participated in the review process and provided feedback. The final report and its recommendations will be presented to the university this year.

While at this time there are no pathways programs in Waterloo Engineering, the university has begun experimenting with pathways programs in other disciplines so the possibility of something similar may not be ruled out. As a university, it is important to maintain certain standards, particularly within engineering programs. Our goal is to ensure that students entering our programs have the skills and knowledge to succeed in our programs. High school courses are the way that we currently assess preparation for our programs. These courses are available online and are easily accessible so they provide a suitable mechanism for the fair comparison of all applicants. We currently do not offer pathway programs into any of our engineering programs. These programs exist in many Ontario universities and mechanisms already exist for students to transfer into our programs from these Ontario universities. We also recognize that our engineering programs may not be a perfect fit for every applicant.

#### **Dean of Engineering's Response:**

I support the director's response to this recommendation.

#### **Dean of Science's Response:**

The Faculty of Science also supports the director's response to this recommendation, but we are committed to increasing access of students from non-standard backgrounds to programs similar to and aligned with NE to help meet the intent of the recommendation.

#### UNIVERSITY LEVEL RECOMMENDATIONS

- 13.** Follow up with NE Director after 1 year to verify why some recommendations were not executed.

##### **Response**

###### **Quality Assurance and Continuous Improvement Office Response:**

Our Institutional Quality Assurance Process requires the program to submit a Progress Report in which they provide an update on the actions taken in response to the reviewers' recommendations. The Progress Report will be reviewed by the Associate Vice-President, Academic and will be submitted to Senate Undergraduate Council for approval.

###### **Dean of Engineering's Response:**

I have nothing further to add to this.

###### **Dean of Science's Response:**

The Faculty of Science supports the response of the Quality Assurance and Continuous Improvement Office.

- 14.** Support counseling and accessibility services to respond to the significant increase in student need.

##### **Response**

###### **Dean of Engineering's Response:**

We continue to provide new ways of improving the well-being of all of our engineering students and have adjusted our Associate Dean's portfolio related to teaching to also include student experience. We have also provided additional resources and have hired well-being officers across the Faculty of Engineering.

###### **Dean of Science's Response:**

The Faculty of Science is adjusting our Associate Dean roles to ensure greater support to students. The new and adjusted Associate Dean (AD) roles are AD for a Diverse, Inclusive and Safe Science, and AD for Faculty and Student Engagement. The AD changes and the *Future of Science* strategic planning process being initiated in the Faculty of Science will lead to new supports and resources for students.

## Recommendations Not Selected for Implementation

**We selected not to implement recommendations #3, #10, #11a, and #12.**

**Recommendation 3:** Professors are available to teach from 8 am to 5 pm.

This recommendation will not be implemented because of difficulties to change and enforce the policy and working schedule among the faculty and departments.

**Recommendation 10:** Do not require instructor consent for approved NE electives. This unnecessary barrier for students in an approved course, required for their degree, should not exist.

Changing the approval process for non-NE courses will be difficult to implement because it requires a change of policy among departments and the faculty has its own policy and requirements.

**Recommendation 11a:** Leverage CTE to build a summer course that sessionals can take to fill already known knowledge gaps that sessionals have and have the host department require sessionals to pass it prior to hiring as a sessional.

Sessional instructors are organizing a union at the University of Waterloo. Any change in the hiring requirement for sessional instructors will require collective bargaining between the UW and the union.

**Recommendation 12:** Develop, with admissions, an inclusive pathway to ensure students with non-standard backgrounds can pursue higher education in a way that maintains the rigor of the Engineering degree. A potential solution is a preliminary year of tailored studies where standard courses could be offered to fill knowledge gaps and prepare these students for a 1st year application process where they will be competitive.

The FoE does not have a pathway for students with non-standard backgrounds. The NE program will follow this faculty policy.

**Implementation Plan**

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	Hold faculty meetings, regularly but not overly frequently, to disseminate information as a departmental meeting would.	The Program Director will arrange town-hall meetings for each team.	Program Director	Planned to be executed in Fall term, 2023
2.	The NE Director makes a budget related to measurable outcomes from strategic planning.	The program director will prepare a proposed program budget by Feb with inputs from the NE executive committee members. The committee should complete and approve the final version of the program budget before March 1 of each year.	Program Director and Executive Committee	Planned to be executed in March 2024
3.	Professors are available to teach from 8 am to 5 pm.	Not selected for implementation		
4.	Generate hand-off document (1 pg) for each course that summarizes: <ul style="list-style-type: none"> <li>a. content that students normally have problems with stated through recurring student feedback</li> <li>b. examples of syllabus, midterm, and final exams</li> </ul>	The NE course outlines are requested during the first week of each term and posted online for the public after receiving consent from individual faculty. It is not mandatory for the faculty to give consent to the public posting of the outline. In the future, the NE Program Coordinator will request access to all NE courses on LEARN so teaching materials may be available for those who teach the course in the future.	Program Coordinator	Planned to be executed in Fall 2023

	c. upload to on-line class materials, only for instructors coop student hired to facilitate			
5.	Allow written student feedback twice per semester for all classes, regardless of year, with professor response in class.	The NE program will increase the number of class representative meetings from one to two per term.	Program Coordinator	Planned to be executed in Fall 2023
6.	Leverage Capstone and NanoDesign Day to engage industry, forming an NE advisory council that incorporates industrial and government representatives.	This is an excellent recommendation and could be achieved.	NE Associate Director	Planned to be executed in Fall 2023
7.	Conduct NE specific outreach (through new or existing outreach activities) to high schools to achieve EDI initiatives as well as education of high school students on NE careers/opportunities.	The NE Associate Director will coordinate the high school outreach activities with the Associate Dean’s Outreach Office to educate high school students about nanotechnology careers and opportunities.	NE Associate Director	Planned to be executed in Fall 2023
8.	Formalize a budget by the NE Director tied to measurable outcomes from strategic planning related to NE program operations.	This recommendation links to “Program level recommendation #1”.	Program Director and Executive Committee	Planned to execute this in Winter 2024
9a.	Develop mechanism for NE leadership group to manage instructors who teach within the NE program.	The NE Director or their designate will work with Department Associate Chairs to oversee instructors of courses within the NE program.	NE Director and Department Associate Chairs	Planned to be executed in Fall 2023

9b.	Provide NE Director the ability to review student evaluations of instructors.	Associate Dean, Teaching & Student Experience will grant access to student evaluations of courses within the NE program to the NE Director or their designate.	Associate Dean, Teaching & Student Experience	Executed in Winter term 2023
10.	Do not require instructor consent for approved NE electives. This unnecessary barrier for students in an approved course, required for their degree, should not exist.	Not selected for implementation		
11a.	Leverage CTE to build a summer course that sessionals can take to fill already known knowledge gaps that sessionals have and have the host department require sessionals to pass it prior to hiring as a sessional.	Not selected for implementation		
11b.	More experienced TAs should be assigned to sessionals or new course instructors.	This is already a practice that is in place and will continue.	Department Chairs Associate	Executed
12.	Develop, with admissions, an inclusive pathway to ensure students with non-standard backgrounds can pursue higher education in a way that maintains the rigor of the Engineering degree. A potential solution is a preliminary year of tailored studies where standard courses could be offered to fill knowledge gaps and	Not selected for implementation		

prepare these students for a 1st year application process where they will be competitive.			
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The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for the Implementation Plan.

Date of next program review \_\_\_\_\_ **2027-2028** \_\_\_\_\_  
Date

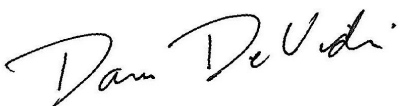
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**Signatures of Approval**

  
\_\_\_\_\_ 9/11/2023  
Chair/Director Date

  
\_\_\_\_\_ Date  
Faculty Dean of Engineering

  
\_\_\_\_\_ *Sept 12/23*  
Faculty Dean of Science Date

  
\_\_\_\_\_ August 18, 2023  
Associate Vice-President, Academic Date  
(For undergraduate and augmented programs)





**Senate Undergraduate Council  
Curriculum Subcommittee**

**For Approval**

**Open Session**

**To:** **Senate Undergraduate Council**

**Sponsor:** David DeVidi, Associate Vice-President, Academic  
**Contact Information:** [david.devidi@uwaterloo.ca](mailto:david.devidi@uwaterloo.ca)

**Presenter:** David DeVidi, Associate Vice-President, Academic  
**Contact Information:** [david.devidi@uwaterloo.ca](mailto:david.devidi@uwaterloo.ca)

**Date of Meeting:** February 5, 2024

**Agenda Item Identification:** **Approval of New Plans, Major Modifications, Plan Inactivations, and Regulation Changes**

**Recommendation/Motion:**

To recommend Senate approve the following major program modifications and regulation changes, as presented.

**Summary:**

The SUC Curriculum Subcommittee has reviewed and agreed, via an e-vote which closed on January 26, 2024, to recommend the items included in the appendices of this report to SUC as part of the regular agenda for recommendation to Senate for approval. These items include new plans, major modifications, plan inactivations, and regulation revisions from the Faculty of Engineering, the Faculty of Environment, and the Faculty of Science.

**Documents Included:**

- Appendix A: Faculty of Engineering
- Appendix B: Faculty of Environment
- Appendix C: Faculty of Science

## WATERLOO | ENGINEERING

Engineering Undergraduate Office

# MEMORANDUM

February 5, 2024

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**TO:** Tim Weber-Kraljevski, Governance Officer, Secretariat


**FROM:** Jason Grove, Associate Dean, Undergraduate Studies, Faculty of Engineering

**SUBJECT:** Regular Agenda Items for Approval by Senate Undergraduate Council

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ALL CHANGES ARE EFFECTIVE SEPTEMBER 2024.

1. **Academic Plan Changes (Major Modifications)**
  - 1.1. Systems Design Engineering
  - 1.2. Quantum Engineering Option
  
2. **Academic Plan Inactivations**
  - 2.1. International Studies in Engineering Option
  - 2.2. Society, Technology and Values Option
  
3. **Other Business**
  - 3.1. Dean's Honours List



Jason Grove  
Associate Dean, Undergraduate Studies  
Faculty of Engineering

## 1. Academic Plan Changes (Major Modifications)

## 1.1 Systems Design Engineering

### Summary

Create 4 New Specializations

### Background & Rationale:

Technical elective packages currently found on the SYDE calendar are advising content and will not appear in the new Quali calendar software since this is not consistent with the calendar guidelines. The creation of 4 new specializations is proposed to replace the current technical packages found in the calendar, allowing students to focus their studies in specific areas and have this represented on their transcript. Students active in the program when the new specializations are introduced can declare the specializations.

## Systems Design Engineering

MARK-UP

...

### ~~Technical Elective Packages~~

~~The Department has identified four technical elective areas within its current offerings. Additional information regarding elective packages may be obtained from the associate chair for undergraduate studies. Students may choose a technical elective package from the four areas identified below to help them in their selection of technical electives. Choosing a specific elective package is not mandatory. Students do not receive any official notification on their transcript for completing an elective package.~~

### ~~Human Systems Engineering~~

~~The elective courses in this package are as follows:~~

#### ~~3B (Winter)~~

- ~~• SYDE 544 Biomedical Measurement and Signal Processing~~
- ~~• SYDE 548 User Centred Design Methods~~

#### ~~4A (Fall)~~

- ~~• SYDE 543 Cognitive Ergonomics~~
- ~~• SYDE 575 Image Processing~~
- ~~• SYDE 584 Physiological Systems and Biomedical Design~~

#### ~~4B (Winter)~~

- ~~• SYDE 542 Interface Design~~

- ~~SYDE 544~~ Biomedical Measurement and Signal Processing
- ~~SYDE 572~~ Introduction to Pattern Recognition

### **Intelligent Systems**

The elective courses in this package are as follows:

#### **3B (Winter)**

- ~~SYDE 322~~ Software Design
- ~~SYDE 531~~ Design Optimization Under Probabilistic Uncertainty
- ~~SYDE 544~~ Biomedical Measurement and Signal Processing
- ~~SYDE 552/BIOL 487~~ Computational Neuroscience
- ~~SYDE 572~~ Introduction to Pattern Recognition

#### **4A (Fall)**

- ~~SYDE 543~~ Cognitive Ergonomics
- ~~SYDE 556~~ Simulating Neurobiological Systems
- ~~SYDE 575~~ Image Processing

#### **4B (Winter)**

- ~~SYDE 522~~ Foundations of Artificial Intelligence
- ~~SYDE 531~~ Design Optimization Under Probabilistic Uncertainty
- ~~SYDE 544~~ Biomedical Measurement and Signal Processing
- ~~SYDE 548~~ User Centred Design Methods
- ~~SYDE 552/BIOL 487~~ Computational Neuroscience
- ~~SYDE 572~~ Introduction to Pattern Recognition

### **Societal and Environmental Systems**

**Note:** Additional experience can be gained by doing related workshop projects in ~~SYDE 362~~, ~~SYDE 461~~, and ~~SYDE 462~~.

The elective courses in this package are as follows:

#### **3B (Winter)**

- ~~SYDE 334~~ Applied Statistics
- ~~SYDE 531~~ Design Optimization Under Probabilistic Uncertainty
- ~~SYDE 532~~ Introduction to Complex Systems
- ~~SYDE 572~~ Introduction to Pattern Recognition

#### **4A (Fall)**

- ~~SYDE 533~~ Conflict Resolution
- ~~SYDE 575~~ Image Processing

### **4B (Winter)**

- ~~SYDE 334 Applied Statistics~~
- ~~SYDE 522 Foundations of Artificial Intelligence~~
- ~~SYDE 531 Design Optimization Under Probabilistic Uncertainty~~
- ~~SYDE 532 Introduction to Complex Systems~~
- ~~SYDE 572 Introduction to Pattern Recognition~~

### **Systems Modelling and Analysis**

**Note:** The elective package structure is such that the students enrolled in this elective package can take additional courses from other departments in order to focus on any specific engineering discipline and at the same time obtain a strong systems modelling and design foundation.

The elective courses in this package are as follows:

### **3B (Winter)**

- ~~SYDE 552/BIOE 487 Computational Neuroscience~~
- ~~SYDE 572 Introduction to Pattern Recognition~~

### **4A (Fall)**

- ~~SYDE 553 Advanced Dynamics~~
- ~~SYDE 556 Simulating Neurobiological Systems~~
- ~~SYDE 575 Image Processing~~
- ~~SYDE 584 Physiological Systems and Biomedical Design~~

### **4B (Winter)**

- ~~SYDE 532 Introduction to Complex Systems~~
- ~~SYDE 552/BIOE 487 Computational Neuroscience~~
- ~~SYDE 572 Introduction to Pattern Recognition~~

### **Specializations**

**Students must complete a minimum of six department-approved technical electives (TEs) to meet graduation requirements. Students may arrange the sequencing of the technical elective courses to suit their plan (and any course prerequisites).**

**The Faculty of Engineering recognizes four designated specializations within the BSc degree in Systems Design Engineering:**

- **Human Factors & Interfaces Specialization**
- **Intelligent & Automated Systems Specialization**
- **Physical & Mechatronic Systems Specialization**
- **Societal & Environmental Systems Specialization**

**Students interested in pursuing one of these specializations must take four required technical elective courses from the corresponding list of approved technical electives specialization package. A minimum average of 60% in the four specialization courses and a grade of at least 50% in each of the four courses is required. Students who satisfy the requirements for Options, Specializations and Electives for Engineering Students will have the appropriate designation shown on their diploma and transcript. Students must declare a specialization for it to be recognized as part of their degree and appear on the transcript and diploma.**

### **Human Factors & Interfaces Specialization**

#### **Required:**

- **SYDE 548 User Centred Design Methods**

#### **At least 2 courses from the following list:**

- **SYDE 334 Applied Statistics**
- **SYDE 542 Interface Design**
- **SYDE 543 Cognitive Ergonomics**

#### **At least 1 course from the following list**

- **MSE 543 Analytics and User Experience**
- **INTEG 340 Research Design and Methods**
- **INTEG 251 Creative Thinking**
- **STV 202 Design and Society**
- **STV 205 Cybernetics and Society**

### **Intelligent & Automated Systems Specialization**

#### **Required**

- **SYDE 522 Foundations of Artificial Intelligence**

#### **At least 2 courses from the following list:**

- **SYDE 322 Software Design**
- **SYDE 577 Deep learning**
- **SYDE 552 Computational neuroscience**
- **SYDE 556 Simulating Neurobiological Systems**
- **SYDE 575 Image Processing**
- **SYDE 572 Introduction to Pattern Recognition**

#### **At least 1 course from this list:**

- **STV 208: Artificial Intelligence and Society—Impact, ethics, and equity**
- **STV 210: The computing society**
- **STV 302 Information Technology and Society**

### **Physical & Mechatronic Systems Specialization**

**Required course:**

- **SYDE 553 Advanced Dynamics**

**At least 2 courses from the following list:**

- **SYDE 554 Nonlinear Dynamic Systems**
- **SYDE 586 Material Selection for Design**
- **BME 540 Fundamentals in Neural and Rehabilitation Engineering**
- **BME 550 Sport Engineering**
- **BME 551 Biomechanics of Human Movement**
- **BME 582 Biomedical Optics**

**At least 1 course from the following list:**

- **SYDE 584 Physiological systems and biomedical design**
- **ECE 224 Embedded Microprocessor Systems**
- **ECE 486 Robot Dynamics and Control**
- **ME 321 Kinematics and Dynamics of machine**
- **ME 547 Robot Manipulators: Kinematics, Dynamics, Control**
- **MTE 325 Microprocessor Systems and Interfacing for Mechatronics Engineering**
- **MTE 544 Autonomous Mobile Robots**

**Societal & Environmental Systems Specialization**

**Required course:**

- **SYDE 535 Computational Simulations for Societal and Environmental Systems**

**At least 2 courses from the following list:**

- **SYDE 531 Design Optimization Under Probabilistic Uncertainty**
- **SYDE 532 Introduction to Complex Systems**
- **SYDE 534 Electric Energy Systems (new course code for Jessie's SYDE 599 course)**
- **SYDE 536 Modeling Transportation Systems (new course code for Lisa's SYDE 599 course)**
- **SYDE 537 Artificial Life: Biology and Computation**

**At least 1 course from the following list:**

- **SYDE 533 Conflict Resolution**
- **STV 201: Pluriversal alternatives—Ideas to postpone the end of the world**
- **STV 305 Technology, Society and the modern city**

**PLAN 478 Transit, Planning and Operations**



## 1.2 Quantum Engineering Option

### **Summary:**

Creation of Quantum Engineering Option

### **Background & Rationale:**

Quantum Engineering is an area of growing focus and is expected to be a fast-growing area requiring engineering talent in coming decades. The proposed Quantum Engineering Option is to help meet the growing demand for education and training in this area.

Active students can declare the option. It is available to BAsC and BSE students.

This Option complements the previously approved Quantum Engineering Specialization that is only available to ECE students. The Option has a higher declaration requirement and requires an additional course.

## **Proposed Faculty of Engineering "Quantum Engineering Option"**

### **Overview**

Quantum Engineering is the application of quantum physics for the generation, transmission, processing, computation, and/or sensing of information using engineering principles and methods. The Quantum Engineering option focus is on foundations, design methodologies and experimental skills to analyze and implement technological platforms using quantum devices, systems and algorithms. This option relies on incorporating engineering approaches to quantum hardware, software and their integration with classical counterparts for applications ranging from computing, sensing, health, communication security to energy, drug discovery and financing.

The Quantum Engineering Option comprises:

- Two foundation lecture courses:
  - One required course in ordinary differential equations
  - One required course in electricity and magnetism or electric circuits
- Four quantum lecture courses:
  - One required course in quantum computing algorithms
  - One elective course in quantum mechanics
  - One elective course in quantum information processing devices
  - One elective course in quantum circuits

Depending on the engineering plan, some of these courses may be part of the student's core curriculum.

### **Intended Learning Outcomes**

Students who complete the option will be able to:

- Demonstrate fundamental knowledge in new “Quantum Engineering” area
- Apply that knowledge to hardware and software platforms

## Coordinator

The option coordinator will normally be an ECE faculty member. The first option coordinator is Hamed Majedi, with Na Young Kim covering the role when Hamed Majedi is unavailable.

## Calendar Description

### Quantum Engineering Option

The option is available to BAsC and BSE students.

### Declaration Requirements

- Students may not declare this option until they have completed both a calculus course (List 1) and a circuits course (List 2). Students must have a minimum average of 75.0% calculated across these two courses, and a minimum cumulative average of 75.0% in order to declare this Option.

### Minimum Average(s) Required

- A minimum option average of 75.0 in the option courses.

### Graduation Requirements

- Complete a total of 3.0 units.

### Required Courses

#### Complete all of the following:

- ECE.405C Programming of Quantum Computing Algorithms
- Complete 1 of the following:
  - AMATH.373 Quantum Theory 1
  - CHEM.356 Introductory Quantum Mechanics
  - ECE.305 Introduction to Quantum Mechanics
  - ECE.405 Introduction to Quantum Mechanics
  - NE.332 Quantum Mechanics
  - PHYS.233 Introduction to Quantum Mechanics
  - PHYS.234 Quantum Physics 1
- Complete 1 of the following:
  - ECE.405A Quantum Information Processing Devices
  - PHYS.468 Introduction to the Implementation of Quantum Information Processing
- Complete 1 of the following:
  - ECE.405B Fundamentals of Experimental Quantum Information
  - ECE.405D Superconducting Quantum Circuits

## List 1

Complete 1 of the following:

- AE.223 Differential Equations and Balance Laws
- CIVE.222 Differential Equations
- ECE.205 Advanced Calculus 1 for Electrical and Computer Engineers
- ENVE.223 Differential Equations and Balance Laws
- GEOE.223 Differential Equations and Balance Laws
- MATH.211 Advanced Calculus 1 for Electrical and Computer Engineers
- MATH.213 Signals, Systems, and Differential Equations
- MATH.217 Calculus 3 for Chemical Engineering
- MATH.218 Differential Equations for Engineers
- ME.203 Ordinary Differential Equations
- MSCI.271 Advanced Calculus and Numerical Methods
- MTE.202 Ordinary Differential Equations
- NE.216 Advanced Calculus and Numerical Methods 1
- SYDE.211 Calculus 3

## List 2

Complete 1 of the following:

- AE.123 Electrical Circuits and Instrumentation
- BME.294 Circuits, Instrumentation, and Measurements
- CIVE.123 Electrical Circuits and Instrumentation
- ECE.106 Electricity and Magnetism
- ECE.140 Linear Circuits
- ECE.375 Electromagnetic Fields and Waves
- ENVE.123 Electrical Circuits and Instrumentation
- GENE.123 Electrical Circuits and Instrumentation
- GEOE.123 Electrical Circuits and Instrumentation
- ME.123 Electrical Engineering for Mechanical Engineers
- MTE.120 Circuits
- NE.241 Electromagnetism
- PHYS.342 Electricity and Magnetism 2
- SYDE.292 Circuits, Instrumentation, and Measurements

## 2. Academic Plan Inactivations

## 2.1 International Studies in Engineering Option

### **Summary:**

Inactivation of ISE Option

### **Background & Rationale:**

The International Studies in Engineering Option has extremely low enrolment (for the classes of 2013-2022, the numbers of graduating students achieving the option were: 4, 6, 6, 3, 2, 3, 1, 0, 0, 0; currently, 1 student has declared the option). Given the lack of interest, its inactivation is proposed.

Impact on students: The student currently in the option will be able to continue. Current students wishing to declare the option will need to do so by Spring 2024; we are not aware of any students who have expressed interest and based on historical interest do not anticipate any negative effect.

Alternatives for students: we will direct students towards the offerings coordinated by the SSO. Current students can enrol in the Global Experience Certificate (GEC), although this has recently been recommended to Senate for inactivation. The SSO is developing a new certificate: the Global Learning and Intercultural Development Experience (GLIDE) Certificate.

## 2.2 Society, Technology, and Values Option

### **Summary:**

Inactivation of STV option

### **Background & Rationale:**

The Society, Technology and Values option has had very limited enrolment in recent years (on average, fewer than 1 per year) and the Centre for STV advises that there are no current students on track to complete the option. In a thorough review of the option, it was identified that the onerous requirements are preventing wider student interest. Enrolment in individual STV courses is healthy and the development of a replacement Diploma credential is in progress (targeting the 2025 calendar for implementation). In addition, this is an option that is open to students in all faculties, which is not compliant with the University credential framework, which indicates that options should be faculty-specific.

Given the above, we would like to inactivate the STV option.

**Impact on current students:** Current students wishing to declare the option will need to do so by Spring 2024; STV will advise students in their courses of this. We hope that the replacement diploma will become available for the 2025 calendar. It would be possible for any student falling in the gap to petition for a back-dated plan modification to add the option.

### 3. Other Business

### 3.1 Dean's Honours List

#### **Summary:**

Update the Distinction and Dean's Honours Minimum Cumulative Average for Graduating Honours and Term Distinction

#### **Background & Rationale:**

The Faculty of Engineering would like to remove the faculty-specific requirements for Term and Graduating honours and align with the other faculties who adopted a consistent framework in 2020.

The current method used by Engineering means that the average required to be DHL in a term is not consistent across programs, terms or levels and is not transparent for students. DHL is different for each program, so a student getting 85 in one program may get DHL, while a higher grade in another program or subsequent term doesn't get DHL. The calculation is only done once in a term, so any student that has a grade change after the fact may remain on (or off) the DHL for the term. The current process is manual and therefore prone to coding and calculation errors. This process is not transparent for students, so they may be on the DHL one term, then off the next with a higher term average. This is potentially demotivating for student, contributing to a poor student experience. There is an equity issue for small programs or students on reduced load (AAS) as they are not eligible under the current rules.

### Awards of Excellence MARK-UP

The Awards of Excellence presented on this page apply to students in degree-granting programs, ~~excluding all majors from the Faculty of Engineering (including Software Engineering). Engineering students should view the Faculty of Engineering section of this Calendar.~~

#### **Graduating Honours**

A student who demonstrates exceptional academic performance in a degree-granting program may be recommended to graduate with either "Dean's Honours" or "Distinction", based on their final cumulative average. Only the highest honour is awarded.

Faculty/Program	Distinction Minimum Cumulative Average	Dean's Honours Minimum Cumulative Average
Arts (including Computing and Financial Management)	80.0%	85.0%
<u>Engineering (BAS plan)</u>	<u>80.0%</u>	<u>85.0%</u>
<u>Engineering (BASc and BSE plans)</u>	<u>80.0%</u>	<u>87.0%</u>
Environment	80.0%	85.0%
Health	80.0%	85.0%



Mathematics	80.0%	87.0%
Science	80.0%	85.0%
Bachelor of Social Work	80.0%	85.0%

## Term Distinction

A student is eligible to receive "Term Distinction" based on their average in all courses taken during a term while in a degree-granting program. In order to receive "Term Distinction", the following must be true:

- The term must have at least one alpha/numeric grade in the average.
- A minimum term average of 80.0% must be achieved.
  - For Faculty of Engineering students (excluding Architecture), a minimum term average of 87.0% must be achieved
  - For Architecture students, a minimum term average of 85.0% must be achieved
- An academic standing for the term of Promoted, Eligible, Satisfactory, Good, or Excellent.
- The term cannot have an INC, IP, MM, or UR. When these grades are resolved to alpha/numeric grades, the term's average will be reviewed for eligibility.

## Notes

1. Students may be deemed ineligible at the discretion of the associate dean, undergraduate studies.
2. Students in Optometry and Pharmacy who are taking less than a full course load due to failure will be ineligible for "Term Distinction" in reduced-load terms.
3. Students in the Faculty of Engineering taking less than 1.5 units in the term will be ineligible for "Term Distinction."

## Rules

MARK-UP

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14. ~~Although it is the Senate of the University that confers degrees, the Faculty of Engineering does recommend students for degrees in Engineering. A student who has successfully met all of the requirements will be Recommended for the BAsC or BSE degree. The degree awarded will be the one associated with the plan of registration. A student who has demonstrated exceptional performance will be Recommended for the BAsC or BSE Degree with Distinction. This recognition is granted to a student who has a cumulative average of 80% or greater, starting with their first enrolment in the 3A term, of those courses that are requirements for their plan, and that have been included in a corresponding term average (i.e., those courses of type blank above). Courses taken while on exchange, or terms for which the academic decision has~~

~~Aegrotat added as a qualifier, do not contribute to the cumulative average. In such cases, the cumulative average will include the most recent four academic terms completed at Waterloo for which a numerical average is available.~~

■ ■ ■

## Dean's Honours List

MARK-UP

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~~To recognize outstanding academic achievement each term, the designation Dean's Honours List will be awarded to exceptional undergraduate Engineering students in each plan. To achieve this designation for a particular term, students must meet the following criteria for the term in question:~~

- ~~1. They must be unconditionally promoted at the end of that term (standings and official grades are available on Quest as specified in the Calendar of Events and Academic Deadlines).~~
- ~~2. They must have term decisions of Excellent and have received no penalties under Policy 71 during the term.~~
- ~~3. Their term averages minus their percentile ranks from the tops of their classes for that academic term must be greater than or equal to 80.~~
- ~~4. They must be in cohorts with 10 or more students.~~
- ~~5. Their course loads must equal or exceed the minimum number of academic units specified by their plan for that term.~~

~~This designation will be reflected on students' transcripts. Students not in the top 10% of their classes are normally not eligible.~~

~~Students with outstanding records throughout their undergraduate careers in Engineering will graduate on the Dean's Honours List if they have been on the Dean's Honours List for at least two of the six academic terms preceding graduation, and have cumulative averages over the final six academic terms of their plan of at least 80%. An appropriate notation will appear on students' official transcript.~~

~~Students enrolled in the Bachelor of Software Engineering (BSE) degree may also qualify for the Dean's Honours List using rules specified by the Dean of Mathematics. The process is described in detail in Software Engineering.~~

# Appendix B: Faculty of Environment

Attachment 13, SUC February 5, 2024

Re: Business Option and Sustainability Financial Management, invalid combination: Revise

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Effective date: September 2024

Rationale: SFM students are already completing a business and environment combination degree. Allowing them to complete the Business Option does not add value for a student's marketability and is a redundant credential. Faculty of Arts will present this at UGAG as an information item.

Consultations:

Within ENV: SEED

Within ENV and Arts: SFM

External to ENV and Arts: No consultations required

ENV Governance:

UGSC – December 8, 2023

FC – January 18, 2024

Arts Governance:

UGAG – November 2, 2023

FC – November 14, 2023

Joint submission to SUC – February 5, 2024

Note: This invalid combination needs to be added to the University Invalid Credential Combination page (<http://ugradcalendar.uwaterloo.ca/page/Acad-Regs-Invalid-Credential-Combinations>)

## Revisions based on 2023/2024 Calendar

A Business Option is available to all undergraduates in the Faculty of Environment, ~~with the exception of~~ **except for** students in ~~Honours~~ **Honours Environment and Business Honours, and Sustainability and Financial Management Honours**. It may not be [combined with the Human Resources Management Minor or the Management Studies Minor](#) because of similar coursework.

# Appendix C: Faculty of Science

## SCIENCE UNDERGRADUATE STUDIES COMMITTEE REPORT – FOR SUBMISSION TO FEBRUARY 2024 SENATE UNDERGRADUATE COUNCIL (SUC) (SFC approval- Dec 1, 2023)

### 1. NEW PLANS

**Motion:** To create two new Options for students in Faculty of Science. These were approved in Biology May 23-24, 2023 (via electronic vote).

#### MICROBIOLOGY OPTION

The Microbiology Option provides a path for students interested in emphasizing microbiology during their undergraduate degree. This Option will provide guidance in selecting relevant microbiology courses and provides recognition of a microbiology focus as part of student academic credentials. It is expected that students interested in this Option will be primarily drawn from Honours Biology, Honours Biomedical Sciences, and Honours Science plans, though it is open to students in any program within the Faculty of Science. Some prerequisite courses for the Option are already required by the Honours Biology and Honours Biomedical Sciences plans and have not been listed as specific requirements for the Microbiology Option itself.

This option will require background in cell biology and genetics, equivalents to BIOL 130 and 239 as well as a background in a microbiology lab equivalent to BIOL 240L. This background will be required to declare this option.

The Microbiology Option can't be combined with a Biology Minor, Biochemistry Minor, Biophysics Minor, Bioinformatics Option, and Cell and Molecular Biology Option, which needs to be included in [Invalid Credential Combinations](#) page of the Undergraduate Calendar.

#### Requirements

1. 4.0 units distributed as follows:
  - o 1.0 BIOL units: BIOL 240, BIOL 241
  - o 3.0 BIOL units chosen from: BIOL 341, BIOL 345, BIOL 346, BIOL 348L, BIOL 431, BIOL 441, BIOL 442, BIOL 443, BIOL 444, BIOL 447, BIOL 448, BIOL 449, and BIOL 475
2. A minimum cumulative option average of 65%.

#### CELL AND MOLECULAR BIOLOGY OPTION

The Cell and Molecular Biology Option provides a path for students interested in cell and molecular biology theory and techniques. This Option will provide guidance in selecting relevant cell and molecular biology courses and provides recognition of a cell and microbiology focus as part of student academic credentials. It is expected that students interested in this Option will be primarily drawn from Honours Biology, Honours Biomedical Sciences, and Honours Science plans, though it is open to any students in any program within the Faculty of Science. Some prerequisite courses for the Option are already required by the Honours Biology and Honours Biomedical Sciences plans and have not been listed as specific requirements for the Molecular Biology Option itself.

This option will require background in cell biology and genetics, equivalents to BIOL 130 and 239. This background will be required to declare this option.

The Cell and Molecular Biology Option can't be combined with a Biology Minor, Biochemistry Minor, Biophysics Minor, Bioinformatics Option, and Microbiology Option, which needs to be included in [Invalid Credential Combinations](#) page of the Undergraduate Calendar.

## **Requirements**

1. 4.0 units distributed as follows:
  - 2.0 BIOL units: BIOL 235, BIOL 308, BIOL 331, BIOL 342
  - 0.5 BIOL unit chosen from: BIOL 302, BIOL 335L, and BIOL 341
  - 1.5 BIOL units chosen from: BIOL 302, BIOL 335L, BIOL 341, BIOL 431, BIOL 432, BIOL 433, BIOL 434, BIOL 441, BIOL 442, BIOL 472, BIOL 483, and BIOL 484
  
2. A minimum cumulative option average of 65%.